The Aero Tech Park as a Model for Industrial Development from an Environmental Perspective

by

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The undersigned hereby certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled The Aero Tech Park as a Model for Industrial Development from an Environmental Perspective by Kenneth C. Burrows in partial fulfillment of the requirements for the degree of Master of Arts in Atlantic Canada Studies

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Abstract

The history of industrial development in the Maritimes rarely acknowledged environmental perturbations during construction and operational phases. The Aero Tech Park at the Halifax International Airport is the first major project in the region to employ sound environmental procedures regarding development and operation. This paper outlines how the unique chain of events precipitated that occurence, and speculates on the probability of similar practices influencing future projects.

The Aero Tech Park which serves as the model for this thesis is situated at the site of the International Airport and a history of the airport is examined. Construction activities during the development of the airport created major environmental perturbations and is outlined in a sequential expose. Development methods at the airport typified existing attitudes of disregard for environmental sensitivities and stressed primarily economic survival regardless of ecological injury. The airport development serves as a graphic example contrasting the careful environmental procedures employed by the Aero Tech Park's development.

The introduction of the thesis explores the various schools of environmental theory and rationalizes a Maritime context. The importance of an accurate "Environmental Impact

Assessment" (EIA) at the conceptual stage of a major project is articulated.

The conclusion weaves the theory with the practical and formulates a comprehensive and comprehendable model for industrial development. A major deficiency during the conceptual phase of the Aero Tech Park is revealed and the necessity of including a "Social Impact Assessment" (SIA) with an EIA is vital with any major project involving significant numbers of people. Finally, the thesis focuses its paradigm of ecological preservation on a tangible basis that can be utilized by County planners and development officers. A revised application form, utilized by the County of Halifax for project development approval, is produced which addresses the various complexities of environmental assessment and serves as a basis for a model of industrial development from an environmental perspective.

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Introduction: Reduction versus holstic approaches to ecology

There has been a great deal written about ecological interpretations by numerous scholars and the lack of consensus is rather startling. One group espouses the holistic point of view, another group reduces everything into economic units; some groups ignore human influences while others recognize them as either an abnormal or normal involvement. One school of thought deems species diversity as a measure of health while another clearly and inarguably concludes species habitat is the only indicator. The lack of continuity and agreement on ecological assessment and preservation has certainly been a major factor in dealing with stressed ecosystems.

Many modern environmentalists have adopted a reductionistic approach to ecology. They have reduced nature into economic units for the primary purpose of advancing culture in a material context. The holistic approach, on the other hand, recognizes the importance of man and nature interacting harmoniously without one being sacrificed for the other. Edward Goldsmith, a noted journalist, makes the following observation: "Ecology, so as to be made scientifically respectable and also compatible with the paradigm of modernism, has become reductionistic, mechanistic, and quantified. To seek this, has meant seeking to discredit the basic principles of ecology, formulated by the great early ecologists such as Thoreau, Clements and Shelford. Rather than being objective as science is supposed to be, they were in fact largely ideological and political. The old well-established principle of ecological succession to a climax must be rehabilitated."[1]

"Succession" is an important development within an ecosystem. "Succession" refers to the natural maturing of an ecosystem until it reaches the climax stage. The climax is a stable phase and has few changes within the system. This idea is certainly not a new one: as early as the 18th century naturalists observed the process of succession.

The theory of succession was constantly under siege by environmentalists who believed succession was retrogressive to material development. This controversial topic came to a head during the late 1930s in heated debates over the great dustbowl. Some ecologists believed the crisis was man-made because of the extensive plowing in the southern plains. In this view, plowing diverted the ecosystem away from its climax state. Indeed, the very principle of a climax was dismissed by many ecologists. Tansley, an Oxford ecologist was particularly keen to discredit the climax concept. He insisted that man could create his own climax, an "anthropogenic climax," which he believed to be superior to

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[1] Edward Goldsmith, "Ecological Succession Rehabilitated," The Ecologist, Vol. 15, No. 3, 1985, p. 104.

the natural variety. Tansley did not want to accept any climax achieved by purely natural processes as an ideal for man to respect and follow. His concern was not to re-establish man as part of nature but rather to de-emphasize the threat to the legitimacy of human empire posed by the natural climax theory. Tansley believed there was no meaningful difference between the balance achieved by nature and that contrived by man. With this premise accepted, no reasonable objection could be made to man's rule over the biological community. Tansley's proposal would in effect remove ecology as a scientific check on man's aggrandising growth.[2] He concluded that the successional stand of the climax must be replaced with an environmental relativism. There could be no exterior model against which the artificial environment could be evaluated scientifically. The yardstick would be tossed away, and man would again be free to design his own world.[3]

The early traditional theory of succession was also bitterly attacked by James Malin, an agricultural historian in 1956. No more-brazen falsehood, Malin insisted, was ever perpetrated upon a more gullible public than the allegation that the dust storms of the 1930s were caused by the "plough

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[2] Goldsmith, p. 105.

[3] Goldsmith, p. 105.

that broke the plains."[4] Malin contended that "the conventional or traditional concept of the state of nature must be abandoned - the mythical, idealised condition, in which natural forces, biological and physical, were supposed to exist in a state of virtual equilibrium, undisturbed by man."[5] Unfortunately, many scientific ecologists have perpetuated this train of thought.

Malin was convinced the great dustbowl was caused by natural phenomenon of the plains and in no way was it to be misconstrued as abnormal.

> Malin was unhappy with what seemed in ecology to be a prejudice against civilization : a belief that only civilized man was evil and that he had no moral right to alter the natural order. The preservationists' oft-repeated charge of "rape" for what modern man had done to the grassland especially enraged him, in part because it implied that nature is more than a mere thing, that is has personal character, that it is female and vulnerable. Nor would he accept any distinction between the environmental impact of Indian and of the White man.[6]

Some ecologists go to great lengths to rationalise their ideological commitment to technological progress. They tell us that a biological explanation of succession may not be necessary at all. What is actually happening can be understood by means of a "statistical process known as a

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[4] Goldsmith, p. 105.

[5] Goldsmith, p. 105.

[6] Goldsmith, p. 106.

regular Markov chain."[7]

Edward Goldsmith describes the Markiv chain:

> It is a stochastic process in which characteristic probabilities depend only on a current state and not any previous state. As it develops it eventually settles into a pattern in which various states occur more or less with characteristic frequency that are independent of initial states. It is argued that this final stationary distribution of states is the analogue of the climax community and that climaxes must occur by the statistical certainties that the Markov process always settles into a stable pattern.[8]

He further suggested that "the different climax communities imply different probabilities of transition among the states, rather than different initial communities, thus convergence too is a necessary statistical artifact."[9]

Many of the reductionist ecologists have been guilty of assumption errors. They believe that because someone developed a mathematical model which simulates in a rudimentary manner some aspects of the real world, then it must be capable of simulating in a sophisticated manner all aspects of the real world.

According to Edward Goldsmith, the whole idea of a Markov chain producing scientifically acceptable data is absurd. He suggests that it is little more than a modern

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[7]Goldsmith, p. 107.

[8]Goldsmith, p. 107.

[9]Goldsmith, p. 107.

form of divination and enjoys credibility only among the naive and the gullible.[10]

Eugene Odum's view of succession leans toward a more holistic approach. Odum stated explicitly that he regards ecosystem development as resulting from: "(1) modification of the physical environment by the community acting as a whole; and (2) the interaction of competition and coexistence between component populations." He regards Frederic Clements's main thesis that ecological succession is a developmental process and not just acting along, as "one of the most important unifying theories in ecology."[11]

Traditional ecologists view an ecosystem as a natural system which grows and ages and eventually reaches its climax stage, a stage which can be compared to its state of adulthood. A normal ecosystem has predictable features that occur in sequential stages. Healthy ecosystems maintain diversity, complexity, productivity, and stability. Environmental history has certainly confirmed that ecosystems mature and grow and move constantly towards their climax. This changing role of ecosystems is necessary in order that they fulfill their role of diversity and production. Ramon Margalef very eloquently describes the maturation of an ecosystem:

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[10] Goldsmith, p. 108.

[11] Goldsmith, p. 108.

> Structure, in general, becomes more complex, more rich, as time passes: structure as linked to history. A more complex ecosystem can be regarded as a more mature ecosystem. Maturity, then, is a quality that increases with time in any undisturbed ecosystem. Mature ecosystems tend to be more predictable, the average life of individuals is longer, the number of produced offspring lower, and internal organisation of ecosystems turn random disturbances into quasi-regular rhythms.[12]

Eugene Odum advances the theory of succession to even greater detail. He notes that the rate of primary production as a proportion of the rate of respiration falls until eventually in a mature ecosystem they equal each other and the ecosystem ceases to grow. Also he suggests food chains which start off by being linear become web-like. Species become increasingly specialised and organisms become larger, life cycles longer and more complex. Survival rate improves as parental care improves and reproduction does not aim at maximising quantity but rather the quality of the offspring.[13]

The holistic approach to ecology views a mature ecosystem as necessary for self-preservation. As Margalef suggested, "maturity is related to evolution in a way that permits generalisation concerning the type of organisms to be found in ecology as a trend toward adjustment to maturity".[14] Traditional ecologists see changes brought about by

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12 Goldsmith, p. 109.

13 Goldsmith, p. 110.

14 Goldsmith, p. 110.

industrial man as having a reversing ecological-successional tendency and thus regard industrial development as an anti-evolutionary process. This reversal gives rise to even greater ecological instability such as soil erosion, water quality and quantity problems, microorganism epidemics, the extinction of plant and animal species, climatic changes, and other serious problems which can only be addressed on a global scale.[15]

Eugene Odum has coined a term for the results of a devasted ecosystem by modern society as "a disclimax or an anthropogenic sub-climax." Interestingly enough, reductionist ecologists view the anthropogenic climax as superior to the natural climax. This premise is difficult to rationalise because human interference with the function of an ecosystem causes a regression in the successional stage. This regression in turn produces a less stable environment which is clearly incompatible with technological and economic progress.

The successional theory can be more easily understood if it is viewed as systems of sequential development. The various stages of an ecosystem occur in the proper order, and if one stage is omitted then the succeeding stages may cease or develop improperly. The stages must also develop in the correct spatio-temporal environment, where adaptations can be

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[15] Goldsmith, p. 110.

formulated. Perhaps the most important aspect of sequential development is that it must occur at an appropriate rate. If the rate is altered by civilization, then the ecosystem's stability is compromised, thereby adversely affecting the net viability of the environment. For an ecosystem to reach its optimal hierarchical order, it must be permitted to develop in its own natural sequential development order.

Ecosystem theory is necessary for basic science and practical purposes. Events occuring at the ecosystem levels have long been recognized as basically responsible for evolution through natural selection. Practically, it is clear that the expanding human population is having increasing pronounced effects on the biosphere - effects which involve a varitey of organisms, populations, and entire ecosystems. Humans usually accept deleterious actions to organisms, populations, and even communities; but, when an entire ecosystem is transformed, people get involved.[16] Obviously relevant early indicators of pre-transformation ecology must be produced.

Henry Regier provides us with an excellent illustration of the way that modern civilization interacts with an ecosystem at varying degrees depending upon demands:

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[16] Henry A Regier and Eric B. Cowell, "Applications of Ecosystem Theory, Succession, Diversity , Stability, Stress and Conservation," Biological Conservation, Vol. 4, No. 2, Jan. 1972, p 84.

> If man's needs are small to moderate, he may allow a particular ecosystem to retain much of its original virgin characteristics and selectively harvest only certain organisms. On the other hand, where his needs are very intense, man may destroy much of the biotic part of an ecosystem and then create and manage a system that more efficiently supplies the particular commodity which is in short supply. In a historical context, the recent trend has usually been one of very selective exploitation of the larger organisms, moving through opportunistic explotitation of medium-sized organisms, and leading eventually to the planned destruction or transformation of an ecosystem to permit the establishment of some form of husbandry-such as agriculture, plantation forestry, or fish culture. Many of the worlds' ecosystems that still resemble their earlier states are liable to become transformed when exploitation technology is developed, enabling them to be modified into tamed cultured plots to satisfy Man's burgeoning needs. Very generally, then, the usual historical process of exploitation results in a gradual reversal of the usual successional process. This can be equated with a lowering of successional status or a reversal or retardation of ecosystem development.[17]

Eugene P. Odum is with the Institute of Ecology at the University of Georgia and is renowned as a world authority on ecosystems. He makes a very interesting observation regarding trends expected in stressed ecosystems:

> when ecosystems are not suffering from unusual external perturbations, we observe certain well-defined developmental trends. Since disturbance tends to arrest, or even reverse these autogenic developments, we can anticipate some ecosystem responses to stress. Trends expected in stressed ecosystems include changes in energetics, nutrient cycling, and community structure and

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[17] Regier, p. 86.

and community structure and function.[18]

The recognition of early stress in an ecosystem is becoming an urgent necessity. One indicator of early stress is an increase in community respiration. This situation occurs when an ecology diverts its growth and production energy to purposes of maintenance for repairing damage. Odum prepared a table of "Trends Expected in Stressed Ecosystems." In general this model covers negative responses in the longer term at the ecosystem level.[19] It contains eighteen components and is presented as follows:

Trends Expected in Stressed Ecosystems

Energetics

1. Community respiration increase (H. T. Odum's pumping of disorder [Odum 1967] or Prigogine's increase in the "dissipative structure" [Prigogine et al. 1972])
2. P/R (production/respiration) becomes unbalanced (< or > 1)
3. P/B and R/B (maintenance:biomass structure) ratios increase
4. Importance of auxiliary energy increase (Margalef's [1975] exosomatic metabolism)

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[18] Eugene P. Odum, "Trends Expected in Stressed Ecosystems," <u>Bio Science</u>, Vol. 35. No. 7, July/August, 1985. p. 419.

[19] Odum, p. 419

5. Exported or unused primary production increases

Nutrient cycling

6. Nutrient turnover increases
7. Horizontal tranport increases and vertical cycling of nutrients decreases (cycling index decreases)
8. Nutrient loss increases (system becomes more "leaky")

Community structure

9. Proportion of r-strategists increases
10. Size of organisms decreases
11. Lifespans of organisms or parts (leaves, for example) decrease
12. Food chains shorten because of reduced energy flow at higher trophic levels and/or greater sensitivity of predators to stress
13. Species diversity decreases and dominance increases; if original diversity is low, the reverse may occur; at the ecosystem level, redundancy of parallel processes theoretically declines

General system-level trends

14. Ecosystem becomes more open (i.e., input and output environments become more important as internal cycling is reduced)
15. Autogenic successional trends reverse (succession

reverts to earlier stages)

16. Efficiency of resource use decreases
17. Parasitism and other negative interactions increase, and mutualism and other postive interactions decrease
18. Functional properties (such as community metobolism) are more robust (homeostatic-resistant to stressors) than are species composition and other structual properties

The first five items deal with the fact that community respiration per unit of biomass has a tendency to increase. Also, biomass accumulation has a tendency to decrease as organisms try to cope with external perturbations. Accordingly, stressed ecosystems would tend to exhibit a decreased ratio of biomass to energy flow, or a low efficiency of converting energy to organic structure.[20]

Items six through eight of the table deal with accumulation of nutrients that may be lost from the system. Increased horizontal transport (one-way flow) at the expense of internal cycling is a prime example of human perturbation. Mining, soil erosion, stream pollution, fertilizer runoff, etc. are all familiar examples.[21]

Community structure is dealt with in items nine through

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[20] Odum, p. 421.

[21] Odum, p. 421.

thirteen of the table. Stressed ecosystems favour development of small organisms and fast growing plants such as weeds. Stress from pollution has a tendency to decrease organism size and species diversity.

Items fourteen through eighteen of the table summarize the overall trends of a stressed ecosystem. Mutualism plays a significant role in a mature ecosystem where the components have adapted to each other within the system. There is system cooperation especially when resources become scarce and mutual interaction has a high selective value. In summary, early warning of stress is more easily detected at the species level and shifts here are accompanied by changes in the rate of respiration and/or decomposition. Stress detectable at the ecosystem level may signal the breakdown in homeostasis and this is justification for serious alarm.[22]

Surprisingly, since 1976 Statistics Canada has recognized the perplexing environmental problems and began an aggressive campaign to collect relevant data. In conjunction with environmental offices, Statistics Canada attempted to formulate a statistical framework devoted to resolving the complex economic-environmental issues of this country. This, of course, proved to be a monumental task but a great deal of good information has been produced nonetheless.

Perhaps it was the famous Stockholm conference of 1972

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[22] Odum, p. 421.

which alerted the world of the need for environmental knowledge and protection. The increasing rate and scope of transformations of ecosystems were graphically articulated. Canada recognized its need for a comprehensive environmental data system. This data would have to address the existing environement and also the stress forces and stress responses in a dynamic ecology.

Rapport and Friend of Statistics Canada developed two tables which are worthy of consideration here.[1] They are as follows:

I Users Needs For Environmental Information

	Environmental foci			
User group	Impact	Conservation	Resource	Regional
Public	e*	a,b	b	a,d
Management and decision makers	c,d	a,b,c,d	a,b,c,d	a,c,d
Scientific and technical	c,d	a,b,c,d	a,b,c,d	a,c,d

*Refers to the information types (see below) most relevant to user and perspective.

Information Types

a) Ecological capital accounts comprising size and spatial distribution of ecological zones and their rates of transformation.

b) Population growth rates, range, and life history parameters for endangered species or economically important renewable resources.

c) Baseline data-characterization of ecosystem in terms of state variables with balance between reductionism and holism, and structure and function.

d) Stresses of human origin and other stress on ecosystems classified by source and type of impact.

e) Perceptual indices of environmental states.

II Ten Commandments For The Design Of Environmental Information Sets

1. Thou shalt be balanced with respect to cultural stressors and ecosystem responses.
2. Thou shalt be balanced with respect to measures of ecosystem structure and function.
3. Thou shalt be eclectic with respect to current ecosystem paradigms.
4. Thou shalt be balanced with respect to mapping, modeling and monitoring.
5. Thou shalt be ecological rather then economic in language and concept.
6. Thou shalt be transdisciplinary with regard to forestry, wildlife, aquatic and other foci.
7. Thou shalt exclude subjective values and subjective weighting schemes.

8. Thou shalt be hierarchical with respect to scientific, management and public information.
9. Thou shalt consist of nested mappings of biomes, watersheds, ecosystems, and ecological communities.
10. Thou shalt accommodate a multiplicity of user's needs - conservation and preservation, impact assessment, environmental engineering, regional planning, resource management, land use - all within an ecosystem framework.[23]

The context of the environmental framework became of paramount importance. There appeared to be two different kinds of basic data. The first dealt with human influences and the natural stressors upon the environment which were capable of transforming it. The second dealt with how the ecological responses of the environment were monitored when subjected to stressors.

This new environmental information system proposed by Statistics Canada was to be made up of three major components - mapping, monitoring cultural stress, and monitoring ecosystem response. The first problem in developing the mapping component was agreeing upon a classification system

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[23] David Rapport and Anthony Friend, <u>Toward a comprehensive framework for environmental statistics: A stress-response approach</u>. Statistics Canada: Minister of Supply and Services, 1979. p. Appendix I, II.

for nature. The age-old model of air, land and sea was inadequate for the new system. The world was to be divided into biomes with the ecosystems being subcomponents. Examples of this proposal can be seen in the following two charts.

Chart 1 Biome Classification

Aquatic

Freshwater

Lotic (rivers and streams)
Rapids
Pools

Lentic (lakes and ponds)
Littoral (shoreline)
Limnetic (upper open water)
Profundal (lower open water)

Marine

Littoral (shoreline)
Rocky
Sandy

Neritic (continental shelf)

Upwellings

Coral reefs

Pelagic (open sea)
Epipelagic (upper)
Mesopelagic (middle)
Batkhypelagic (middle)
Abyssal (lower)

Terrestrial

Desert:
Hot
Cold

Tundra:
Arctic
Alpine

Prairie:
Moist
Dry

Savana

Temperature coniferous forest

Temperature deciduous forest

Tropical forest:
Rain forest
Seasonal forest

Chart II List of Biomes and Ecosystem Components

Grassland Biome

Shortgrass ecosystem
Tallgrass ecosystem
Mixedgrass prairie ecosystem
Palouse prairie ecosystem
Desert grassland ecosystem
Annual grassland ecosystem
Mountain grassland ecosystem
Everglade grassland ecosystem
Subarctic grassland ecosystem

Tundra Biome

Shrub meadow ecosystem
Scrub heath ecosystem
Dwarf Shrub ecosystem
Shrub-moss-lichen snowbed ecosystem
Monocotyledonous bog and mire ecosystem
Tundra meadow ecosystem
Fell field ecosystem

Temperature Confierous Forest Biome

Appalachian extension of boreal ecosystem
Montane (Rocky Mountains) ecosystem
Subalpine (Rocky Mountains) ecosystem
Montane (Sierra Nevada) ecosystem

Subalpine (Sierra Nevada) ecosystem
Northern pacific coast ecosystem
Pinyon-juniper ecosystem
South Eastern United States coniferous ecosystem

Broadleaf Forest Biome

Tulip-oak ecosystem
Oak chestnut ecosystem
Oak-hickory ecosystem
Maple-beech ecosystem
Maple-basswood ecosystem
Mixed mesophytic (Smokey Mountains) ecosystem
Hemlock-hardwood ecosystem
Magnolia maritime ecosystem
Maritime live oak ecosystem
Broad-sclerophyll ecosystem
Chaparral ecosystem
Western oak ecosystem
Sub-tropical (Florida) ecosystem

Coastal Biome

Near-land marine ecosystem
Estuarine ecosystem
Marsh ecosystem
Mangrove ecosystem
Dunes and adjacent land area ecosystem

Adjacent Ocean Biome (new addition)

Western Atlantic ecosystem
Gulf of Mexico ecosystem
Eastern Pacific ecosystem
Arctic ecosystem

Island Biome

Island forest ecosystem
Mangrove ecosystem
Coral reef ecosystem
Seagrass and algal ecosystem
Grassland and marsh ecosystem
Stream, lake and pond ecosystem[24]

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[24] Rapport, p. appendix III.

The significance of this taxonomy is related to management and decision making on environmental matters. Natural and human stresses acting upon system transformation can be addressed as well as providing a basis upon which to organize responses of a stressed ecosystem.[25] The classification would have to be flexible and capable of easy revision.

Baseline data on sequential mapping of natural communities of biomes and ecosystems would be necessary. From the data dynamic changes in boundaries could more readily be observed. Some natural transformations occur very slowly; for example, a grassland may take two thousand years to reach a mature climax forest stage.[26] Some natural transformations can occur very quickly such as perturbations from flood or fire. Human stresses could be closely monitored and allow for a rapid ecosystem rehabilitation program to reverse the transformation.

In essente, land transformation accounts would consist of ecoregions and described in terms of perturbations, could be identified particularly with the aid of remote sensing and thus readily discerned.

The second and third components of Statistics Canada's new framework is monitoring cultural stress and ecosystem

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[25] Rapport, p. 36.

[26] Rapport, p. 37.

response. Under ideal circumstances the relationship between stress and response could be inferred from each. There is however, an enormous gap within this perfect relationship. One of the major problems, aside from the overwhelming amount of information required, is the time lapse between the onset of stress and its manifestation at the ecological community level. Also, stress can appear at points far distant in a geographical sense from its point of origin. Stresses can also interact with other stresses, both man-made and/or naturally produced.[27] These are but a few of the problems in the taxonomy of stress.

Statistics Canada addressed the sensitive question of cost and feasibility. Apparently some of this system's requirements are already in place, such as remote sensing equipment from satellite monitoring, low flying observation aircraft, and recent advances in computer technology. This approach also acknowledges the burdensome amount of information already gathered and encourages a framework offewer information sets. This concept, of course, is part of the holistic approach.

A good summary of the relationship between the three

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[27]Rapport, p. 38.

basic elements of the environmental information system can be found in Appendix I, part 3 of Statistics Canada's report. The ecological mapping provides the basic geographical units within which the measurements of stress and ecosystem response will be carried out. The measurement of human activities which tend to stimulate or transform ecosystems, along with natural perturbations (climatological events, for example) are the forces which tend to transform these natural regions from one stage to another. The ecosystem responses which comprise the so-called ecosystem profile represent the change in the nature of the natural system. Thus, to summarize the environmental information, there are geographical regions characterizing natural communities, there are forces which tend to transform these natural systems to alternative states, and there are the measurements of the state of the natural system itself. It should be mentioned that often the man-induced perturbations of natural systems are sufficient, not to change it drastically from one category of ecosystem or biome to another, but merely to change its qualitative nature or stature. It is these sorts of changes which need to be monitored in terms of ecosystem profiles rather than ecosystem accounts. Naturally, when the perturbation is sufficient to transform the system from one ecosystem prototype to another, then this transformation will be reflected in the ecosystem transformation accounts.[28]

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[28]Rapport, p. 53.

Statistics Canada derived from their research that a single data framework system is unrealistic. They suggested two systems: 1) "the physical transformation of environmental resources, through the process of production and consumption, into economic commodities; 2) the interaction of human activity and the environment, including the monitoring of vital signs of ecosystem transformation".[29] Statistics Canada's goal was to produce a statistical system from a functional perspective. They chose not to use a formal and rigid system based on equations of mathematics and physics. They thought the stress-response system was more appropriate, than the functional relationships which are stochastic.

The stress-response approach is an attempt to correlate the relationship between the stressor activity and the environmental response. The purpose of the system can be summed up as providing the data base for three fundamental concerns: 1) Stewardship - the need to protect and conserve environmental assets for future generations; 2) Environmental quality - the need to maintain and enhance the quality of the ambient environment for quality-of-life objectives; 3) Irreversibility - the need to make explicit the closing of potential options by man-inititated permanent restructuring of the environment, i.e., destruction of

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[29] Rapport, p. 69.

ecosystem.[30] These three fundamental areas could be used at the local level and global level and could accommodate areas between.

The stress-response approach can be extremely important in identifying sources of stress rather than merely stating existing conditions within the environment. Policy regulations must strive for early stress identification and preventative maintenance rather than for "ad hoc" band-aid responses. Instead, not all stress is man-organized and it is necessary to account for natural stress and particularly its synergistic effect when the two interact. The stress-response framework is flexible and adaptive and well-suited to technology-environmental interaction assessment.

Statistics Canada have identified one of the most important problems of environmental assessment and serves to reinforce the purpose of this paper. They summarize their view as follows:

> the knowledge of man-environmental interaction is still rather fragmentary and there are no well developed models that would permit an easy selection of the relevant parameters. Although environmental managers are quite familiar with local conditions, it is quite a different matter to correlate of overall activity; in other words, to link in real time local micro data with that of macro statistics. Nevertheless, it is precisely this kind of cause-effect relationship that is required for the formulation and implementation of

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[30] Rapport, p. 74.

policies what is happening locally in the contextand the proper allocation of national resources.[31]

The interaction elements of stress-response relationships and sources of stress can be classified into three different areas of action for environmental protection. The first is an attempt to reduce environmental stress through modifying processes ~~of~~ production and consumption. This action would take place at the source of the stress and would be classed as a "Preventive Action." The second type would act upon the stress directly and try to ameliorate the existing perturbation and would be classed as a "Curative Action." The third activity is directed towards a broad spectrum of conservation and protection of environmental assets. Designated special land use areas such as national parks, game reserves, and watershed areas, would be one type of action. Delineating inventories of natural resources, both renewable and non-renewabe, for conservation purposes would come under the classification of a "Conservation Action".

Chart Three-I illustrates very graphically the relationship of the stress framework to government policy.

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[31]Rapport, p. 77.

Chart Three-I: Relationship of the Stress Policy

Collective (government policy and individual response to environmental degradation)

Types of Action

PREVENTIVE	CURATIVE	CONSERVATION	
Fundamental changes in process of production and consumption	Implementation of regulation for restraints and environmental standards	Legislation for the protection and conservation of environmental assets	Inventory accounts for the stock of environmental assets

Statistical Measurements of the State of the Environment

Statistical measure of human activity	Stress indicators	Response indicators

Measures of change in stock

The stress-response approach certainly has many fine qualities and contributions for environmental protection. There appears to be however, no clear cut, hands-on approach to implementing this system. It has clearly identified the problem of resource management and protection but like virtually all other studies, it goes beyond practical application by non-scientific decision makers. Additional paring and refinement is necessary before a workable model can be produced. In order for regional populations to utilize the vast amount of scientific environmental data, it is necessary to provide for a liaison process. This liaison procedure would have the awesome task of communicating to the decision makers on a level of practical reality. This communication would certainly include some form of environmental impact assessment (EIA).

From the Journal of Environmental Management (1984); an article entitled an Ecological Framework for Environmental Impact Assessment by Gordon Beanlands and Peter Duinker, provides an excellent overview of EIA. The abstract of the article states:

> Environmental impact assessment (EIA) has been plagued over its almost fifteen year history by very sporadic application of ecological principles and by generally weak scientific approaches. A two year Canadian study recently examined these problems and investigated possible solutions through a series of 10 technical workshops held across the country. The results show that the EIA community is capable of much more rigorous and productive applications of the science of ecology in impact assessment studies. The findings of the study are presented in four main categories: 1) basic scientific considerations important in EIA; 2) some improvements from an ecological perspective; 3) a set of "requirements for organizing and conducting ecological impact studies"; and 4) recommendations on institutional initatives for improving the practice of ecological science in EIA. There is growing evidence that the recommendations arising from the study are already being implemented in Canada.[32]

One drawback to EIA advancement in Canada has been the lack of continuity within the process by the

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[32] Gordon E. Beanlands and Peter M. Duinker, "An Ecological Framework for Environmental Impact Assessment," Journal of Environmental Management, London: 1984 Academic Press, June, 1983, p. 267.

various participants. Government administrators review the assessment from a political perspective and strive for non-controversial successes. Project investors are usually seeking the minimal amount of environmental data necessary to gain licensing approvals and their primary interest leans toward good public relations. As can be expected, the consultants are often caught in the middle. They are to produce results which will allow the project to go ahead but, at the same time, they must also assure the government there are sufficient safeguards so as to not encourage a negative public reaction. Fortunately for the consultants there are no specific guidelines to follow. Unfortunately for the public interest, their mystical slight-of-hand assessments continue to prevail.

An EIA must contain good time and space boundaries in order to be credible and relevant to decision-making. Also an EIA must address the quantitative nature of baseline and monitoring studies. For an assessment to have impact, it must be introduced early enough so as to force a thinking-through process prior to expensive field operations. "More than any other single factor under the control of the investigator, it is the lack of an initial comprehensive study strategy that limits the effective deployment of time and resources in an EIA."[33]

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[33] Beanlands, p. 271.

Dr. G. Beanlands summarizes six requirements an EIA should address: 1) identify early an initial set of valued ecosystem components to provide a focus for subsequent activities; 2) define a context within which the significance of changes in the valued ecosystem components can be determined; 3) show clear temporal and spatial contexts for study and analysis of expected changes in the valued ecosystem components; 4) develop an explicit strategy for investigating the interactions between th project and each valued ecosystem component, and demonstrate how the strategy is to be used to co-ordinate the individual studies undertaken; 5) state impact predictions explicitly and accompany them with the basis upon which they were made; 6) demonstrate and detail a commitment to a well-defined program for monitoring project effects.[34]

Obviously, EI assessments would have to be monitored by EI assessment experts and it would be necessary for administrative agencies to employ them. Technical consultants, project investors, government licensing authorities would all have to acknowledge the EI assessment significance and cooperate with the EIA experts in planning and development. With such a joint effort technological progress would certainly have a minimal deleterious effect on our environment. The fundamental question is whether

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[34] Beanlands, p. 275.

it is feasible and at what level. No doubt mega projects could include this strategy in their development process. There is however the further matter of smaller regional or municipal projects. We need to determine how realistic an EIA is on a smaller scale project. Perhaps with some streamlining, individualizing, and simplified colloquial synthesizing it could produce a manageable model for local development.

Chapter 1: Current Assessment and Regulation of Industrial Development in Nova Scotia

Over the past 15 years I have been involved in residential development in Halifax County. I have observed the criteria for development evolve from virtually no regulations to the relatively sophisticated and comprehensive system that exists currently for residential development. The guidelines for industrial development in 1987 appear to be in a similar state as that for residential development in the early 1970s. The County and the Province cannot wait 15 years to achieve a comprehensive format for industrial development, especially in light of the major environmental issues at risk. It is on this environmental context of industrial development that my research focuses, and I am using the Aero-Tech Park of Halifax County as a case study.

Presently, an application for an industrial park in Halifax County goes through a similar procedure as applying for a house-lot approval. A preliminary application is submitted to the Halifax County Planning office and from there copies are distributed to County Engineering, Storm Water Management, Department of Health, Department of Transportation and Department of Environment. If the comments from each department are favourable then the applicant can proceed to the tentative or final stage. During this phase soil assessments are analyzed, surveys conducted, and all engineering is addressed. Once again these results are distributed to the same departments and favourable comments must be returned. The last phase is the "final endorsement" one and requires that all work such as road building, underground services, storm sewers, runoff restraints, bank seeding and any agreements in Council be confirmed regarding the project. Once all comments from the various departments are positively acknowledged, then the project is a legal entity endorsed by the chief planning officer of Halifax County.

For residential development this system is fine but for industrial development there is an alarming deficiency. The Department of Environment must play the key role in successful industrial development. Unfortunately, that department is understaffed and unprepared to deal with the highly complex issues of ecological and sociological ramifications of industrial parks.

At the commencement of my research, I was concerned whether there was sufficient environmental research available. To my surprise, I discovered we are inundated with scientific studies, and the problem seems not to be a paucity of information but rather volumes and volumes of unreadable, disjointed collections of studies. For any scientific study to have an impact, it must be clear and concise to the decision makers. It must be comprehensible to the public in a social context where the voters must bring pressure to bear on the politicians. This is a major dilemma existing today. We have the tools, experience and knowledge to build an industrial complex in our rather delicate ecological setting but there is no relevant paradigm of environmental protection within our current development practices.

Recent scientific research suggests that a new classification of divisions of nature is necessary to develop an environmental data framework system.[35] The new clearly defined system could properly identify ecological stress factors and the corresponding ecological responses. The comprehensive data framework would then allow the decision makers to follow the best policy for environmental protection. Within the data framework, special attention would be devoted to EIA (Environmental Impact Assessments). Extensive research has been conducted by the federal government in the area of EIA and there are some exciting results surfacing in rather obscure publications. The urgent requirement for quality environmental assessment practices is clearly evident today and the news media serve as a constant reminder of this problem. For example in January 1987 an article in the Mail Star is entitled "Department Admits Error" and the article goes on to state:

> The department of environment erred

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[35] Rapport, p. 21.

> when it approved transportation of potentially toxic wastes from a northend Halifax scrapyard to a regional landfill site, an environment spokesman told municipal leaders Tuesday.
>
> "Standard procedures were not followed by the department, and I apologize on behalf of environment," said environmental engineer Duncan MacKay at a meeting Tuesday of Metropolitan Authority.
>
> "A mistake has been made, and we are man enough to say we made it."
>
> A Jan 6 letter penned by an environment deparment employee advised Dominion Metals Nova Scotia Ltd. it could transport "materials" from its Kempt Road location to metro's regional sanitary landfill site in Upper Sackville.
>
> The "material" Dominion wanted to transport, however, was soil from its location, believed by many obersers to be toxic because of the nature of Dominion's long-standing Kempt Road operation.[36]

Obviously an EIA was not conducted prior to the department's approval.

Another article in the Mail Star dated December 5, 1986 graphically explains Atlantic Canada's deplorable state of environmental health. The short article is certainly worth replication.

> REGION FAILS CHECK ON ENVIRONMENTAL QUALITY:
>
> The environmental quality of Atlantic Canada is "nothing less than alarming" although there are some reasons for satisfaction, federal Environment Minister Tom McMillan said Thursday.
>
> The minister, in Halifax attending an Atlantic Provinces Economic Council (APEC)

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[36] Mike Coleman, "Department admits error." The Mail Star, Jan., 1987, p. 1.

business outlook conference, released the first state of the environment report on Atlantic Canada.

Mr. McMillan said the region continues to suffer from acid rain although it it not highly industrialized.

"We Atlantic Canadians suffer from the garbage ejected into the air by our more industrialized, economically advantaged neighbours to the south".

He said salmon can no longer produce in nine river systems in Nova Scotia and their survival is endangered in 22 other provincial rivers. The acid levels of 16 lakes in New Brunswick and Nova Scotia, he said, have been increasing to a degree that threatens to damage fish populations.

He also said the sediments of Atlantic Canada's major harbours have been infected with cadmium, a highly toxic poision used in electroplating. As well, 2,400 hectares of Caraquet Bay, an oyster producing area of New Brunswick, have been closed because of fecal contamination.

Atlantic Canada also faces the problem of haphazard urban development with agricultural land being used for roads, highways, industrial or residential developments.

Mr. McMillan said the quality of groundwater is also at risk because of "misuse and overuse" of agricultural chemicals.

The region's forests are also threatened by extensive clearing, forest fires and disease.

He said air quality levels through-out the region are being compromised by increasing ground-levels of ozone, a possible danger to human health. Although the levels of air pollution are below Canadian and U. S. national averages.[37]

This article should have started a Maritime revolution

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[37] Sally Smith, "Region fails check on environment quality," The Mail Star, Dec. 5, 1986. p. 1.

but as far as I can ascertain it elicited virtually no public reaction. This is, in part, why our environmental health has deteriorated to its dismal present state. The public in the past, by and large, were willing to sacrifice nature for short term economic gain. Jobs at any cost were the primary goals of politicians. Today we are suffering the consequence of such short-sighted planning or lack of planning. The public is only now becoming aware of its enormous environmental responsibility. Obviously, jobs are vital to our existence and we must continue to develop our economic community. However, it must coexist with sound ecological practices. An examination of our development history clearly identifies areas of environmental weaknesses and indignities. It is absolutely imperative that these unconscionable indiscretions be acknowledged and eliminated in future growth. Whenever environmental protection is addressed, the topic of cost-effectiveness invariably surfaces. Recent empirical data from the U.S. illustrates how accurate EI assessments not only protect the ecology but also save development dollars.

Dr. Gordon Beanlands, an acknowledged environmental authority, presented a lecture at St. Mary's University, Halifax, in January 1987 to a group of graduate students. He emphasized the importance of EIA and graphically illustrated how it can save development project dollars. He argued persuasively, that with strict adherence to the findings of an EIA, a major industrial project would enjoy increased economic efficiency. This is a goal for which the Maritimes must strive. An ecology which prohibits industry is not feasible and an economy which annihilates the ecology cannot sustain itself. Therefore, a model for the integration of environment and technology is vital. The decision makers must be able to understand its function and have the mandate to enforce its covenants. Using the Aero-Tech Park as a case study, I propose to produce a Maritime paradigm model for industrial development from an environmental perspective.

Chapter 2: Development Without Assessment: Halifax International Airport

The Aero Tech Park is located in Halifax County adjacent to the Halifax International Airport. A brief history of the airport is not only interesting but also necessary for the development of this thesis. If a comprehensive published history of the airports exists, it is an extremely well kept secret. My research began at the airport with an interview with the operations manager, who was responsible for, among other things, historical data. After an hour of discussion he produced four pages (one of which was a map) of general information from a soon - to - be - published but still confidential document entitled Halifax International Airport Master Plan. He then suggested I contact a representative from Public Affairs, and also an employee of the Atlantic Canada Aviation Museum. He also suggested that a Halifax International Airport Master Plan produced in 1973 may be helpful; however, he did not have a copy nor did he know where a copy could be procured. He believed however that he had seen one at The Saint Mary's University library many years ago. A thorough search of the library with the assistance of no less than three librarians produced nothing. The Public Affairs representative was very polite but had no information other than referring me back to the airport. He suggested I go right to the top and contact the airport manager's office. I complied but was informed that even though there should be lots of historical data, none could be found. The employee at the Aviation Museum was very amiable but knew of no helpful information and referred me to the curator of the Museum. The curator proved to be very loquacious and a great story teller but had no relevant factual data. Apparently, a comprehensive history of the International Airport has yet to be written and only bits and pieces can be found in newspaper articles. Consequently, my research relies heavily on the local Halifax newspapers.

The Halifax International Airport is located twenty three miles north of the provincial capital, Halifax, and is situated on approximately twenty four hundred acres of land. The nearest communities are Enfield, five miles to the north and Fall River, six miles to the south. The elevation of the airport is four hundred and seventy-five feet above sea level and with few exceptions is the highest point in the surrounding area. The remainder of the topography slopes generally away from the facility and consists of rolling hills and small lakes and streams. The airport is owned by Transport Canada and is a designated port-of-entry.

Although the Halifax International Airport opened in 1960, the history of public airport activity in the metro area can be traced back to 1927. It was in that year the national defence department's civil aviation branch requested the city of Halifax to consider a site for an airport.

By July 1928 a number of sites were examined and the recommended location was the Bluebell Farm in the city's west end. Two landing strips were constructed, one having a length of eighteen hundred feet and the second one being two thousand feet long. Actual operation commenced on January 9, 1931.[38]

The airport continued to operate and by 1938-39 studies were conducted to see if the facility could be expanded. It was deemed not feasible and the RCAF airfield in Dartmouth proved more satisfactory for the budding airlines enterprise. The Halifax facility did continue its operations, however, until the onset of World War Two when it was then converted to an army camp and the airport's license terminated.

At the close of the war, it was decided by the city of Halifax and the federal government to undertake surveys for a new airport location outside the city limits. Absence of fog became the main criterion for site selection and the initial favored location was at Lucasville near Bedford. The area was monitored for a year and the average visibility proved to be no better than the foggy Eastern Passage location.[39]

The search then proceeded to the Kelly Lake district near Waverley. Apparently Trans-Canada Airline pilots remarked that the Kelly Lake area was clear when the

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[38] Brian Hayes, "History of public airport activity started in 1922," The Chronicle Herald, May 14, 1983, p. 10.

[39] Eric Dennis, "Site Approved for Modern $5,000,000 Airport For Halifax," The Chronicle Herald, Oct. 12, 1954, p. 1.

surrounding Halifax-Dartmouth area was enshrouded in fog. Two years of weather monitoring confirmed the pilots' observations and the site was approved for future airport development.[40] An agreement was reached with the Department of Transport to construct the airport, and the city of Halifax was to purchase the land to operate the facility. It is interesting to note that environmental impact was never a consideration.

Halifax city council agreed to provide up to $100,000.00 for the land purchase and on April 5, 1955 the site was acquired. The initial estimated cost of construction for the facility was five million dollars and that amount was expected to produce one of the most modern airports in Canada, capable of handling large volumes of domestic and overseas flights.[41] Runway construction began in the summer of 1955 and the airport was sufficiently completed by June 1960 to permit a temporary license for Visual Flight Rules operations. Dominion Day, 1960, marked the gala official opening for full operations of the airport. The completed cost was a staggering eighteen million dollars and the ultra modern facility was labelled the pride of Nova Scotia. An interesting item appeared in the <u>Chronicle Herald</u> on July 4, 1960 which described some of the advanced workmanship: "the

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[40] Dennis, p. 1.

[41] Dennis, p. 1.

building walls are sprayed interiorally with asbestos."[42] After having read the article I contacted a senior official from the Department of Health and inquired as to the present status of the interior walls. He informed me that the Department of Health is not permitted to inspect the facility, nor are they welcome there. In fact, he said that several years ago health officials were literally "kicked out" when making an official visit. The Department of Health does not, as of this writing, know whether or not asbestos is still present in the airport.

The Halifax International Airport proved successful and has enjoyed continous growth since its opening in 1960. In 1966 a major renovation took place at the terminal building which required extensive excavation. Even though there had been a number of fish kills nearby there had been no connection made to the airport. By 1976 employment at the airport reached 1600 compared with 1200 employees two years prior.[43] 1976 was a busy year at the airport: work began on a 4.5 million dollar addition to the main terminal, the Ministry of Transport and Ottawa committed 3.3 million dollars for security fencing and an electrical service

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42 "No. 1 New York Alternate Modern in Every Detail," <u>The Chronicle Herald</u>, July 4, 1960, p. 1.

43 Gordon Murray, "Airport could employ 2,000 within 2 years," <u>The Mail Star</u>, June 8, 1976, p. 1.

building; a service station was built, Eastern Provincial Airways began construction of a 9.2 million dollar hangar; IMP began clearing land for a half million dollar general aviation centre; and a $400,000 tourist information centre was slated to open in the spring of 1977.[44]

Today the Halifax International Airport is big business: there are approximately 2000 employees, there are 70,000 airplane movements annually; it handles more than three million passengers a year; and it contibutes directly or indirectly over 135 million dollars annually to the economy of the area.[45] It is this awesome economic influence of the airport that has allowed other issues to go virtually unnoticed over the years. Environmental concerns have, for one reason or another, been ignored until 1976 when a major fish kill prompted sufficient attention to necessitate an impact study of the airport and its operations. Chapter three of this thesis deals with the airport's biological assessment and clean-up recommendations.

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[44] Murray, p. 1.

[45] Jim Gowen, "Halifax International Airport-25th anniversary," The Chronicle Herald, Sept. 3, 1985, p. 12.

Chapter 3: Recognizing the Link Between Acid Run-off and Fish Kills

Nature has suffered serious pertubations from post World War II technology and for many years this fact was overlooked or just reluctantly accepted. The policies respecting Halifax Airport provide us with excellent examples of this careless attitude. It was not until 1976, after many years of fish kills, that the government was motivated into responding. A comprehensive study was ordered and subsequently carried out by the firm of Canadian-British Consultants Ltd. and completed on April, 1978. The results of the study clearly delineated serious environmental hazards and this chapter discusses in some detail the findings of that study.

The Halifax International Airport is situated on the divide between streams draining to the Atlantic Ocean and streams draining to the Bay of Fundy. Some 64% of the property drains via Bennery Brook to the Shubenacadie River and thence to Fundy. Approximately 20% of the property, the south-west area drains to Fundy via the Johnson River and through lakes Soldier, Miller and Thomas. The remaining 16%, the area in the southwest quadrant, between the runways, drains to the Atlantic.

The underlying bedrock is a highly fractured fissile band of slate which is heavily mineralized. In many areas, the bedrock is exposed either naturally or as a result of construction since soil cover, except in a few limited areas, is generally thin.

The airport has experienced almost continuous construction to meet the ever-increasing needs of the facility. Serious problems arose within the property as a result of rapid corrosion of corrugated metal pipe used for sub-surface drainage necessitating major replacements. Off the property a number of major fish kills have occurred in the Shebenacadie River and some of the headwater lakes. The first major fish kill in 1960 led to the closure of the fish hatchery at Wellington on Lake Fletcher.

Pressure on the Shubenacadie River system as a source of public water has increased steadily since 1960. A major fish kill in September, 1976 also created operating problems with some of these water utilities and as a result the study commenced.

The study was divided into two stages. In the first stage, the study area encompassed a large area outside the boundaries of Transport Canada's property in order to assess environmental impacts. Water quality sampling was carried out on several streams to establish their water quality and to indicate the need for more detailed work in later stages. The Airport Master Plan was reviewed; Airport personnel and those of private and Crown corporations were interviewed; activities generating liquid wastes and the type and volume of waste were identified. A preliminary evaluation of the performance of the existing sewerage and sewage treatment facilities was carried out. A working paper was prepared on the various potentially polluting activities at the airport.

The second phase of the program was implemented in May, 1977 and a decision was made to abandon sampling stations outside the airport property and to concentrate on major streams at the property line. A number of stations were established to monitor specific activities and a measuring weir was constructed to monitor storm water quantity and quality. The site chosen for the permanent station received drainage from the most highly urbanized section of the property and the area in which most of the airport activities were conducted. Biological sampling of selected aquatic insects and plants was also carried out in June and October at twelve selected sites on streams around the periphery of the airport.

The study concluded from sampling and past history that the most significant environmental problem was associated with acidified drainage and high levels of heavy metals in runoff from the property. The major cause for concern was the area draining to the Shubenacadie River. The Bennery Brook drainage basin was the first priority, particularly the West Branch. See Table 3-1 for summary of test results.

Table 3-1

Location	Mean pH	% Below Guideline	Total Average	Acidity % Above Guideline	Al.Fe.Min. % Above Guideline

Bennery Brook at property line both branches	3.7	79%	82 ml	91%	100%
East Branch Bennery- measuring weir-urbanized	5.8	0	19.1 ml	23%	100%
West Branch EPA Hanger and undeveloped	3.2	90%	432 ml	89%	100%*
South End 06-24 Rock cuts and fills almost entire watershed	3.1	100%	245 ml	100%	100%*
(All above drain to Shubenacadie)					
South End 15-33 Very small [illegible]	3.4	85%	88 ml	100%	100% (except Fe 12%)
Between run-ways largely undeveloped	5.0	14%	20 ml	23%	100% (except Fe 36%)

(Last two stations drain to Atlantic)[46]

A recommendation was made to prevent the formation of acid drainage by covering the exposed areas with an oxygen barrier composed of approximately three feet of compacted clay material covered wih soil and either seeded or sodded to minimize erosion, depending on the steepness of the area. It

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[46] Canadian-British Consultants Limited, <u>Environmental Clean-Up Program Assessment Study</u>-Halifax International Airport". Vol. 1. Halifax: Canadian-British Consultants Limited, April, 1978. p. S. 1

was to be a phased program commencing in the Bennery Brook watershed with fill areas receiving first priority. Monitoring would be continuous to assess the effectiveness of the program.

On the severe cuts near some taxiways, sealing and sodding was not practicable due to the steepness of the slopes. However, oxidation would still take place via direct rainfall on the face. It was necessary to seal the face and the most practical method would be spraying concrete on as gunite. More radical alternatives of treating the acid drainage were not recommended except as a last resort if a seal process proved ineffectual.

De-icing of aircraft was found to be a problem. But, since this technology is rather a recent practice, little is known of its long term impact. Since de-icing is carried out in the cold months, the time of minimum biological activity, the immediate impact is tempered. Plane washing also creates a pollution hazard since the waste water contains high levels of phosphate, nitrogen, and phenols, and the discharge is direct to the West Branch of Bennery Brook. Bottom sediments of the West Branch of Bennery Brook showed accumulations of phosphates and nitrogen which could have been flushed into the stream during storms. A recommendation was made to have the wash waste redirected to the sanitary sewage treatment facility from holding tanks with uniform bleeder valves.

Runway ice control chemicals, oil spills and firefighting training are all contributors to the overall pollution problems at the airport.

The problem of future construction can be summed up in one word - slate. The solution is to minimize excavation which exposes the highly mineralized slate. It is necessary to cover exposed slate quickly with fill from either the other areas of the airport or having it trucked in. Slate should not be used for fills or as road material unless it is to be covered and sealed. A number of other recommendations were presented in the 1978 Consultants study in connection with construction activities:

1) Deep foundations should be avoided wherever possible and, as far as practicable, slab footings should be used.

2) Test pits should be dug before excavation to determine the potential danger of creating an acid drainage problem.

3) The area west of the EPA hangar, near the firefighting training area, should not be excavated down to the taxiways elevation.

4) It is also imperative that construction drawings of all new buildings be kept at the Halifax Airport. Further, copies of construction drawings of all existing developments, particularly underground tanks, cables and pipes, should be available at the airport for quick reference in the event of spills or new construction. Damage to certain buried facilities because of a contractor or airport staff being unable to locate them could be disastrous.[47]

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[47] Canadian-British Consultants Limited, p. X. XI.

The recommendations proved to be very valuable but the amount of information that was apparently unknown about the airport up to the time of that study is nothing short of astounding.

As early as 1960 a major fish kill occurred on the Shubenacadie River. Investigations attributed the fish kills to a decrease in pH and an increase in the amount of hydrous iron compounds in the Miller Lake and Bennery Brook drainage systems. Both these drainage systems have part of the airport area in their headwaters district. Other major fish kills have been recorded on the Shubenacadie River since the airport was constructed. The 1977 study finally makes a correlation between airport construction and major fill kills particularly where the construction has necessitated excavation of mineralized slate bedrock. No fish kills have been reported since September, 1960 in the Miller Lake drainage system due to the fact that the construction activity has taken place in the Bennery Brook drainage area. The last major fish kill was in September, 1976 during the construction of the EPA hangar. The following is an interesting table of dates, construction activities and fish kills on the Shubenacadie River.

Table 3-2 Fish Kill History Shubenacadie River

Major Contruction		Major Fish Kills
Terminal and runways	1957-1960	September, 1960
Imperial Oil	1959-1960	
IMP Hangar (large)	1959	
IMP Hangar (small)	1961	
Air Canada Hangar	1961	
Air Halifax Hangar	1961	October, 1961
Highways slate needs	1965	October, 1965
Avis Service Station	1966	September, 1966
Highways slate needs	1968	November, 1968
Halifax Flying Club	1970	
Mobil Oil Hangar	1972	
Highway Overpass	1974	August 1974
Aircon Tank Farm	1975	October, 1975
EPA Hangar	1976	September, 1976[48]

The study unearthed very important information as to the type of geology and soils located at the airport site. Apparently, the Halifax International Airport is underlain by two groups of metamorphosed sedimentary rocks that originated as deep sediments deposited in shallow water. These rocks consist of a lower quartzite member and an upper slate member. The quartzite member was originally a sandstone which became impregnated with silica. The slate was originally a mud which was consolidated into layered rock by simple pressure. Later geological activity uplifted and strongly folded these rocks into a surface that resembled corrugated cardboard. Subsequently, great masses of liquid magma intruded the bottom beds and cystallized as granite while still below the surface. The effect of this intrusion

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[48] Canadian -British Consultants Limited, p. 3.

converted the shale and quartz-rich sandstone into metamorphic slate and quartzite. Erosion has stripped thousands of feet of rock away leaving narrow bands of slate which occupy troughs or synclines separated by wider bands of quartzite occupying hills or anticlines reducing the mountains to a level titled plain. Later the passage of the continental ice sheet scoured the area removing most of the soil cover and rearranging the remainder.

The airport property is located astride a band of slate rock containing abundant pyrite and other minerals disseminated throughout the rock and along fractures in the rock known as cleavage planes created during uplifting and folding of the rock. An analysis of a grab sample of slate taken in the airport area by the Nova Scotia Department of Environment and subjected to whole rock analysis for metals gave the following results:

Table 3-3 Analysis of Slate Rock Sample

Element	Percentage	ppm
Aluminum	4.65	
Iron	2.56	
Manganese	0.025	
Cobalt		500
Nickel		150
Lead		150
Arsenic		1.25

Canadian-British Consultants Limited, p. 28.

Most of the soils located on the airport property have developed from surficial materials from two main sources, a) glacial till derived from locally occurring bedrock, b) till derived from carboniferous shales and sandstones that were transportated into the area from the north by glacial action. Soil types developed from surficial materials corresponding to above are a) Bridgewater, Halifax and Riverport, b) Hantsport and Wolfville. Areas of exposed bedrock and organic soils can also be found on the site.

The predominate soil types found on the property are Bridgewater and Hantsport. Bridgewater soils have developed from medium textured olive-coloured till derived principally from the underlying slate bedrock. These soils have good internal drainage but are often shallow and stony. Hantsport soils are derived from moderately fine textured reddish-brown glacial till. The main texture of the till is sandy clay loam. These soils have imperfect internal drainage and are often shallow and stony. Hantsport soils are often found associated with Wolfville soils.

The occurrence of Wolfville soils is limited to a small area of the property along the Guysborough Road. Wolfville soils are derived from basically the same parent material as Hantsport soils. Wolfville soils have good internal drainage but are sometimes shallow. Riverport soils are found on the eastern part of the property and in a small area across the Guysborough Road. Riverport soils are often found in association with Bridgewater soils and are similar in appearance and texture. They are derived from basically the same parent materials as Bridgewater soils. Riverport soils have imperfect internal drainage and are often limited to the northern part of the property. These soils have developed from moderately course textured olive to yellowish-brown till derived chiefly from quartzite. Parent material texture ranges from sandy loam to gravelly sandy loam. The soils are often shallow, stony, and porous. Soil drainage varies from well drained to excessively well drained.

Wolfville and Hantsport soils are the most erodible soils found on the airport property. Bridgewater and Riverport soils have a moderate susceptibility to erosion with the Halifax soils being the most resistant to erosion.

Vegetation at the airport is located in the Atlantic Uplands Section of the Acadian Forest Region. The natural vegetation has been greatly disturbed over most of this section. Broad areas of brushland and fire-created and erosion barrens are characteristic.

Some of the barrens support open black spruce with scattered trembling aspen, red maple, red oak and eastern white pine. On better soils, tolerant hardwoods are prominent though not usually of good quality. On wet sites, in areas of peat accumulation and in swamps, black spruce, tamarack, red maple, black ash and alder brush are common. The moist climate and gentle relief have created considerable areas of non-forested bogland.

Much of the vegetation complex characteristics of the Atlantic Uplands can be found on the airport property. Approximately fifty percent of the property was cleared for the construction of the airport complex and its operating requirements. Some of the area not built upon is covered with grasses and low shrubs. A third of the property is currently forested with stands of mixed wood predominating over softwood stands. Hardwood stands form a more minor constituent and the balance of the property is composed of swamps, bogs, barrens, highways, pits and quarries. There appears to be evidence of some thinning of timber stands in some areas of the property due to past logging activity.

The wildlife habitant on the airport property has undergone severe habitant alteration due to the construction of the airport facility. Approximately one half of the airport site has been cleared for the construction of airport facilities or for their operation thus reducing or altering the available wildlife habitant. The airport property is fenced around most of its perimeter restricting the movement of wildlife particularly large mammals on and off the property. The airport habitant supports a few deer and other small animals. The property itself supports no waterfowl production but the lakes surrounding the property support a few broods of waterfowl; the numbers are not significant.

Airport personnel have reported a slight problem with the few deer residing on the property. Occasionally deer browse on the grass between the runways but are easily scared off. They are destroyed only if necessary.

The airport does experience a problem in the fall and winter when the wind blows in from the Atlantic carrying flocks of snow buntings into the area. These birds feed on the seedlings that border the runways and other areas, creating the danger of bird strikes with airplanes. Patrols are used to scare the birds away. It is essential to keep the grass closely cut so that it doesn't go to seed. This discourages the birds by removing a source of their food.

Operations and construction in and around the airport can certainly affect the environment of surrounding areas. The off-site effects are due to air, water and noise pollution occurring during the operational phases. The significance of these effects is dependent on the sensitivity of the surrounding resource and their importance to both community and ecology.

An area of major concern regarding off-site pollution is the Shubenacadie River. This river is currently used for public water supply, recreation, and commercial fisheries. Three communities, Lantz, Elmsdale and Enfield currently draw their drinking water from the river. The river is also a popular canoe waterway, being one of three waterways in Nova Scotia that has been rated as very easy. In addition, its proximity to a major urban area certainly contributes to its popularity. The lower reaches of the river below the Stewiacke River also supports a recreational fishery with the principal sport fish being salmon and striped bass. The number of salmon taken by anglers from the main stem is much lower than on the Stewiacke River, which is recognized as a major salmon river in Nova Scotia. Catch figures for a three year period are as follows:

Tables 3-4 Catch Figures - Salmon

Main Stem Shubenacadie River				Stewiacke River		
1977	1976	1975		1977	1976	1975
77	74	298	Number of fish taken	474	622	1138
459	393	1421	Number of pounds	3486	3208	5384[50]

The river is not an important spawning area but its importance lies in the fact that it is a passageway for migrating fish to reach their spawning areas in headwater streams. Among the species that migrate up and down the river are gaspareau, shad, striped bass, salmon, smelt and eels. Gaspareau and shad are the most abundant species.[51]

Information contained thus far in chapter three was ascertained directly from the only assessment study conducted

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[50] Canadian-British Consultants Limited, p. 35.

[51] Canadian-British Consultants Limited, p. 27-35.

on the airport up until 1978. The study was a two volume report produced for the Environmental Protection Service, Department of Fisheries and Environment and was entitled Environmental Clean-up and Program Assessment Study - Halifax International Airport. The format of the study, the assessment methodology, and the statistical accountability may all be marginally outdated in 1987, but the underlying message and primary environmental concern is as relevant today as it was in 1978. Acid drainage has been and continues to be a serious threat to the environment. With the thorough and comprehensive environmental assessment and the positive indentification of acid drainage perturbation, it should then be concluded that the airport could develop with pollution-free pride. This, however, is not the case.

In 1982 the airport once again precipitated a major fish kill as a result of construction activities on two taxiways. Even though the logistics of the perturbation was well understood by this time, another study was ordered. Transport Canada contracted the consulting firm of Porter Dillon to conduct the study which was completed on April 9, 1985 and entitled Environmental Study of the Salmon River Watershed in the Vicinity of Halifax International Airport, Halifax, Nova Scotia. The following is a summary of this $94,000 plus study.

The Salmon River Environmental study was commissioned by Transport Canada following the construction of Taxiways B and D at the Halifax International Airport. This report addresses the environmental impact on the 50 km^2 headwater region of the Salmon River Watershed resulting from the discharge of acid drainage from the airport. This report also describes a series of mitigative measures which may be introduced as part of current abatement programs and incorporated in future development projects scheduled for the Halifax International Airport.

The taxiways specific to this study were constructed in 1982. During construction, a highly mineralized slate bedrock was blasted, excavated, used for taxiway fill and/or placed in a disposal site referred to as the waste rock pile. Several months following the initiation of taxiway construction, the taxiway underdrains and waste rock pile began to discharge large quantities of a low pH, highly acidic and heavy metal laden water, commonly identified as "acid drainage".

In response to environmental concerns, Transport Canada constructed a lime treatment facility designed to neutralize the acid drainage and to prevent environmental damage to the receiving Salmon River Watershed. Although the treatment system generally achieves an effluent quality sufficient for surface stream discharge, it experiences reduced treatment efficiency under winter conditions and handles only approximately one-half of the total acid drainage discharged to the Salmon River due to underdrain and waste rock pile bypass. Furthermore, a significant disposal problem has developed as a result of the massive accumulation (20,000 m^3) of lime sludge.

This analytical study involved the disciplines of hydrology, chemistry, geology, biology and engineering. When assembled, the physical, chemical and biological data produced by this investigation identify an aquatic system which is stressed to the point where normal fish populations and benthic productivity do not and cannot exist, a condition directly attributed to the discharge of acid drainage from the airport. In the absence of remedial action, the 50 km^2 headwater region of the Salmon River Watershed will remain an unsuitable habitat for salmonid and other fish species for several decades if not longer.

Remedial measures required to alleviate the problem are:

1. capping the waste rock pile or disposal of the waste rock pile in a designed landfill;

2. controlling stormwater and runway underdrain discharge;

3. sludge dewatering, solidification and final disposal;

4. treatment phase out and monitoring.

The optimum means of implementing these works should be determined immediately through preliminary engineering and economic evaluation.

In order to prevent generation of acid drainage from the construction of new facilities, alternate engineering techniques are required. These include attention to underdrain design, above grade construction, excavation procedures, application of special cover and backfill material and alternate waste rock disposal methods.[52]

The study was well conducted and professionally presented but it revealed nothing really new and simply confirmed the fact that the knowledge and technology already existed to deter such an environmental misfortune. If this premise is true, then we need to ask why the same mistake was made again. The only logical explanation can be that Transport Canada even into the 1980s perceived development in terms of cost-effective economic units and paid but token lip-service to environmental issues. As the 1980s mature, the federal and provincial Department of Environments are

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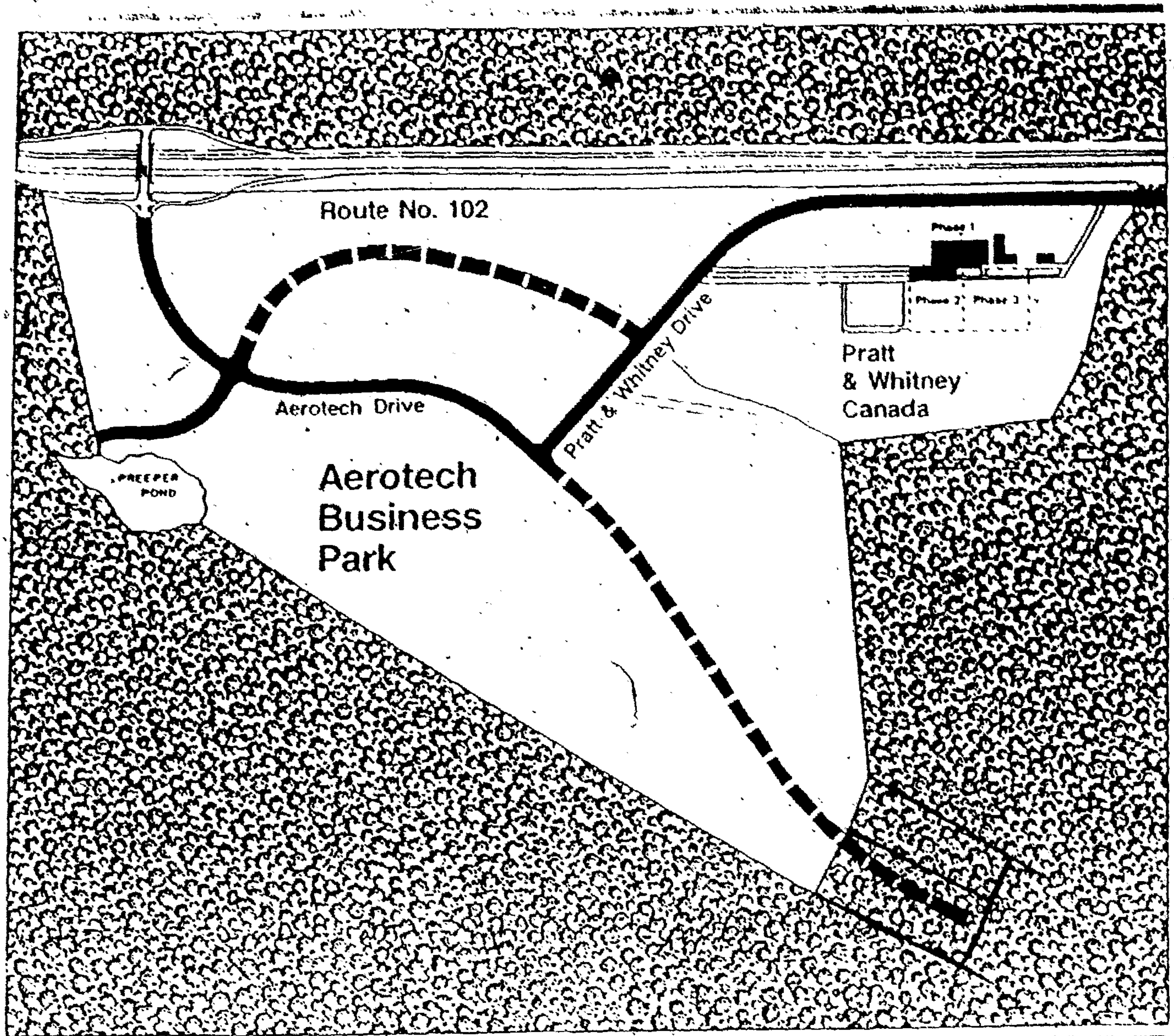
[52]Porter Dillon, Environmental Study of the Salmon River Watershed in the Vicinity of the Halifax International Airport-Halifax, Nova Scotia, Halifax: Porter Dillon Limited, April 9, 1985, p. 1 -11.

gaining a higher public profile and certainly Transport Canada will eventually have to acknowledge their prominence.

Environmentally speaking, there is little left to the imagination regarding the site of the Halifax International Airport. It is with that major advantage the Halifax County Aero Tech Park began its growth and development activities. The Aero Tech Park has approached the environmental issues at the airport with an entirely new attitude of ecological sensitivity. The Aero Tech Park represents to Nova Scotians the best that can be expected in the complex field of high technology. The Park looms largely on the socio-economic horizon of hope and prosperity for many Maritimers. The question now is whether this show-case, high profile industry can develop and thrive in such an environmentally sensitive area. Chapter four introduces the Aero Tech Park and traces its growth and development from a socio-environmental perspective.


Route No. 102
Phase 1
Phase 2
Phase 3
Pratt
& Whitney
Canada
Pratt & Whitney Drive
Aerotech Drive
PREEPER
POND
Aerotech
Business
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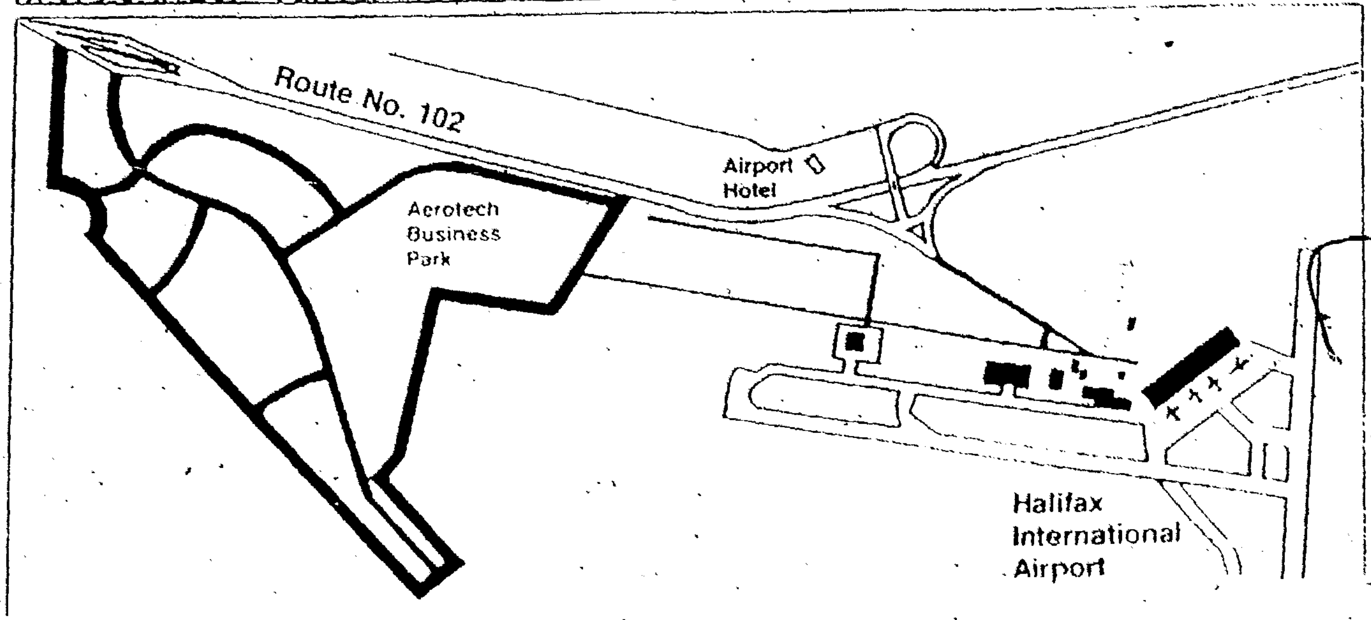
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International
Airport

Chapter 4: Development with assessment: Aero Tech Park

In the industrial world, events do not always follow a "grand master plan". The Aero Tech Park did not manifest itself from an original brillant brainstorm, rather it happened initially quite by accident and good luck. The story begins in the late 1970s with the Canadian Armed Forces.

At that time, the Canadian Armed Forces were deciding on purchasing a new fighter aircraft and the choices were narrowed to two versions of the F-18 and F-16 Falcon. The F-18A Hornet was a sea-based jet to be built by the McDonnell-Douglas Corporation of St. Louis, Missouri, with the Northrop Corporation of Los Angeles, California participating as chief airframe sub-contractor. The roles were reversed for the other model. Northrop was bidding for the general contract for the F-18L Cobra model, a land-based aircraft, with McDonnell-Douglas as the sub-contractor. But there was a big difference for Nova Scotians. If Northrop won the bid to market the F-18L, it would build an airframe component machining center, and it would build it in Nova Scotia, near the Halifax International Airport and accessible to the Halifax-Dartmouth metropolitan area. Northrop lost and the Armed Forces decided to go with the Hornet.[53]

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[53] "High Tech Expands," New England Business, Jan., 1987, p. X.

Prior to the Armed Forces decision, Northrop undertook an extensive feasibility study of the airport site as a location for its airframe component machining center. Apparently, much of the study did not portray Nova Scotia as a culturally priviledged province. But it did identify the fact the province has excellent proximity to large markets, has an exceptionally capable transportation network, and a virtually unlimited labour force. Even though Northrop was not successful, their proposal planted the seed for a high technology park at the airport.

It was at this stage Jack J. MacLeod and Lorne Denny began their relentless and obstacle filled journey of promoting the concept of high technology at the airport. Mr. Denny, a native of Hamilton, Ontario, was acutely aware of the significance of an airport industrial park. Mr. Denny travelled to Durham, North Carolina and studied a successful high technology park there. He came back to Halifax with excellent references and credentials to promote the high tech concept. Every conceivable roadblock imaginable was thrown in Mr. Denny's path by the province. Reasons included excessive cost, too much existing industrial parkland on the market, lack of need, and irrelevance of the concept to the traditional economy. Mr. Denny persevered and a recommendation from Mr. MacLeod brought Mr. Denny and the Department of Regional Industrial Expansion together. A singularly astute and perceptive individual in DRIE did something no one in the province would do, he listened to Mr. Denny, and liked what he heard.

Prior to the DRIE meeting, one of most troubling difficulties for Mr. Denny and Mr. MacLeod and the newly formed Halifax Industrial Commission was the enormous problem of financing. A number of consulting firms were requested to review this new concept and devise a plan of action to accomplish the Commission's goals. With the consent of Mr. MacLeod, I have included a private and confidential proposal from a local consulting firm which illustrates clearly that feasibility is based solely on economic viability. Its title is Approach to Financing Airtech Park, Municipality of the County of Halifax (1986), and I quote the crucial sections:[54]

> Background of Need:
>
> Today we are told in one breath of the enormous offshore earnings, which are about to flow, and which will make Nova Scotia a "have" Province, provide jobs, income, security and a better life, and in the next we are told that drilling rigs cost too much here, that they are cheaper imported from Sweden, a country with the highest standard of living in the world, even after being towed across the Atlantic. We are told too that those who come here are completely outfitted and provisioned from other sources. And we believe that businesses in other areas lie in wait for the unwary oil companies to buy products and services. By contrast Nova Scotia businesses waits for the oil companies to come to them, or for a government to come with suggested products and the money to put

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[54] Lorne Denny and Jack J. MacLeod. Personal interviews. Halifax Industrial Commission: Dutch Village Road. January, 1987.

them in business.

It is certainly true oil companies that can build refineries and drill in deserts half a world away, or in tropical Borneo or the wastes of the North Sea, know how to look after their needs and won't be seeking out reluctant or sub standard Nova Scotia businesses. It is equally true that, if they can buy the goods and services here of the quality they need and at the price they can pay, it makes sense to do so.

Not only are we looking for oil companies and offshore resources to spur a stagnant economy, but we hear a wide cry for the establishment of high technology industry to locate here to encourage employment, so that this area does not become an industrial backwater. Of course, though the two are inextricably intermingled, they are at the same time separate and distinct.

They are intermingled because a drilling rig is, and needs, the product of high technology to become operational: it requires engineering, design, welding of uncommon alloys, machining of drill bits, and other items of micro tolerances, communications equipment, computers, electronics controls, analysers, rescue equipment, positioning equipment, services and supplies.

High technology companies and services produce all these components but may not have as their reason for being, the equipment for oil rigs. To this extent they are separate and distinct. The producers of electronic equipment may welcome oil rig business, but equally be interested in fisheries, charting the ocean depths, satellites, radio location beacons, navigation aids, and electronic robots or weaponry to keep their scientists and engineers busy and their equipment in use.

High technology enterprises, just as drilling rigs, may bring great economic benefits to a region. Both have one thing in common, they want a local, technical sub contract infrastructure to make and service things for them that they regard as being uneconomic, (or impractical) to incorporate in their own operations. They need communications, transportation and municipal facilities.

Even if the drilling rig is forced to operate off shore, it doesn't have to be supplied from shore. Reliability is more important than convenience. The high technology plant only locates in a place where all the infrastructures are in place, and the community, after weighing all the assests and liabilities, is assessed clearly as a good place for people to live and work.

Historically, great cities came into being at the convergence of significant trade routes. The Halifax area has a great support, only a hundred odd miles from the great circle route of the Atlantic; it has an International Airport, and it has excellent road and rail communications. In addition, it has the capacity to supply municipal services, though in many respects it lacks the industrial sub-contract base to support the high technology industry needs referred to above.

Nova Scotia as a whole has a couple of hundred machine shops, varying from the village blacksmith to Halifax Shipyards. None of these shops, however, have CNC machine tools (computer number controlled) or equipment which can receive a drawing by digital communication, reduce it to a cathode ray display (TV), feed the information to a CNC machine tool and make a part.

There are approximate two dozen electronic design shops, some with limited production capability in Nova Scotia; one of these employs several hundred, 3 about 25-30 and the rest 1-10. Some have advanced designs in their field, but if they were to be considered for a substantial order they would lose out on two bases: one, they couldn't physically handle the order; and two, their financial status is so precarious that a major buyer would be afraid to trust in delivery.

The Airtech Park

The foregoing has sought to establish, in outline, the needs of a modern industrial community and some idea of what is lacking in the Province and therefore needed in the Park.

The Airtech Park under consideration has some 800 acres owned by the Municipality of the County of Halifax located adjacent to a Class II airport. It is proposed to develop this site as a high technology plant location, seeking out appropriate customers to buy or lease land, build or lease manufacturing plants, and produce goods and services. The latter would be particularly related to the production of components for, or the supply and overhaul of, aircraft and components and also to participation in defence offset and sharing agreements.

Plans call for 10 acre sites. If it were assumed that the average plant for this size of site were to be 100,000 sq. ft. and employing 100, it would mean total employment (without maintenance services) of 8,000, supporting about 30,000 people, and possibly employing another 4,000 in sub contract activity. These are matters an environmental and feasibility study will determine more accurately.

Financing

In recent years large projects in Nova Scotia, if approved and supported, have usually looked to Federal or Provincial Agencies for financing, to an excessive degree even if the project had excellent potential with alternative financing available, government sources were usually exhausted first. It could be argued that this outlook goes with the apathetic approach to seeking new business; at least this view has been attributed on occasion to those who should participate more in servicing offshore drilling activity.

The long term development of an Airtech Park of the scope proposed would appear to be, in the context of heavy reliance on government funding in these years of economic restraint, a doubtful proposition. Deficit financing has become a word to be avoided at all costs in Provincial and Federal circles. Any project which might add to the deficit could expect a lot of opposition and many delays.

For the Park to be as successful as possible, its organization as an operating body must be flexible and well funded in advance. Some of the municipal facilities should be in place. When a prospective customer is considering a plant site in the Airtech park, we must be aware that he is probably considering one or two sites. Since feasibility studies are not cheap, prompt responses to approaches are particularly critical.

If the person or corporation dealing with the customer is forced to wait for the customer's decision, and then tries to stall him while an application for funds is made to a government agency (which will take an indeterminate time to complete, particularly in these times), the chances of the customer receiving satisfactory answers within his time frame are limited, and in any case the negotation tends to take on "an on again off again character." The loss of potential customers will be higher than necessary and the nature and rate of development of the Park spasmodic.

This situation can become critical because it is based on illogical financial planning and this would soon become known in the market place. If three major companies negotiate to locate in the Halifax Airtech Park and all end up elsewhere and it becomes known, as it will, that an inability to mesh third party government financing with customers' requirements and timing was the root cause, then fewer potential clients will appear and their demands are likely to be higher in terms of concessions, again because site studies are expensive.

Consider what would happen if the Airtech Park or

Corporation were to be amply funded in advance. When the customer and the Park Corporation sat down to talk, each would know that the other could carry out his part of any financial agreement, the cards would be on the table. Consider also the situation where the Park Corporation, recognizing certain high technology sub contract requirements, has decided to establish in the Park a high production, high technology electronic and parts warehousing facility, capable of meeting large production needs of all Nova Scotia electronic companies and still having usable capacity for the rest of Canada and for world markets. And finally consider a decision to provide a large sheet metal facility for unusual alloys, high precision CNC machining, tool and die making, possibly grinding, honing, forging and rare alloy casting both with aircraft and defence procurement certification and any other required.

Surely with such flexibility the Park could be planned with properly scheduled development, with increasing customer satisfaction, resulting in world recognition. It might also incorporate a free port for industrial manufacture and re-export. The free port would include the two industrial facilities proposed above.

We have a considerble preliminary investigation of a means of accomplishing the necessary financial structure and believe that the capital markets would provide a source of funds for such a development based on a retractable preferred stock "guaranteed" by the Municipality. Such a financial instrument can be designed to minimize any rish and be highly profitable to the municipality. Some features could include:

1. A normal corporation formed with the common stock controlled by the municipality.
2. Stock sold to the public in the form of retractable (redeemable at the customer's option at a stated time) preferred.
3. Dividends at a floating rate tied to the bank prime rate.
4. The money not invested in the Park, from time to time would be invested in prime securities to yield a maximum return. This would allow dividends to be paid and a fund at compound interest to be built up to meet the obligation on the retraction date of the preferred stock.
5. Money actually invested in the Park capable of supporting dividend requirments.
6. The Park Corporation would supply, for a fee, service and maintenance requirements and build, equip, lease or sell, on a turnkey basis, any type of plant negotiated.
7. Advantage might be taken of deferred tax liabilities to ensure payment of dividends out of retained earnings - a must if the owner of a preferred share is to qualify for

a dividend tax credit.

8. A small proportion of the Park's tax base, might be set aside by the Municipality to provide for excess retraction over that funded in 3 above.
9. The Park Corporation being wound up when the Park's development is substantially completed, becoming part of the municipality's general assests.

Further Steps

The Department of Regional Industrial Expansion has been approached to fund a feasibility study to examine the legal, accounting, financial, marketing and tax ramifications of the proposed financial instrument to be offered to the public.

We feel that since this proposal does not drain the finances of the Federal or Provincial governments, is designed to be self liquidating, provides taxes to three levels of govenments and meets employment needs on a large scale both during and after construction, it is worthy of consideration. If you share our feelings, we would be prepared to work with you and the relative government authorities, in accomplishing the successful development of the Airtech Park.

Respectfully submitted:
Professional Directors Inc.[55]

The bulk of the initial financing came ultimately from DRIE and this factor above all others is why the Park has enjoyed proper environmental practices during the infrastructure start-up activities. More about that unplanned but happy event later.

In a recent article published in <u>New England Business</u>, an interesting summary of scenarios and events about the Park is revealed. Much of the information comes from Halifax's Mr. J. MacLeod, a former Air Force pilot and now consultant

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[55]Professional Directors Inc., <u>A Proposal to Develop a Financing Plan for the Aerotech Business Park</u>, Halifax: Professional Directors Inc, Oct. 13, 1982, pp. 1-5.

charged with marketing the high technology park for the county. With construction under way for the park's first two major tenants, a new location for high technology activity in Nova Scotia has developed, says MacLeod. Although several companies have developed a high tech base for Nova Scotia's economy over many years, private business people and development officials are predicting that both established U.S. and Canadian companies and start-ups will open more facilities in the province.

"Nova Scotia is the kind of place that attracts high tech people," explains John M. Currie, president of Micronav Ltd., a microwave navigational equipment developer and manufacturer in Sydney, on Nova Scotia's Cape Breton Island. "High tech people work very hard, and they play very hard, especially outdoors. Nova Scotia provides a working environment where 15 minutes from work you can be in the wilds or on the ocean," says Currie.

As are most New England states, Nova Scotia is looking for high technology companies to diversify its economic base and to replace aging or extinct industries with businesses looking toward the turn of the century and beyond. Federal, provincial and local resources are being allocated to help in the relocation and start-up efforts. Post-secondary educational institutions are altering their course offerings or implementing new programs to accommodate the demands for production and engineering brain-power.

The Aerotech Park project is probably the best example of the new initiative, says MacLeod, and one the government hopes will be repeated in industrial parks and municipalities throughout Nova Scotia.

When the Northrop proposal went south, Halifax County officials decided to study the feasibility of building an industrial park on the patchwork of public and privately-held land that made up the Northrop site. "We felt that a very carefully designed and controlled high technology park would be attractive to many companies and in the best interest of the area," says MacLeod.

The county commissioned a series of studies to see if the idea had any merit. The land, although some 13 miles from downtown Halifax, was on Route 102, the province's major highway and part of the TransCanada Highway. And the feeling was, as with many other urban centers in Canada and the United States, "that the city was spreading out to embrace the more rural areas surrounding it," says MacLeod.

Though the economic feasibility and environmental impact studies weren't complete by the time the county's option to buy the land was about to expire, it went forward on the project. "The county took the risk of owning all that land, but in the final anaylsis it paid off," says MacLeod. In late 1982-early 1983 the studies were completed, and basic development of the site and its infrastructure began.

In total, about $24.6 million (Canadian) in federal and county money has been invested in preparing the park for tenants. The national government over four years has contributed $20 million to Airtech Park. The park has a federal mandate to spark new private investment in Canada, says MacLeod. The growth of private business and the shrinking of government ownership or involvement in industry is one of the prime economic objectives of the administration of Prime Minister Brian Mulrooney.

The Park was divided into two sections of roughly 600 acres each. Offered first were parcels in Phase I, which includes 580 acres on the far side of the airport's border. As soon as aerospace and defense-related businesses have filled the first area, land in the second will be developed and offered for sale.

At about the same time that the Aerotech Park marketing efforts began, Pratt & Whitney Canada, a division of United Technologies Corp. in Hartford, Connecticut, was searching for a site for an experimental production plant. The company wanted to build its first flexible, computer-integrated manufacturing plant in North America. Pratt & Whitney Canada is based in Longueuil, Quebec, outside of Montreal.

The negotiations for Pratt & Whitney's $90 million (Canadian funds) investment in Aerotech Park included the federal, county and municipal governments offering development incentives, says MacLeod. In exchange for creating new employment and tax revenues, Pratt & Whitney was given an undisclosed package of grants. Such financial assistance is earmarked for certain aero-space and related companies under the federal Defense Industry Productivity Program.

Skilled labor has been a scarcity in Nova Scotia in recent years and Pratt & Whitney's production requirements dictate a new level of production training for its workers, says MacLeod. Using federal money, the province created a $10 million (Canadian) pool of training money.

In early 1985, with negotiations completed, Pratt & Whitney became the park's first tenant. Construction of its 142,000-square-foot facility began in the spring of 1986. It is scheduled to be completed this spring, with the first production beginning in January 1988.

The plant will manufacture more than 100 components to be used in commercial aircraft engines, explains Douglas Renton, general manager for the Halifax Operations for Pratt & Whitney Canada. The manufacturing operation will be housed on one floor, which will be a huge production and storage facility that is currently under construction.

According to the general manager, the experimental or revolutionary aspect of the plant, is the nature of the jobs that workers will perform. "Everyone in this factory will be comfortable sitting at a computer key-board," says Renton. Production workers will be highly skilled technicians. The manufacturing equipment is mostly automated and computerized. "This plant will enable us to do in 20 days what it used to take us 20 weeks to complete," says Renton. He also points out that the new machinery has created a new social situation, for the workers overseeing or operating the equipment have a new role to play in the manufacturing process."

Teams of workers will be organized around the flow of production, so that everyone will have the skills and training to perform more than one job. Previously, manufacturing workers were trained to perform a specific job, and training rarely went beyond that job. But at the Pratt & Whitney plant, broader talents are being sought. "We will pay for skills," says the general manager. Workers will receive pay upgrades for each additional usable skill they acquire. When a problem arises in the process, a solution will come from team members interaction with one another.

"We have been working since August 1985 analyzing how to organize the workforce on a team basis," says Renton. Production teams will be created, each with 20 to 25 production technicians. There will also be a technical support team and a management team.

A committee of representatives of the 100 workers who already have been hired are ironing out the details of various compensation levels and benefits that will be offered to workers. Renton indicates the attempt to be flexible in that area as well: "Right now, because this is all new, there is no preconceived notion of how this plant should operate, how it should look." The committee system is one that the company plans to keep in place for the next several years, as the factory grows to its anticipated level of 750 employees.

In all but a few positions, the company has been able to recruit local production and engineering talent. "The Technical University of Nova Scotia and Dalhousie University (both in Halifax) have generated a tremendous number of technically competent workers," including engineers, says Renton.

Of the first 38 students in the flexible manufacturing systems program interviewed at the Nova Scotia Institute of Technology in Halifax, the company hired 26. The bulk of the government training money allocated to Pratt & Whitney's program has been given to NSIT to train production workers. The school has instituted a year-long program for prospective workers. A miniature computer-integrated factory has been set up, simulating the equipment in the components facility. Student workers learn to operate and maintain the manufacturing robots and robotic systems such as automatic storage retrieval. In the process, parts needed for production are placed in their specified areas by a computer-aided robot machine.

Though Nova Scotia's population is only about 875,000, with approximately 300,000 people in the Halifax Dartmouth metropolitan area, there are additional resources for high tech labor, says MacLeod and Renton. "Nova Scotians are very loyal to their province," says MacLeod. "Many who've left Atlantic Canada for jobs in central Canada or the United States are willing and eager to return."

Renton concurs. Several of his new employees are repatriated Nova Scotians recruited from other provinces. The returning labor pool is made up of people who hold either technical or advanced degrees. MacLeod points out that many of Nova Scotia's high tech workers, particularly in the technical area, are former military personnel: "Canada has a relatively small but efficient armed forces," he says. "Members are trained well beyond the standards of the American or British armed forces because fewer people man the sophisticated technology. When Canadians leave the service, they are sought out by companies."

Litton Industries Inc. has just broken ground on its new 95,000-spuare-foot facility. At Aerotech Park, Litton will maintain avionic and electronic systems for the CP140 Aurora anti-submarine aircraft used by the Canadian armed forces. It also plans to manufacture the X-Brand radar system to be used as part of the Low-Level Air Defense Program operated by the North Atlantic Treaty Organization.

Despite the fact that construction has just begun, Litton has already hired 75 people, most of whom are now undergoing special training at NSIT. By next year, 500 people will be employed. Between Pratt & Whitney and Litton, about 2,000 eventually will be employed at Aerotech Park. A multi-tenant building is currently under construction, but it is too early to predict the number of companies and their employee figures that will operate there, says MacLeod.

The new operations at Aerotech will strengthen the existing high-technology industry in Nova Scotia and help it grow, says Colin McCrae, manager of the anti-submarine warfare program for Hermes Electronic Ltd. Hermes employs about 525 people at its plant at the Woodside Ocean Industries industrial park in Dartmouth. While some observers may think otherwise, "we will probably benefit from the arrival of Litton and Pratt & Whitney," says McCrae, "because they will further establish the infrastructure that is the base for the high-tech industry."

Hermes' origins in the province date back to 1949, and after changing hands several times, it is now a division of DevTek, based in Toronto. The Dartmouth company has delivered over 1 million sonabuoys (submarine detection devices) to the Canadian, U.S. and other NATO navies. Sonabuoys production accounts for about 90% of the company's $30 million (Canadian) in revenue each year.

McCrae says there have been many improvements in conditions for high-tech companies over the past several years: "I remember that in the past we had difficulty getting enough personnel with engineering skills, but that has changed." New programs at various levels of post-secondary school education have placed more qualified workers into the labor force. "We've worked closely wih NSIT to develop programs and offer opportunities to students," says McCrae. "Our senior engineers have a close relationship with the teaching staff at the Technical University, so that ensures that our requirements are heard." The arrival of more high tech companies can only boost the skill and education levels further, he says.[56]

As I mentioned earlier DRIE was responsible for most of the initial financing, supplying twenty million of the twenty four million dollars necessary for the infrastructive construction. There was however one large string attached to the financial undertaking and that was DRIE had to be completely satisfied by the Federal Department of Environment that the project could develop within environmentally safe guidelines. Consequently, the Federal Department of Environment assumed power and influence that was previously unheard of in this province. In my opinion, the Department did not abuse their power, for they were extremely thorough and precise in carrying out their mandate. As early as August 1982 an environmental guideline was produced by the Environmental Protection Service and Department of

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[56] "High Tech Expands", New England Business, Jan. 1987, pp. X-XIV.

Environment and was specifically prepared for the Aero Tech Park. Released in August, 1982, the guideline is worth quoting in its entirety and is included here as an appendix to this chapter. With special permission from Environment Canada, I examined virtually all the environmental correspondence related to the Aero Tech Park from 1982 to the present. There are literally hundreds of items of correspondence and nearly everyone alludes to the acid drainage problem. The Aero Tech Park has been very carefully guided by the Environmental Protection Agency and there was little left to chance environmentally speaking. The acute sense of responsibility fostered by EPS sparked a greater awareness in other government departments and soon an eclectic team of advisors virtually guaranteed a sound project. The impressive and prodigious attention to environmental sensitivity at the Aero Tech Park is certainly a welcome contrast to the unremorseful ecological perturbations inflicted by DOT during construction of the Halifax Airport.

APPENDIX

Section 1: Introduction

Government agencies familiar with the Halifax Airport site have reviewed the Aerotech Business Park Terms of Reference; Environmental Impact Study; Halifax County, Nova Scotia, and based on previous experience with other projects in the area are suggesting to the proponent that the environmental issues associated with park development be investigated as outlined on the following pages.

This project differs from most due to the occurrence of mineralized slate in the development area. Although many of the environmental impacts associated with park development and operation are not unusal and can be readily mitigated to acceptable limits, the potential environmental problems associated with acid drainage from disturbed slates greatly increases the complexity of impact assessment, required abatement measures, and determination of residual impacts.

Thus, activities not having potential for creating acid runoff may be investigated at a screening level, recognizing that such screening may indicate further more detailed studies are required.

Any development activities which necessitate the disturbing of soil overlying slate formations or the excavation of the slate bedrock have the potential to create an acid drainage problem. Those activities are of sufficient concern to warrant detailed studies, including field investigation, preliminary component designs, development of specific pollution abatement procedures, and the determination of residual impacts.

The remainder of this section outlines the assessment information requirements considered appropriate to define and assess the significant environmental effects of the proposed

Aerotech Industrial Park.

The environmental assessment report should contain the following components:

2.1 Description of the project

2.2 Discussion of development alternatives

2.3 Study approach

2.4 Description of the existing environment

2.5 Identification and evaluation of impacts of the preferred alternative

2.6 Identification and assessment of mitigatory measures

2.7 Description of implementation of mitigatory measures

2.8 Discussion of residual impacts

2.9 Description of proposed monitoring programs

The proponent shall superimpose feasible project development alternatives on the existing environment and then investigate and describe all beneficial and adverse implications for various resource users and environmental components such as:

i. Resource Utilization

(a) Fisheries

(b) Water

(c) Forest

(d) Mineral and construction materials

(e) Recreation

(f) Agriculture

(g) Wildlife

2. Ecologically Sensitive Areas

3. Water Quality

4. Air Quality

It is important to note the above is not extended to represent a complete list of environmental components to be examined. If during the course of investigation by the proponent it becomes apparent that other components of the environment may be influenced, they should be examined and presented in the report.

In forwarding the environmental assessment report, the proponent should indicate the extent of commitment to implement designs, construction activities, and mitigation measures recommended in the report.

Section 2 describes components of an environmental evaluation. Special references are drawn to the acid runoff potential. Section 3 outlines the activities which should be assessed.

Section 2

2.1 Description of the Project

The proponent should present a complete but concise project description. This should include relevant information relating to the design, methods and timing of construction, operation, maintenance and abandonment of the project.

The principal environmental concern associated with this project is the possible creation of an acid drainage problem which may persist even after construction is complete. This aspect of the project will receive thorough examination and, therefore, the project description should be presented in sufficient detail to accommodate close scrutiny. Information on any aspect of the project which will necessitate excavation over or into slate bedrock is of particular importance.

The proponent should indicate in the design of the project proposed methodologies for the treatment of effluents (domestic industrial) and runoff water, and should recognize that the project is expected to comply with all pertinent federal and provincial regulations, Statutes, and municipal by-laws.

2.2 <u>Development Alternatives</u>

The selection of appropriate alternatives for the location, design and operation of the basic components of the project, including development phrases, green areas, grading requirements, water supply, access routes, waste treatment facilities and runoff controls are seen as an integral part of the project planning and design process. Several identified alternatives should be examined in sufficient detail such that the major environmental impacts associated with each are clearly identified and a clear comparison between options, in terms of environmental differences, can be made. While environmental matters may not be the sole consideration in the final decision, the differences in terms of environmental impacts, and hence the trade offs made, must be clearly indicated and the <u>most environmentally sound alternative identified</u>. If the option preferred by the proponent is not the one identified as the best from an environmental viewpoint, all reasons for the choice of the preferred options should be explained.

2.3 Study Approach

The purpose of including such a discussion is to provide an understanding of how the conclusions and recommendations of the study were conceived. It is important that the reader be made aware of the approach taken in identifying the study area; in data gathering (including the analytical methods, and the source, reliability, and adequacy of the data used); in impact identification; in site evaluation and selection; in the determination of the need for mitigation measures and monitoring systems, and in defining criteria for determining and evaluating residual impacts.

2.4 Existing Environment

A description of the local environment, current stresses acting upon it, and any existing trends is essential to an understanding of the interaction of the proposed project (and associated off site activities) with the environment. The description should focus on those components of the terrestrial, atmospheric, and freshwater environments which may be directly or indirectly affected by the project. The depth to which components of the environment (social, physical and biological) are described should reflect the detail of information used in identifying potential project impacts and the significance of those impacts. The size of the study area itself should depend upon the extent of the potential impacts and may vary according to the component being discussed and should be delineated in the report. Any data (including maps and narrative descriptions) which are necessary for the understanding of impacts should be part of the text. Detailed background data should be included as appendices to the text.

The data used to describe the existing environment will also serve as a basis for comparing data from environmental monitoring programs in the operational phase. Therefore, it is important that the data sets be readily comparable. This will partly be determined by the design of the baseline study program and the nature of the existing data.

Finally, the proponent should investigate and present information on the extent and nature of slate which has potential to generate acid. It is equally important in describing the existing environment to identify those areas of slate which naturally or as a result of previous activity are already acid producing. Information such as location of slate, depth of cover if any, type of overburden, proximity to streams, background water quality, etc., are essential in determining potential problems in project development.

2.5 Identification and Evaluation of Impacts of the Preferred Alternative

The identification and evaluation of impacts should be considered the main focus of the environmental impact assessment. All effects, impacts and risks which may occur as a result of interaction between the construction, operation, maintenance and abandonment of the proposed project, both on and off site, and the terrestrial, atmospheric, and freshwater environments to be affected, should be identified. Considerations should be given to the following when describing potential impacts of the project:

1. The component of the environment affected
2. The magnitude of the impact
3. The significance of the impact

4. The duration of the impact
5. When during the life of the project it may be expected to occur
6. The aspect of the project responsible for its occurrence
7. The likelihood of occurrence

Inherent in any predictive exercise is a degree of uncertainty; predicted impacts should be clearly stated and the significance of the impact to particular environmental components noted. Estimates as to the likelihood of an impact occurring should be provided where they will improve the understanding of reasons for selecting a favoured alternative.

Any difficulties in obtaining data critical to an evaluation of alternatives or in predicting impacts of a selected alternative should be clearly identified as early in the study as possible, and preferably prior to submission of a completed report.

2.6 Identification and Assessment of Mitigatory Measures

The report should describe how adverse effects of the project may be minimized, prevented, remedied or avoided, and should include recommendations for maximizing opportunities for environmental enhancement resulting from this project.

The most effective mitigative measure is the selection of the project alternative with the least negative impacts. If more than one mitigative measure could be applied to control a potential negative impact the report should discuss the relative merits of each and the reasons for selecting one method over another. Cost estimates should be included where relevant to the selection.

2.7 Implementation of Mitigatory Measures

The environmental impact assessment report should explain how the proponent proposes to ensure that the mitigatory measures would be implemented.

2.8 Residual Impacts

Residual impacts are a major source of information for those decision makers who must determine whether or not to proceed with a project as proposed. Those impacts which occur during construction or over the life of a project, despite the implementation of mitigatory measures, are considered to be residual impacts. A complete listing and full description of such impacts is necessary as they represent changes to the environment which will not be avoided.

2.9 Monitoring Program

Monitoring programs are an essential part of the environmental control procedure. A comprehensive monitoring network will provide information to allow an assessment of the efficiency of pollution control facilities and to ensure compliance with specified effluent limits. The proponent shall describe any baseline monitoring and shall propose a monitoring program which includes project discharges off site, e.g., liquid effluents, noise, air emissions, etc., and environmental effects in the receiving environment. Such a program shall complement any baseline monitoring developed in consultation with the regulatory agencies.

The report should specify the corrective action that will be taken when monitoring indicates such need, and what levels of contamination will initiate such corrective action.

Section 3

Activities to be Assessed

Where mineralized slate is expected to be encountered a full environmental evaluation is warranted. Where this is not the case a screening may suffice.

Impacts should be investigated for the following activities or conditions:

Surveys

(a) Site surveying; disturbance to soils

(b) Soil testing; ground cover sensitivity to vehicle movement and creation and handling disposal of any wastes

(c) Hydrological testing; types and quantities of dye tracers

(d) Environmental surveys; disturbances to wildlife in area

Construction

(a) Site clearing and grading:

-clearing, grading and rehabilitation activites and schedules

-relocation and "disposal" of excavated mineralized slate

-surface runoff patterns and controls

-areas of mineralized slate exposed (sequential operation if applicable)

-creation of dust

(b) Road construction

-removal and placement of topsoil

-relocation and disposal of any mineralized slate

-type of fill for base and sub base, and source

-creation of ditches for runoff control

-disruption to traffic patterns

(c) Excavations/gradings:

-probable areas and volumes of mineralized slate to be excavated, other bedrock and overburden

-planned disposal methods of mineralized slate

-alterations to water table

-blasting and drilling requirements

(d) Drainage alterations (see also a, b, c)

-sensitivity of receiving waters and associated biota to increased turbidity, modified pH values, heavy metal releases

(e) Service facilities:

-overall designs for water supply, industrial waste, and surface runoff lines, power and telephone cables (if buried)

-water volumes required, and preferred and alternate sources[57]

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[57] Environmental Protection Service and Nova Scotia Department of Environment, Environment Guidelines and Information Requirements for the Aero Tech Business Park, Halifax County, Nova Scotia, Halifax: Department of Environment, August 1982, pp. 1-9.

Conclusion: Towards a Holistic Format for Industrial Development

The Aero Tech Park has certainly been a very special project in terms of environmental assessment and protection. However, one cannot help but ponder the question whether this sophisticated approach to the Park will continue with forthcoming projects or whether it was a one shot exception. Also, in light of the enormous effort from the environmentalists, we need to ask whether their contribution was comprehensive and beneficial in an ecological context. Regretfully, I must conclude a negative response to the above questions simply because there is no mechanism of action or formal guidelines to ensure a thorough evaluation.

The introduction of this thesis examined in detail the various schools of thought regarding environmental theory and disclosed the fact that there is no single or simple philosophy which is exactly proper for every occasion. Rather there must be a holistic approach to development which acknowledges the existence and importance of the project within a macrocosm. Industrial development is not new to the Maritimes: at the turn of the century Nova Scotia was a secondary producer of the highest order in North America. Environmental concerns during that era were virtually nonexistent and remained that way into the 1970s. There were two reasons for that attitude: 1) initially, there was only limited knowledge of environmental perturbations and 2) later, there was only token regard for environmental issues for fear of discouraging development.

The reductionist theory proliferated in the first half of the century. Development was assessed in terms of economic units and the financial consultant was 'the major force in any project. As the Maritimes experienced increasingly depressed economic conditions right into the 70s, the concern for environmental issues went unheeded. It was not until the promise of untold wealth, lying offshore, that the attitude toward industrial development showed a marked improvement. Offshore oil and gas gave promise of jobs and prosperity. Talk of Nova Scotia becoming a have province permeated the air. It was in this buoyant atomsphere that the Aero Tech Park made its entrance into the industrial scene. The timing could not have been better. With the economic future appearing bright, it became a possibility that the Aero Tech Park could actually develop with the optional luxury of environmental awareness and protection. The Aero Tech Park signaled the first significant deviation away from reductionism and a shift toward holism. The environmental issues were finally being addressed and ironically the success of the project depended upon not only financial viability but also environmental protection. As I mentioned earlier, DRIE in conjunction with the Environmental Protection Agencies were the primary influences regarding environmental awareness. In addition, the positive political and economic atmosphere, and the Aero Tech Park's timing in relation to oil and gas, played vital roles in the complex mosaic of the project.

The environmental impact assessment conducted at the Aero Tech Park was very effective but by no means complete. There is one very significant aspect of the Park which has received very little attention - the "social impact assessment (SIA)." If a project involves a number of employees, it is imperative an SIA be conducted.

The concept of SIA is primarily an area of systematic inquiry, which seeks to investigate and understand the social consequences of planned change and the process involved in that change. The SIA is invaluable as a basis for decision making and as a source of public information. SI assessments, above all, are and should be about people. It is community based, rooted in the problems and needs of those who are faced by change or dislocation. Often they are "people in the way" of various kinds of development schemes. The rationale for the emergence of SIA is to make their concerns clearly understood and so make the decisions which affect them both responsive and responsible. Four types of social change are usually investigated as part of SIA:

a) Demographically-related changes, e.g., the effects of increases or decreases in population growth on local facilities and services, neighbourhood cohesion and community stability;

b) Economically-related changes, e.g., the effects of new patterns of employment and income on the financial stability of residents, municipal tax base and the viability of local business and social service organizations;

c) Resource related changes, e.g., the effects of changes on natural resources upon which people depend for subsistence, employment or recreation;

d) Culturally-related changes, e.g., the effects of demographic, economic and resource-related changes on community institutions, traditions and values and on the way of life of individuals in communities.[58]

Consequently, when a proper EIA and a thorough SIA are conducted at the preliminary stage of any development, the project ultimately has a much stronger survival potential.

EI and SI assessments at the conceptual phase of a major development are naturally very costly. There are, however, methods by which this cost can be mitigated. It is quite reasonable to assume any project which creates employment, contributes to a tax base, and operates in a safe environmental setting, is desirable by government standards.

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[58] Canadian Environmental Assessment Research Council, Social Impact Assessment, Canada: Minister of Supply and Services, 1985, p. 2.

Projects which eventually create major environmental perturbations are not only damaging to an incumbent government but remedial solutions are extremely costly when the industry ultimately fails. Hence the government must promote and acknowledge EIA and SIA by allowing the project a tax credit equal to the cost of professional environmental and social assessment. For example, if a corporation spends fifty thousand dollars in pre-approval EIA and SIA and the corporation property tax bill at the end of its first year of operation is ninety thousand dollars, then a net tax bill of forty thousand dollars would result. This system is straight forward and clear and would certainly benefit both sides.

At the beginning of this chapter, I alluded to the fact that the environmental success of the Aero Tech Park was due to a number of exceptional circumstances and that chances of a similar success story were minimal partly because of a lack of a mechanism of action or a development model. In a recent conversation with a senior development officer for Halifax County, I asked a spontaneous question as to what the letters EIA represented. He though for a moment and began thinking aloud - "Earned something, ah, earned income may be, ah, earned income average"? Eventually, I informed him of its meaning - "Environmental impact statement" and he was very much aware of its existence and meaning. The point I am trying to make is that planners are still thinking in terms of economic units or the reductionist theory. The mechanism of action for environmental and sociological preservation must be controlled by the development planners and introduced at the preliminary stage of the formal approval process. In order to indicate changes that need to be made it will be necessary to reproduce here a sample of the application form which any industrial development must utilize when appplying for a project approval within Halifax County. The first change should occur in the Environment box on the form. Here is the existing form:

APPLICATION STATUS FORM

FILE NO. SUBDIVISION NAME:

Approval/Endorsement for Lots	Chkd by	D.O.	Date
Rejection of Lots:	Chkd by	D.O.	Date
Approval ONLY for Lots: Endorsement	Chkd by	D.O.	Date

Fee Paid	Processed by	Date Incomplete	Date Complete	Zoning:

FORWARDED To:	Date Sent	Date Re-Sent	Date Re-Sent
Transportation			
Health			
Environment			

Engineering

Parkland

Other
(Mun. Solicitor,
Mun. Affairs
Etc.)

Instructions for Preliminary Evaluation or General Comments:

The Environmental section of the application should be divided into three divisions. The first section would read Environment -

1) Is project site on or near known hazardous geological formations? If yes - EIA required.
2) Does project involve ultimately 100 acres of land or more. If yes - EIA required.
3) Does project involve ultimately 100 people or more either directly or indirectly? If yes - SIA required.

Developer's would accept this legislation because is would help to ensure their projects' success. The Municipality of the County of Halifax has the mandate to enforce such requirements by using municipal Bill 80. This is a Private Members Bill implemented in 1974 and gives the Development Officer authority to refuse a plan based on a negative report from the Department of the Environment. A proposed new application status form would be very similar to the old one with the very important change to the Environment section and a sample would appear as follows:

APPLICATION STATUS FORM

FILE NO. SUBDIVISION NAME:

Approval/Endorsement for Lots Chkd by D.O. Date

Rejection of Lots: Chkd by D.O. Date

Approval ONLY for Lots: Endorsement Chkd by D.O. Date

Fee Paid	Processed by	Date Incomplete	Date Complete	Zoning:

FORWARDED To:	Date Sent	Date Re-Sent	Date Re-Sent
Transportation			
Health			
Environment Is project site on or near known hazardous geological formations? If yes - EIA required.			
Does project involve ultimately 100 acres of land or more? If yes - EIA required.			

Does project involve ultimately 100 people or more either directly or indirectly? If yes- SIA required.

Engineering

Parkland

Other
(Mun. Solicitor,
Mun. Affairs
etc.)

Instructions for Preliminary Evaluation or General Comments

The ultimate goal of this thesis was to produce a "model" for industrial development that was comprehensive and comprehendable within an environmental perspective. The Aero Tech Park was used as a role model because it represented the first major shift away from reductionism and a swing toward holism. The site of the Aero Tech Park, the Halifax International Airport, was examined historically and environmentally to reveal the marked contrast in development attitudes and practices as compared to the Tech Park. The philosophies of the various schools of environmental assessment were reviewed. The importance of utilizing EIA and SIA at the preliminary conceptual stage was demonstrated and a method of dealing with the cost factor was presented. Eventually and finally, this complex mosaic theory came to focus on a revised "Appliction Status Form" used by the Municipality of the County of Halifax Development Office. It is the finding of this thesis that Development officers, planners, consultants and developers will find it in their best economic interest to adopt this paradigm of ecological preservation and develop it to its fullest potential.

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