

**GREAT LAKES ENVIRONMENTAL POLICY:  
THE ECOSYSTEM APPROACH AND AN ECONOMIC PERSPECTIVE**

by

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## **ABSTRACT**

This thesis is concerned with the conceptual foundations of environmental law and policy in the Great Lakes basin, the world's largest freshwater ecosystem. The Great Lakes regime is now widely recognized as one of the most advanced international environmental management regimes in existence. Over the past two decades, toxic contamination has emerged as a highly pressing ecological issue in the Great Lakes basin. In Canada and the United States, the ecosystem approach, a comprehensive and integrated approach to environmental management, has been adopted both bilaterally and domestically in the Great Lakes' complex environmental policy framework to guide the protection of ecological integrity. There has been extensive discussion of the ecosystem approach, particularly from scientific and managerial perspectives; however, the economic content of the concept has been largely neglected, despite the importance of considering all relevant perspectives in the development of law and policy.

This thesis is divided into five chapters. After discussing in Chapter 1 the ecological and institutional contexts and methodological issues of the analysis, this thesis defends, in Chapter 2, the view that economic theory has relevance to issues of environmental law and policy. In addition to highlighting the main contours of welfare and environmental economic theory, a main conclusion, and an essential premise upon which the analysis proceeds, is that economics remains a useful analytical approach to environmental issues, despite some important criticisms.

Subsequently, in Chapter 3, the analysis shifts to an examination of four bilateral and domestic Great Lakes instruments that form the core of Great Lakes toxic pollution policy:

(i) the *Great Lakes Water Quality Agreement*; (ii) the *Great Lakes Binational Toxics Strategy*; (iii) the *Canada-Ontario Agreement*; and (iv) the *Final Water Quality Guidance for the Great Lakes System*. After outlining key principles underpinning each instrument, the thesis underscores common themes running through the collective policy framework. The ecosystem approach constitutes a unifying concept in this framework.

The ecosystem approach is examined from an economic perspective in Chapter 4. After identifying key elements of the ecosystem approach, this chapter highlights important parallels between fundamental welfare and environmental economic notions. One main conclusion is that economic concepts and approaches, such as environmental valuation, externalities, and self-interest, form an integral part of the ecosystem approach.

Finally, Chapter 5 identifies some directions for further research. Given that, as the thesis seeks to establish, economic theory constitutes an important, albeit not sole, perspective on the ecosystem approach, a key challenge will be to facilitate interdisciplinary analysis and cooperation leading to effective operationalization of the concept.

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## **CHAPTER ONE:** **CONTEXT AND METHODOLOGY**

### **I. INTRODUCTION**

The Great Lakes have vast ecological, social and economic importance. The five lakes, Superior, Huron, Michigan, Erie and Ontario, collectively contain one-fifth of the earth's surface freshwater and comprise the largest freshwater ecosystem in the world.<sup>1</sup> The Great Lakes basin is biologically diverse and provides support for over 45 globally imperiled or rare species that are present either exclusively or predominantly within it.<sup>2</sup> In addition to their ecological significance, the Great Lakes are a source of drinking water and energy for humans, and are used for recreational, transportation, agricultural and industrial purposes by 46 million Canadians and Americans.<sup>3</sup>

A complex institutional structure and policy framework has evolved over the past century, and particularly over the past three decades, in an effort to address Great Lakes environmental concerns. The Great Lakes regime is now widely recognized as one of the most advanced international environmental management regimes in existence. This dissertation examines the conceptual foundations of the Great Lakes policy framework relating to toxic water pollution, one of the region's most pressing environmental challenges. In particular, the present work analyzes the "ecosystem approach" qualitatively from an

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<sup>1</sup> International Joint Commission (IJC), *First Biennial Report under the Great Lakes Water Quality Agreement of 1978* (Windsor: IJC, 1982) at 1.

<sup>2</sup> United States, United States Environmental Protection Agency, *Water Quality Guidance for the Great Lakes System: Supplementary Information Document*, EPA-820-B-95-001 (March, 1995) at 1 [hereinafter *Guidance Supplementary Information Document*].

<sup>3</sup> *Ibid.* at 1.



economic perspective. The ecosystem approach constitutes the fundamental principle of integrated and comprehensive environmental management in the Great Lakes basin. However, despite extensive policy analysis and development in the Great Lakes basin, there appears to have been little attempt, thus far, to analyze this concept from an economic perspective. This dissertation argues that economic theory has analytical and practical relevance to environmental law and policy, despite some limitations of the perspective. The present work also highlights key principles and themes underlying key instruments addressing toxic contamination within the Great Lakes basin. Furthermore, this dissertation identifies key elements of the ecosystem approach and, within this conceptual framework, argues that the ecosystem approach relies on core economic concepts and approaches, such as environmental valuation, externalities, and self-interest.

## **II. GREAT LAKES ENVIRONMENTAL POLICY**

The Great Lakes are a transboundary resource governed by a complex multi-jurisdictional regime, which consists of two federal governments and nine sub-national governments within Canada and the United States. In an attempt to address environmental concerns within the Great Lakes basin, both countries have signed several bilateral agreements and have enacted numerous pieces of legislation. The policy frameworks addressing toxic water pollution in the Great Lakes basin are established primarily by bilateral agreements between Canada and the United States, national agreements, and federal, provincial and state legislation. At the bilateral level, Canada and the United States

first signed the 1972 *Great Lakes Water Quality Agreement*,<sup>4</sup> an agreement that initially focused on the issue of eutrophication<sup>5</sup> but was subsequently amended to address a range of Great Lakes environmental concerns, particularly toxic contamination. The present *Great Lakes Water Quality Agreement*<sup>6</sup> constitutes the overarching agreement between Canada and the United States and articulates shared commitments to restore and protect the Great Lakes. In addition, Canada and the United States have developed and recently signed a binational strategy, the *Great Lakes Binational Toxics Strategy*,<sup>7</sup> which sets forth a collaborative process by which both countries will work towards furthering objectives relating to persistent toxic substances established under the *GLWQA*. At the national level, within Canada, the *Canada-Ontario Agreement*<sup>8</sup> provides the present framework for coordination of shared federal and provincial responsibilities for ecosystem management in the Great Lakes basin, including Canadian obligations under the *GLWQA*. Within the United States,

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<sup>4</sup> *Agreement Between the United States of America and Canada on Great Lakes Water Quality*, United States and Canada, 15 April 1972, 23 U.S.T. 301 [hereinafter *1972 GLWQA*].

<sup>5</sup> Eutrophication is the process by which a lake becomes depleted of oxygen as a result of decomposing algae and other aquatic plants which initially flourished from increasing nutrient enrichment of the lake. See T. Kehoe, *Cleaning Up the Great Lakes: From Cooperation to Confrontation*, (DeKalb: Northern Illinois University Press, 1997) at 60-61.

<sup>6</sup> *Agreement Between Canada and the United States of America on Great Lakes Water Quality*, 15 November 1978, 30 U.S.T. 1383, [hereinafter *1978 GLWQA*], as amended by *Agreement Amending the Agreement of November 15, 1978, as amended, on Great Lakes Water Quality*, United States and Canada, 18 November 1987, T.I.A.S. 11551, [Present Agreement hereinafter referred to as *GLWQA*]; [1987 amendment hereinafter referred to as *1987 Protocol*].

<sup>7</sup> *Canada-United States Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes Basin*, Canada and United States, 7 April 1997, online: USEPA <<http://www.epa.gov/glnpo/p2/bns.html>> (last modified: 6 January 1998) [hereinafter *Great Lakes Binational Toxics Strategy*].

<sup>8</sup> *Canada-Ontario Agreement respecting the Great Lakes Basin Ecosystem*, Canada and Ontario, 1 April 1994 [hereinafter *Canada-Ontario Agreement*].

regional cooperation has occurred at the state level in the form of several interstate voluntary agreements focusing on Great Lakes environmental issues.<sup>9</sup>

In addition to participation in bilateral and intranational agreements, both Canada and the United States have enacted numerous statutes aimed at addressing water pollution.<sup>10</sup> In the United States, the United States Environmental Protection Agency (USEPA), in consultation with the eight Great Lakes states and stakeholders, developed the *Final Water Quality Guidance for the Great Lakes System*,<sup>11</sup> a set of regulations aimed at promoting greater consistency and effectiveness in states' water quality standards. Moreover, at the provincial and state level, both Ontario and the American states have enacted statutes aimed at improving water quality.

The unifying theme of the Great Lakes policy framework is the ecosystem approach to environmental management. In essence, the ecosystem approach entails an integrated and comprehensive approach to research, policy development, and implementation that

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<sup>9</sup> Such agreements include the 1985 *Great Lakes Charter*, the 1986 *Toxic Substances Control Agreement*, and the 1989 *Great Lakes Protection Fund*. See S.M. Siros, "Transboundary Pollution in the Great Lakes: Do Individual States Have Any Role to Play in its Prevention?" (1996) 20 S. Ill. U.L.J. 287 at 299-303.

<sup>10</sup> In Canada, the revised *Canadian Environmental Protection Act*, Bill C-32, *An Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development*, 1<sup>st</sup> Sess., 36<sup>th</sup> Parl., 1999, is the most important federal statute addressing toxic pollution. However, other Canadian federal initiatives include federal pollution prevention programs, including a number of voluntary projects and partnerships. For a summary of federal pollution prevention activities, see Canada, Environment Canada, *Pollution Prevention in the Ontario Great Lakes Basin: 1997*, 1997. In the United States, key federal environmental protection statutes relating to toxic pollution include the *Clean Water Act of 1977*, 33 U.S.C. §121 *et seq.* (1977), the *Pollution Prevention Act*, 42 U.S.C. §13101 *et seq.* (1990), and the *Great Lakes Critical Programs Act of 1990*, 33 U.S.C. §1268 *et seq.* (1993).

<sup>11</sup> 40 C.F.R. pts. 9, 122, 123, 131 and 132 (1995).

recognizes the multi-faceted nature of environmental degradation. As Lynton K. Caldwell observed:<sup>12</sup>

An ecosystem approach means, therefore, that action affecting the lakes, taken or authorized by the governments, shall proceed on the understanding that the bounded field of policy is no less than the basinwide watershed of the Great Lakes and the multifarious relationships interacting within and intruding from without.

An ecosystem approach therefore stands in stark contrast to a narrow single-medium or uni-jurisdictional approach to environmental management.

In sum, the environmental policy frameworks in both Canada and the United States are founded on an interrelated network of instruments, ranging from international agreements to domestic provincial and state regulation. The ecosystem approach is a fundamental concept in the existing policy framework. It is necessary to understand the ecological and institutional context within which the present analysis of the framework's conceptual foundations will be conducted. The following section undertakes this objective, first, by outlining the nature of toxic contamination in the Great Lakes with emphasis on the sources, pathways, characteristics and threat of toxic contamination in the region, and second, by describing the various key players in the Great Lakes regime.

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<sup>12</sup> "Introduction: Implementing an Ecological Systems Approach to Basinwide Management" in Caldwell, ed., *Perspectives on Ecosystem Management for the Great Lakes - A Reader* (Albany: State University of New York Press, 1988) at 3.

### III. ECOLOGICAL AND INSTITUTIONAL CONTEXT

#### (i) Nature of Toxic Contamination in the Great Lakes

##### (a) Sources and Pathways of Toxic Contamination

There are many sources of toxic substances. Some of the major sources of toxic water pollution are industrial processing and discharges, agricultural and urban run-off, and waste disposal.<sup>13</sup> Industrial processing such as metal processing, petroleum refining and the pulp and paper industry are identified by some commentators as the most significant Canadian stationary point-source contributors.<sup>14</sup> Industrial discharges of pollutants into sewer systems is also a significant source of water pollution because toxic wastes may end up being discharged in effluent, spread on land as sludge, or released into the atmosphere during incineration. Agricultural and urban run-off are also major sources of toxic water pollution through pesticide use, sludge disposal, and sanitary sewer overflows.<sup>15</sup> Finally, waste disposal contributes to toxic water pollution in several ways, including municipal solid waste incineration,<sup>16</sup> volatilization into the atmosphere from waste storage facilities during chemical and biological degradation, and leachate from landfills and waste dumps.<sup>17</sup>

Toxic substances enter the Great Lakes from four primary pathways. First, they enter the system through "point sources", such as direct industrial discharge pipes, effluent

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<sup>13</sup> P. Muldoon & M. Valiante, *Toxic Water Pollution in Canada: Regulatory Principles for Reduction and Elimination* (Calgary: Canadian Institute of Resources Law, 1988) at 12 [hereinafter *Toxic Water Pollution in Canada*].

<sup>14</sup> *Ibid.* at 12-13. These sources produce toxic substances such as volatile organic compounds, industrial solvents, and metals (such as arsenic, zinc, copper and mercury).

<sup>15</sup> *Ibid.* at 14.

<sup>16</sup> This method of waste disposal is a source of toxic substances such as furans, dioxins, lead, mercury, nickel, chromium and cadmium: *ibid.*

<sup>17</sup> *Ibid.*

flow from municipal sewage treatment plants and storm sewers.<sup>18</sup> Second, they may enter the Great Lakes through atmospheric deposition.<sup>19</sup> Third, they may be re-introduced into water following reactivation of contaminated sediments. Reactivation may occur by disturbing lake bottoms through natural processes, such as storms and scavenging fish, or through human-related activities, such as dredging.<sup>20</sup> Finally, groundwater contamination is another pathway by which toxic substances may enter the environment. Groundwater contamination may occur at shallow waste disposal sites, deep-well disposal of liquid wastes as well as through run-off and leaching into the water table.<sup>21</sup> As larger amounts of synthetic chemicals were manufactured and used, and as more industrial and municipal waste was generated, these pathways increasingly became the conduits for toxic contamination of the Great Lakes. From the 1960s, the effects of toxic contamination became more evident, and ongoing research has provided an extensive knowledge base of the characteristics and impact of toxic substances on wildlife, fish and humans.<sup>22</sup>

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<sup>18</sup> Canada, Environment Canada, Department of Fisheries and Oceans & Health and Welfare Canada, *Toxic Chemicals in the Great Lakes and Associated Effects: Synopsis* (Ottawa: Ministry of Supply and Services Canada, 1991) at 6 [hereinafter *Toxic Chemicals in the Great Lakes*].

<sup>19</sup> The upper lakes, Superior, Michigan and Huron, receive a significant portion of their PCBs, DDT and lead directly from the atmosphere. In contrast, total PCB inputs in absolute terms from local sources to the lower lakes, Ontario and Erie, are four times higher than to the upper lakes. For a comparison of chemical loads to the Great Lakes and percentage attributable to atmospheric deposition, see *ibid.* Mobile sources, such as automobiles, trucks, and trains) are a significant source of lead and various organic compounds such as benzene. Stationary sources, such as commercial, institutional and residential sites, introduce metals (cadmium, arsenic, selenium, chromium, mercury) and organic chemicals (such as PAHs): *Toxic Water Pollution in Canada*, *supra* note 13 at 15.

<sup>20</sup> *Ibid.* at 16.

<sup>21</sup> *Toxic Chemicals in the Great Lakes*, *supra* note 18 at 6; *Toxic Water Pollution in Canada*, *supra* note 13 at 16.

<sup>22</sup> Canadian Environmental Law Association, Great Lakes United & National Wildlife Federation, *Treading Water: A Review of Government Progress Under the Great Lakes Water Quality Agreement* (October, 1997) at 10.

### (b) Characteristics of Toxic Contaminants

There is no universally accepted definition of what constitutes a toxic chemical. However, for the purposes of this dissertation, the definition of "toxic substance" in the *GLWQA* is adopted because this is the primary operational agreement on Great Lakes water quality. Thus, a toxic substance is considered here to be:<sup>23</sup>

a substance which can cause death, disease, behavioural abnormalities, cancer, genetic mutations, physiological or reproductive malfunctions or physical deformities in any organism or its offspring, or which can become poisonous after concentration in the food chain or in combination with other substances.

There are several general characteristics which may distinguish toxic substances from conventional pollutants.<sup>24</sup> The four most salient features of toxic chemicals are persistence, bioaccumulation, biomagnification, and the propensity to cycle through the environment, although the existence or extent to which each characteristic is evident depends on the particular toxic substance. "Persistence" refers to the fact that some toxic chemicals do not degrade or break down rapidly, through chemical, physical or metabolic processes, into less toxic substances.<sup>25</sup> Toxic substances may be bioaccumulative based on their tendency to concentrate in organisms.<sup>26</sup> Moreover, as these organisms are consumed by larger organisms, toxic substances may increase in concentration at each trophic level through the process of 'biomagnification'.<sup>27</sup> Finally, toxic substances cycle through the environment, for

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<sup>23</sup> *GLWQA*, *supra* note 6, Art. I(v).

<sup>24</sup> For a summary of the physical, chemical, ecotoxicological and human health toxicity characteristics of eleven common toxic substances, refer to the United States, United States Environmental Protection Agency, *Regulatory Impact Analysis of the Great Lakes Water Quality Guidance - Final Report* (March 1995), Appendix A [hereinafter *Regulatory Impact Analysis*].

<sup>25</sup> *Toxic Water Pollution in Canada*, *supra* note 13 at 11.

<sup>26</sup> *Ibid.* at 11-12.

<sup>27</sup> *Ibid.*

example, as they drain into lakes, volatilize into the air and are atmospherically deposited back onto land.<sup>28</sup> Because of these unique characteristics, toxic substances pose very serious and complex environmental challenges to the Great Lakes ecosystem.

### (c) Threat of Toxic Contaminants to the Great Lakes Ecosystem

Despite its enormity, the Great Lakes ecosystem<sup>29</sup> is particularly sensitive to persistent, bioaccumulative chemicals because of the lakes' unique physical, chemical and biological characteristics. Such characteristics include: (i) long hydraulic retention times, indicating a relatively closed system; (ii) low biological productivity; (iii) low suspended solids concentrations; (iv) great depth; and (v) the presence of fish and wildlife populations confined to, and ecologically dependent on, the Great Lakes system.<sup>30</sup>

The significance of the Great Lakes' vulnerability is amplified by the fact that scientists have detected 362 contaminants in the system, and approximately one-third of these have toxicological data showing that they can have acute or chronic toxic effects on aquatic life, wildlife and human health.<sup>31</sup> Thus, toxic contaminants pose a diffuse health threat to human, wildlife and fish in the Great Lakes basin.<sup>32</sup>

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<sup>28</sup> *Ibid.* at 12.

<sup>29</sup> The Great Lakes ecosystem, referred to as the "Great Lakes Basin Ecosystem" in the *GLWQA*, is therein defined in Art. I(g) as:

the interacting components of air, land, water and living organisms, including man, within the drainage basin of the St. Lawrence River at or upstream from the point at which this river becomes the international boundary between Canada and the United States.

<sup>30</sup> *Guidance Supplementary Information Document*, *supra* note 2 at 3.

<sup>31</sup> International Joint Commission (IJC), *Cleaning Up the Great Lakes* (Windsor: IJC, 1991).

<sup>32</sup> For a consolidation of papers on the effects of toxic substances in the Great Lakes, explorations of improved methods for assessing effects on biota, and recommendations for further research, see M.S. Evans, ed., *Toxic Contaminants and Ecosystem Health: A Great Lakes Focus* (Toronto: Wiley & Sons, 1988).



Although assessment of the impact of toxic substances on humans has proved difficult to ascertain,<sup>33</sup> increasing numbers of studies suggest that effects of toxic chemicals on human health include increased risk of cancer, kidney damage, endocrine disruption, and adverse reproductive outcomes.<sup>34</sup> Moreover, as some commentators have observed, recent research on human health effects of environmental contaminants in the Great Lakes basin has emphasized that significant health consequences are associated with exposure to toxic contaminants.<sup>35</sup>

Similarly, wildlife and fish in the Great Lakes face a plethora of adverse effects attributable to toxic contaminants. Health effects on wildlife and fish include reproductive effects, eggshell thinning, generational effects, deformities, organ damage, behavioral changes, hormonal changes, metabolic changes, immune suppression and tumors.<sup>36</sup>

In sum, after entering the Great Lakes system through numerous pathways, toxic substances cause insidious health effects to the inhabitants of the ecosystem, and these health effects are magnified by the unique nature of both the contaminants and the ecosystem itself. Within this context, a complex network of organizations, groups and

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<sup>33</sup> *Toxic Chemicals in the Great Lakes*, *supra* note 18 at 37. For a discussion of the reasons for the limited understanding of the effects of toxic substances on Great Lakes biota as well as recommendations to improve assessments, see M.S. Evans, "Toxic contaminants and Great Lakes ecosystem health: current understandings and strategies for improved assessments" (1993) 2 J. Aquat. Ecosyst. Health 87.

<sup>34</sup> *Guidance Supplementary Information Document*, *supra* note 2 at 4-5; and International Joint Commission (IJC), *Sixth Biennial Report under the Great Lakes Water Quality Agreement of 1978* (Windsor: IJC, 1992) at 17-24.

<sup>35</sup> Canadian Environmental Law Association, Great Lakes United & National Wildlife Federation, *supra* note 22 at 14.

<sup>36</sup> *Ibid.* at 13, citing the Agency for Toxic Substances and Diseases Registry, *Public Health Implications of Persistent Toxic Substances in the Great Lakes and St. Lawrence Basins* by B.L. Johnson *et al.* (Atlanta: U.S. Department of Health and Human Services, 1997). Also see *Toxic Chemicals in the Great Lakes*, *supra* note 18, Chs. 3 and 4.

government has evolved to address the environmental concerns of the Great Lakes basin, as outlined below.

## (ii) Great Lakes Institutional Regime

The Great Lakes regime is comprised of a network of institutions and organizations,<sup>37</sup> which exist within the context of a very long history, between Canada and the United States, of shared resource management, including bilateral policy making.<sup>38</sup> The 1909 *Boundary Waters Treaty*<sup>39</sup> is one of the most significant treaties in this bilateral relationship. The fundamental purpose of the *Boundary Waters Treaty* was to protect boundary waters, including the Great Lakes, against unilateral diversions and to secure a right of navigation.<sup>40</sup> Furthermore, and most significantly, the *Boundary Waters Treaty* established the International Joint Commission (IJC) as the primary organization to carry out its purposes. Thus, the IJC was established generally to provide a means of resolving water issues between Canada and the United States involving rights, interests or obligations along

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<sup>37</sup> The challenge facing those who share stewardship responsibility for the environmental and economic well-being of the Great Lakes system is how the region, as a collectivity of political jurisdictions, organizes itself to manage shared resources for the common benefit: M.J. Donahue, "Water Resources and Policy" (Chap. 6) in Federal Reserve Bank of Chicago & Great Lakes Commission, *The Great Lakes Economy: Looking North and South* (Chicago: Federal Reserve Bank of Chicago, 1991) at 57.

<sup>38</sup> See L.M. Bloomfield & G.F. Fitzgerald, *Boundary Water Problems of Canada and the United States* (Toronto: Carswell, 1958); and J.E. Carroll, *Environmental Diplomacy - An Examination and a Prospective of Canadian-U.S. Environmental Relations* (Ann Arbor: University of Michigan Press, 1983).

<sup>39</sup> *Treaty Between the United States and Great Britain Relating to Boundary Waters, and Questions Arising Between the United States and Canada* (1909), United States and Great Britain, 11 January 1909, 36 U.S. Stat. 2448, U.K.T.S. 1910 No. 548 [hereinafter *Boundary Waters Treaty*]. The *Boundary Waters Treaty* is highly significant because, as Muldoon noted, it "persists as the framework for governing, or at least providing a foundation for, bilateral resource management": "Bilateral and Multilateral Dimensions of International Environmental Law" (Chap. 15) in E.L. Hughes, A.R. Lucas & W.A. Tilleman, eds., *Environmental Law and Policy*, 2<sup>nd</sup> ed. (Toronto: Emond Montgomery Publications, 1998) at 566.

<sup>40</sup> S.P. Gallagher, "Great Lakes Water Quality Initiative: National Standards Governing a Binational Resource" (1995) 2 Indiana J. Global Leg. Stud. 465, online: Indiana University School of Law <<http://www.law.indiana.edu/glsj/glsj.html>> (date accessed: 25 October 1998).

a common border.<sup>41</sup> After the 1972 *GLWQA* was signed by Canada and the United States, the IJC assumed a central position with respect to Great Lakes issues, particularly research, data and oversight of agreement operation.<sup>42</sup> Although its role has been weakened in recent years,<sup>43</sup> the IJC continues to be a central institution under the present *GLWQA*, which forms the primary operational agreement relating to Great Lakes water quality.

Although the IJC is the binational agency overseeing the *GLWQA*, the parties to the agreement are the federal governments of Canada and the United States and, by extension, all of the other governmental jurisdictions within the Great Lakes basin. The two principal federal environmental agencies responsible for implementation of programs to achieve the objectives of the *GLWQA* are Environment Canada and the USEPA.<sup>44</sup>

In addition, at the sub-national level, the provincial government of Ontario<sup>45</sup> and the governments of all eight littoral states<sup>46</sup> have also developed and implemented numerous

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<sup>41</sup> M. Valiante & P. Muldoon, "Ecosystem Governance: Some Lessons from the Great Lakes Regime" (Dartmouth College Conference on International Governance in the Twenty-first Century, September 14-16, 1995) [unpublished] [hereinafter *Ecosystem Governance*] at 3.

<sup>42</sup> *Ibid.* at 5. In addition to increasing the IJC's prominence, the 1972 *GLWQA* established new binational organizations to assist the IJC with performance of its expanded functions under the Agreement: the Great Lakes Water Quality Board, the Science Advisory Board and a regional office in Windsor.

<sup>43</sup> S.J. Toope & J. Brunnée, "Freshwater Regimes: The Mandate of the International Joint Commission" (1998) 15 *Arizona J. Int'l & Comp. L.* 273 at 282-283.

<sup>44</sup> In Canada, other federal agencies responsible for some programs affecting the Great Lakes are the Department of Fisheries and Oceans, Health Canada, Public Works and Government Services Canada, and Transport Canada. In the United States, although the USEPA holds most of the basic environmental control authorities of the federal government, other federal agencies whose responsibilities include environmental regulation are the Department of the Interior, Department of Agriculture, and Department of Energy, as well as independent regulatory commissions such as the Nuclear Regulatory Commission and the Federal Energy Regulatory Commission.

<sup>45</sup> Although Quebec contains a portion of the St. Lawrence River basin, Ontario is the sole Canadian province bordering on any of the Great Lakes or encompassing the Great Lakes basin. The principal Ontario ministry responsible for water pollution programs is the Ministry of the Environment and Energy; however, the Ministry of Natural Resources and the Ministry of Agriculture, Food and Rural Affairs also administer some programs affecting the Great Lakes.

<sup>46</sup> New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin and Minnesota.

environmental protection policies and programs.<sup>47</sup> Furthermore, as noted in Section II, the Great Lakes regime has been strengthened by intergovernmental agreements both between federal and sub-national governments, and also between state governments.

Non-governmental organizations also play a pivotal role in the Great Lakes regime, as some commentators have argued, in ensuring the dynamism and relevance of the formal governance structure.<sup>48</sup> Significant non-governmental constituencies within the Great Lakes

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<sup>47</sup> One should note that there are considerable differences between the federal and provincial or state intergovernmental relationships in Canada and the United States. In Canada, under the *Constitution Act, 1867* (U.K.), 30 & 31 Vict., c. 3, ss. 91, 92, reprinted in R.S.C. 1985, App. II, No. 5, the federal and provincial governments each has jurisdiction over various classes of subjects affecting the environment. In addition to classes assigned exclusively to one level of government, both levels have concurrent jurisdiction over certain aspects of environmental protection. The federal government generally has clear jurisdiction over interprovincial and international matters as well as over federal lands, coastal and inland fisheries, oceans, navigation and shipping. As a province, Ontario has primary authority over natural resources, municipal governments, property and civil rights, and matters of a local or private nature. For details on the Canadian constitutional division of powers, see P.W. Hogg, *Constitutional Law of Canada*, 4<sup>th</sup> ed. (Toronto: Carswell, 1996). In contrast to Canada, the U.S. federal role is paramount in many areas of resource and environmental policy and programs. As Donahue observed, "[a]ccountability for Great Lakes management efforts lie at the federal level, where policies and programs are either dictated directly or relegated to the states with the retention of oversight authority": *supra* note 37 at 63. Moreover, although states have substantial authority in water policy, their authority is largely derived from, and is subject to, a preemptive federal authority.

<sup>48</sup> *Ecosystem Governance*, *supra* note 41 at 13-14. For an analysis of the role of non-governmental organizations, particularly Great Lakes United, in the system of governance that has evolved to manage natural resource use, and the impact of that management on the Great Lakes ecosystem, see J. Manno, "Advocacy and Diplomacy in the Great Lakes: A Case History of Non-Governmental-Organization Participation in Negotiating the Great Lakes Water Quality Agreement" (1993) 1 Buff. Env. L.J. 1. Manno concluded at 55 that the following lessons can be distilled from non-governmental-organizations' experience in negotiating the GLWQA:

- (1) international agreements and treaties can serve the political agendas embraced by environmental NGOs;
- (2) technological complexity provides NGOs with a niche to fill and a means to develop credibility;
- (3) NGOs have the ability to represent transnational interests;
- (4) NGO participation in national bureaucratic forums can serve as a guide in international forums;
- (5) transnational NGOs' technical expertise and political savvy make them authoritative negotiators;
- (6) familiarity and commonality of interests help to facilitate structured international environmental problem-solving;
- (7) international environmental agreements provide a basis for domestic change;
- (8) NGO participation can stretch traditional negotiating formats; and
- (9) the profitable interrelationship of international governmental organizations and NGOs must be developed with caution.

community include the scientific sector,<sup>49</sup> environmental and citizens' organizations,<sup>50</sup> and industry coalitions.<sup>51</sup> Organized labour groups, First Nations and Tribal communities,<sup>52</sup> and members of the general public participating in the development of action plans<sup>53</sup> are other important sectors that are active in the Great Lakes regime. Regional communication and coordination within the Great Lakes basin occurs, in part, through the State of the Lakes Ecosystem Conference (SOLEC), a biennial conference aimed at bringing together decision-makers, such as federal, provincial, and state government staff, municipal representatives, First Nations, Tribes, environmental non-government organizations, and industry groups.

It is important to note that the institutional regime is continually in flux, both in terms of government priority placed on environmental programs and public interest in environmental protection. In recent years, there has been a trend toward deregulation, devolution and downsizing, and a corresponding decrease in political commitment to environmental protection.<sup>54</sup> In addition, citizens' concern with the environment does not

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<sup>49</sup> Since the 1950s and 1960s, Canadian and American scientists have collaborated to increase knowledge about the ecological state of the Great Lakes basin: *Ecosystem Governance*, *supra* note 41 at 14.

<sup>50</sup> There are hundreds of such organizations, many of which are locally-based, but some with binational representation. Prominent environmental organizations include Great Lakes United (binational), Pollution Probe, Canadian Environmental Law Association (in Canada), Sierra Club, and the National Wildlife Federation (in the United States).

<sup>51</sup> Commercial and industrial interests increasingly began participating in binational environmental policy processes from 1990. The Council of Great Lakes Industries, formed in 1990, is a binational coalition which has taken an active role in attempting to shape policy at the binational level: *Ecosystem Governance*, *supra* note 41 at 16.

<sup>52</sup> One significant contribution by these groups has been to highlight attention for the need for environmental justice and representation in implementing the *GLWQA*. See, for example, EAGLE Project, Indigenous Environmental Network & Great Lakes United, *Environmental Injustice in the Great Lakes Water Quality Agreement* (IJC Great Lakes Water Quality Public Forum, Niagara Falls, 2 November 1997).

<sup>53</sup> *Ecosystem Governance*, *supra* note 41 at 16.

<sup>54</sup> IJC, *Ninth Biennial Report on Great Lakes Water Quality* (Windsor: IJC, 1998) at 18. For example, a 1997 survey found that governmental resource support for RAP and LaMP activities, and monitoring and surveillance activities had generally decreased, while governmental resource support for regulatory and enforcement activities had generally not changed: IJC, Water Quality Board, *Review of Government Resources*

remain constant in relation to other issues. For example, in the mid-1990s, environmental protection fell from being one of the most important Canadian public policy issues to a secondary concern relative to employment and other economic prosperity issues.<sup>55</sup> Nonetheless, some observers believe that public concern with environmental protection is beginning to re-emerge.<sup>56</sup> Thus, in analyzing environmental policies, one must recognize that the socio-political context in which policies exist is neither static nor insignificant in shaping policy outcomes.

It is also important to note that the patterns of use and abuse of the Great Lakes, as a freshwater resource, form part of the institutional context. Policy-makers and other regime participants are faced regularly with issues of implementation of the agreements and legislation relating to environmental protection and management. Over time, their attitudes and views on the "best" manner in which to achieve various objectives may become more rigid and less malleable. Similarly, the attitudes of other key sectors, such as industries, may become more firmly rooted in established practices. These entrenched positions must be recognized, particularly by those advocating institutional reform. Although this dissertation does not focus on such reform, entrenchment is noted here because it constitutes one, albeit not immediately obvious, aspect of the Great Lakes institutional context.

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*and Changing Program Thrusts as They Relate to Delivery of Programs under the Great Lakes Water Quality Agreement*, online: IJC <<http://www.ijc.org/boards/wqb/govres/review.html>> (date accessed: 5 November 1998).

<sup>55</sup> S. Grey, "Environmental Protection Thinning: As Government Funding Dries Up and Public Interest Turns to Indifference, the Watchdogs are Beginning to Fade Away" *The Globe and Mail* (19 August 1997) A1.

<sup>56</sup> "Canadians Green Up Again" (1998) 8 *Environmental Policy & Law* 669.

In sum, as highlighted above, key actors within the formal structure include the IJC, Environment Canada, the USEPA and provincial and state government agencies. Within the broader Great Lakes community, numerous other constituencies play an important role in developing and assessing environmental policy.

#### **IV. THEORETICAL APPROACH**

##### **(i) An Economic Perspective**

When environmental degradation emerged as a significant public policy issue in the 1960s, economic literature contained a purportedly coherent view of pollution and its policy implications. Economists generally viewed environmental degradation as a problem involving the imposition of external costs in the form of pollution imposed on society by economic agents who did not face an appropriate set of "prices" for their polluting activities. The solution advocated by economists, through the theory of externalities, was therefore to prescribe appropriate "prices", or incentive-based instruments, for the activities resulting in external costs. However, despite their firm belief in the propriety of their approach, environmental economists were generally dismayed with their limited impact on the design of environmental measures.<sup>57</sup>

Within the field of law, some scholars have sought to develop an economic approach to law. In very general terms, the resulting discipline of Law and Economics represents an

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<sup>57</sup> W.J. Baumol & W.E. Oates, *The Theory of Environmental Policy*, 2d. ed. (New York: Cambridge University Press, 1988) at 1. As Baumol and Oates observed, policy-makers have generally opted for traditional "command-and-control" instruments involving stipulated limitations on allowable levels of emissions and the use of specified abatement technologies.

attempt to reconcile the often divergent goals of efficiency and justice. The essential premise of an economic approach to law is that fundamental economic concepts, such as rationality and maximization, equilibrium and efficiency, are also fundamental to understanding and explaining the law. This approach is well-established in antitrust law; however, from the 1960s, the field of Law and Economics began to expand as some scholars, particularly in the United States, explored legal and economic interconnections in areas such as tort, contract and property law.

As Law and Economics evolved in those key areas, some scholars sought to develop an economic approach to environmental law based upon the belief that inequities caused by environmental externalities, which infringed property rights or entitlements, could be fairly remedied by applying economic cost-benefit analysis.<sup>58</sup> As Richard L. Revesz observed, the economic perspective on environmental degradation can be defined by reference to normative, positive, and attitudinal characteristics.<sup>59</sup> The normative goal of the economic perspective is to maximize social welfare. From an economic perspective, a reduction in pollution is socially advantageous only if it increases the welfare of the victims of pollution by more than the corresponding decrease in welfare of those causing the pollution. Thus, there is a socially optimal amount of pollution. The positive, or descriptive, feature of the economic perspective is that the existence of excessive pollution is explained by reference to a divergence of a polluter's private costs and the social costs resulting from the activity.

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<sup>58</sup> W.Z. Hirsch, *Law and Economics: An Introductory Analysis*, 2d. ed. (Toronto: Academic Press, 1988) at 295.

<sup>59</sup> R.L. Revesz, *Foundations of Environmental Law and Policy* (New York: Oxford University Press, 1997) at 3-4.



Finally, the attitudinal characteristic of the economic perspective is that pollution is not viewed as an antisocial action worthy of moral opprobrium. Rather, pollution is viewed as a consequence of rational behaviour by economic agents. Thus, the disciplines of both environmental economics and Law and Economics both employ a cost-benefit approach in the analysis of economic or legal behaviour and both are founded on similar core concepts, such as efficiency, rationality and optimality.

The Law and Economics approach to environmental law, with its adherence to economic analysis of environmental problems, has been criticized on operational and ethical grounds. Critics fundamentally challenge the utility of economics in analyzing the law. For example, critics of an economic approach to environmental law question the validity of cost-benefit analysis, in part, on the basis that it involves very difficult problems of quantification<sup>60</sup> and ignores important distributional effects.<sup>61</sup> These critics also attack the assumptions upon which economic analysis of law is founded, such as the assumptions that individuals are rational and self-interested and that consumers' willingness-to-pay reflects the value of goods.<sup>62</sup> In addition, economic incentives, such as subsidies and tradeable

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<sup>60</sup> For example, see J.L. Knetsch, "Economics, Losses, Fairness, and Resource-Use Conflicts" in M. Ross & J.O. Saunders, eds., *Growing Demands on a Shrinking Heritage: Managing Resource-Use Conflicts*, Essays from the Fifth Institute Conference on Natural Resources Law (Calgary: Canadian Institute of Resources Law, 1992) 20.

<sup>61</sup> This standard criticism is closely related to the more general criticism of economists' reliance on the Kaldor-Hicks principle, a compensation principle which disregards distributive concerns in measuring social welfare.

<sup>62</sup> A. Wellington & A. Greenbaum, "Social Conflict and Environmental Law: Editors' Note" in A. Greenbaum, A. Wellington & E. Baar, eds., *Social Conflict and Environmental Law: Ethics, Economics and Equity*, vol. 1 (North York: Captus Press, 1995) at 18-19.

pollution permits, have been criticized on ethical grounds, more specifically, on the basis that they involve "pricing" the environment.<sup>63</sup>

As the foregoing discussion has sought to highlight, there is considerable academic debate, particularly in the legal community, about the relevance of economics in designing and understanding environmental law. This dissertation attempts to contribute to the debate about the utility of economics to environmental law. This dissertation is both rooted in, and distinct from, the traditional Law and Economics approach to environmental issues, which, as noted above, employs an economic cost-benefit methodology. With respect to its similarity to a traditional Law and Economics approach, the present work is based on, and explicitly defends, the essential premise that fundamental economic concepts, such as efficiency, rationality, and optimality, are also fundamental to understanding and explaining the law. However, in diverging from a traditional Law and Economics approach, this dissertation does not seek to employ an economic cost-benefit methodology. Rather, this dissertation, in part, attempts to highlight important parallels between economic theory and a fundamental environmental policy principle. The methodology employed in the present work is discussed further in the following subsection; however, it is important to note here that there is a significant divergence between the traditional, cost-benefit approach and the qualitative, conceptual approach used in this dissertation.

Policy development represents a process in which academic discussion and competing views in general are transformed into regulatory initiatives. The Great Lakes

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<sup>63</sup> For example, see D.E. Booth, "Ethics and the limits of environmental economics" (1994) 9 Ecological Economics 241.

basin is an ecosystem in regard to which there has been unparalleled environmental policy development, coordination, and innovation. Surprisingly, however, there appears to have been little attempt, thus far, in either academic or policy fora, to examine the extent to which economic concepts are applied in environmental policy in this region.

## **(ii) Methodology**

In examining the conceptual underpinnings of Great Lakes toxic water pollution policy and attempting to apply an economic perspective on one key principle, this dissertation seeks to accomplish three main objectives: (i) to illustrate the analytical and practical relevance of welfare and environmental economics to law and policy, despite some limitations of an economic approach; (ii) to highlight key themes of the existing policy framework; and (iii) to illustrate the extent to which core economic concepts permeate the ecosystem approach, a cornerstone principle of the policy framework.

The dissertation is organized in the following manner. Chapter 2 outlines key concepts developed in the field of welfare and environmental economics, and particularly fundamental principles such as efficiency, optimality, and externalities. A primary objective of this chapter is to demonstrate the general environmental relevance of economics. As this chapter seeks to establish, economics remains a useful analytical approach to environmental issues, despite some important criticisms. The utility and relevance of economics to environmental law and policy constitutes an essential premise upon which this dissertation is based, and Chapter 2 seeks to recognize and defend the application of an economic perspective to Great Lakes policy. In Chapters 3 and 4, the analysis shifts specifically to

Great Lakes environmental policy. Chapter 3 focuses on four key Great Lakes agreements and regulatory initiatives: (i) the *Great Lakes Water Quality Agreement*; (ii) the *Great Lakes Binational Toxics Strategy*; (iii) the *Canada-Ontario Agreement*; and (iv) the *Final Water Quality Guidance for the Great Lakes System*.<sup>64</sup> After providing a general outline of each instrument, Chapter 3 identifies key principles upon which each instrument is founded and highlights common themes underlying the agreements collectively. As this analysis of the policy framework also attempts to illustrate, the ecosystem approach, an integrated and comprehensive approach to Great Lakes environmental management, constitutes a fundamental principle of the framework. In Chapter 4, I outline the historical context of the ecosystem approach, argue that the concept consists of five core elements, and analyze its elements with a view to highlighting the principle's economic content. The upshot of the analysis is that economic concepts and approaches, such as environmental valuation, externalities, and self-interest, constitute an important, albeit not sole, aspect of key elements of the ecosystem approach. Finally, Chapter 5 concludes this dissertation by identifying some significant implications and potential areas of further research which flow from the discussion.

There are several compelling reasons for examining the conceptual foundations of environmental policy in the Great Lakes basin, particularly from an economic perspective. First, research on economics and the Great Lakes region involves issues of broad and

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<sup>64</sup> It is important to note that, although there are many instruments which address water quality in the Great Lakes, these instruments largely establish the overarching toxic water pollution policy framework in this region.

pressing importance. Second, the existence of bilateral and domestic agreements and regulatory initiatives indicates the existence of articulated principles and objectives which would facilitate qualitative research seeking to develop and examine a conceptual framework of the region's environmental policy. Third, environmental policy is increasingly being linked to economic considerations, such as productivity and employment, and hence the topic represents an area of both practical and theoretical significance. Finally and significantly, there appears to have been little attempt, thus far, to examine the contributions of economic theory in developing the complex environmental policy of the Great Lakes region. Thus, the Great Lakes region represents good and relatively unexplored terrain for contributing to the theoretical debate on the relevance of economics to environmental law and policy.

I have not addressed other interesting issues involving economics and Great Lakes governance. These issues are briefly identified below both to point out other possible fields of inquiry and to delineate more clearly the bounds of the present work. One issue not discussed in this dissertation is the state of the Great Lakes regional economy, a clearly important matter which has been addressed in other works.<sup>65</sup> Another important issue which is beyond the scope of the current work is the econometric question of the impact of particular environmental policies on various sectors within the Great Lakes region. A third,

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<sup>65</sup> See, for example, Federal Reserve Bank of Chicago & Great Lakes Commission, *supra* note 37; and D.R. Allardice & S. Thorp, "A Changing Great Lakes Economy: Economic and Environmental Linkages" (Background Paper presented at State of the Lakes Ecosystem Conference, Dearborn, Michigan, October 26-28, 1994), online: Consortium for International Earth Science Information Network <<http://epawww.ciesin.org/glreis/nonpo/ndata/solec/economic/economic.html>> (date accessed: 3 October 1998).

highly interesting issue which has received extensive attention elsewhere is analysis of the institutional aspects of Great Lakes governance. Because of its complexity and importance, the Great Lakes regime has been the subject of considerable study by students of international relations and others seeking to understand the factors underpinning its success and future challenges.<sup>66</sup> Thus, although there are clearly other important questions relating to economics and the Great Lakes regime, this paper strives to focus on the conceptual underpinnings of the system and to explore a foundational principle qualitatively from an economic perspective.

In sum, the foregoing discussion has attempted to outline and justify the scope and manner of inquiry of this dissertation on the conceptual underpinnings of Great Lakes toxic water pollution policy and on the economic content of the ecosystem approach, one of its fundamental guiding principles. The present work occurs within the broader context of relatively established environmental economic theory and an ongoing debate in the legal community about the utility of economics in understanding law. The Great Lakes basin constitutes a region in which there has been considerable environmental policy development, but surprisingly little analysis of the underlying conceptual framework of the region's policies on toxic pollution, particularly in relation to economic theory. Prior to examining the conceptual underpinnings of Great Lakes environmental policy, it is necessary to

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<sup>66</sup> See, for example, *Ecosystem Governance*, *supra* note 41. For a regime analysis of the IJC's role in boundary waters management, see Toope & Brunnée, *supra* note 43. A number of other works dealing with the issue of institutional reform under the ecosystem approach are referenced in Chapter 4.

understand the main contours of the economic perspective on environmental degradation.

Chapter 2 seeks to accomplish this goal.

## **CHAPTER TWO:** **ECONOMIC THEORY AND THE ENVIRONMENT**

The nature of one's perception of an object or event is largely dependent on one's perspective. This assertion also applies to matters of policy, where characterization of an issue is closely related to the analytical perspective adopted by the observer. With respect to legal issues, including environmental concerns, the economic approach to law purports to provide useful insights into legal systems. This chapter seeks to accomplish several objectives. Section I of this chapter will justify the use of economics in seeking to understand law. Sections II and III will provide a broad overview of the fields of welfare economics and environmental economics. The primary focus here will be on the fundamental economic concept of social efficiency. Finally, Section IV will outline, and attempt to respond to, some criticisms of economic analysis of law, particularly environmental law. The central argument of this chapter is that, despite some important criticisms, economics remains a useful analytical approach to environmental issues.

### **I. UTILITY OF ECONOMICS IN ANALYZING LAW**

There are at least three important contributions that economics can make to legal analysis. First, economics helps legal scholars gain a necessary external perspective on their discipline. Second, on a normative level, economics can help clarify value conflicts by showing how much of one value, specifically, efficiency, must be foregone to achieve



another value.<sup>1</sup> Finally, on a positive level, economics can contribute to an understanding of the underlying reasons of legal decisions and the economic effects of legal outcomes.<sup>2</sup> Each of these contributions or justifications are examined in greater detail below.

### (i) External Perspective on Law

Economics contributes to legal scholarship by providing a necessary external perspective. As Werner Hirsch noted, one point of contact between law and economics involves:<sup>3</sup>

the criticism voiced by some that legal scholars view the law too much from within - too much in terms of the law's own logical structure. When the law steps outside itself, these critics claim, it lacks a well-developed theoretical or empirical apparatus with which to explore the world around it. ... Yet as legal scholars look outside law, they find that economics has developed paradigms that seem to provide a powerful analytic framework for the study of law.

Thus, external perspectives provide useful insights to legal scholarship because law clearly does not exist in a social vacuum, and rather is merely one aspect of a larger social structure.

The recognition that law is not, and should not be treated as, an autonomous discipline is one of the legacies of legal realism,<sup>4</sup> a legal movement dominant during the 1920s and 1930s which sought to place the study of law within a broader social context.<sup>5</sup> The particular attraction of using economics to understand law stems from the

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<sup>1</sup> R.A. Posner, *Economic Analysis of Law*, 5<sup>th</sup> ed. (New York: Aspen Publishers, 1998) at 27.

<sup>2</sup> *Ibid.*

<sup>3</sup> W. Z. Hirsch, *Law and Economics: An Introductory Analysis*, 2d. ed. (Toronto: Academic Press, 1988) at 3.

<sup>4</sup> N. Mercuro & S. G. Medema, "Schools of Thought in Law and Economics: A Kuhnian Competition" in R. P. Malloy & C. K. Braun, eds., *Law and Economics: New and Critical Perspectives* (New York: Peter Lang Publishing, 1995) 65 at 66.

<sup>5</sup> For an outline of the growth of the American legal realist movement, see G. Minda, *Postmodern Legal Movements: Law and Jurisprudence at Century's End* (New York: New York University Press, 1995) at 25-43.

interdependence of the two disciplines, which Nicholas Mercuro and Steven Medema succinctly summarized as follows:<sup>6</sup>

[A] change in law or working rules leads to a change in the incentive structure which in turn leads to a change in institutional behaviour which in turn leads to a change in economic performance.

The utility of economics in legal analysis is therefore premised on the close interconnections between legal and economic processes. In addition, as outlined below, economics also contributes to legal analysis both normatively and positively.

## (ii) Clarification of Value Conflicts

On a normative level, although economics cannot claim greater moral authority than other social scientific approaches, it contributes to the clarification of value conflicts by demonstrating the inefficiency of particular types of activities. As Richard Posner observed:<sup>7</sup>

Although the economist cannot tell society whether it should seek to limit theft, the economist can show that it would be inefficient to allow unlimited theft and can thus clarify a value conflict by showing how much of one value - efficiency - must be sacrificed to achieve another.

Thus, the focus of economics on efficiency is useful in legal analysis because it provides a benchmark founded on one type of value, efficiency, against which other, often competing, values may be compared. As such, economics provides one type of measure for balancing competing values, an objective which is plainly central to law in pluralist societies. Hence,

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<sup>6</sup> Mercuro & Medema, *supra* note 4 at 66.

<sup>7</sup> Posner, *supra* note 1 at 27.

by showing the inefficiency of particular social goals, economics contributes to their overall selection.<sup>8</sup>

In addition to contributing to the choice of social objectives, economics may also be able to demonstrate the inefficiency of the means chosen to achieve those objectives. For example, if society determines that limiting theft is a desirable objective, economic analysis could demonstrate that certain types of measures would lead to more prevention at lower cost. As Posner notes, this is a normative contribution because "[i]f the more efficient methods did not impair any other values, they would be socially desirable even if efficiency were low on the totem pole of social values."<sup>9</sup> Thus, on a normative level, economics helps to clarify value conflicts by focusing on efficiency and thereby provides a frame of reference for the assessment of competing social objectives and the means to achieve those objectives.

### (iii) Explanation of Legal Decisions

In addition to its general analytical and normative contributions, economic analysis of law also plays a positive role by attempting to explain legal rules and outcomes without seeking to change them or to make them better. In asserting that many areas of the law "bear the stamp of economic reasoning", Posner noted that:<sup>10</sup>

Granted, few judicial opinions contain explicit references to economic concepts. But often the true grounds of legal decision are concealed rather than illuminated by the characteristic rhetoric of opinions. Indeed, legal education consists primarily of learning to dig beneath the rhetorical surface to find those grounds, many of which may turn out to have an economic character.

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<sup>8</sup> Demonstration of the inefficiency of particular social goals requires that economic value can be properly assigned in all relevant contexts. The criticism that economic valuation is not possible in all relevant circumstances is discussed in Section IV below.

<sup>9</sup> Posner, *supra* note 1 at 27.

<sup>10</sup> *Ibid.*

Legal rules and outcomes very often directly affect the manner in which parties' resources are allocated. Thus, it seems logical that the law may promote or, at least, be consistent with economic concerns, and may be illuminated by economic analysis.

Positive economic analysis can illuminate the legal system at several levels. First, with respect to the common law, economic analysis of legal doctrine and judicial reasoning can demonstrate the considerable extent to which particular areas are permeated by economic concerns. For example, in highlighting the parallels between legal and economic considerations, Posner observed that resolution of many private legal disputes require consideration of the future impact of the decision, including its impact on the frequency of accidents and the costs of precautions.<sup>11</sup> Second, positive economic analysis can focus on the institutional features of the legal system, for example, to explain the allocation of law enforcement responsibilities between the public and private sectors.<sup>12</sup> Finally, positive economic analysis can provide insights into the estimation or prediction of behavioural responses to a change in the legal environment.<sup>13</sup> As Hirsch observed, economic analysis can make major contributions in providing answers to such questions as: What are the likely effects of a proposed law? What are the effects of an existing law? Have its objectives been obtained?<sup>14</sup>

In sum, economics can contribute to our understanding of law in three important respects: (i) by providing a necessary external perspective; (ii) by clarifying value conflicts

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<sup>11</sup> *Ibid.* at 28.

<sup>12</sup> *Ibid.* at 27.

<sup>13</sup> Hirsch, *supra* note 3 at 8.

<sup>14</sup> *Ibid.*

by demonstrating the inefficiency of particular types of activities; and (iii) by explaining legal rules, outcomes and institutions, and facilitating empirical analysis. Welfare economics is one of the primary disciplines from which economic analysis of law has drawn. Section II provides an overview of welfare economic theory and, in particular, strives to highlight the centrality of the concept of social efficiency. This concept, as outlined in Section III further below, is fundamental to environmental economics.

## II. WELFARE ECONOMIC THEORY

As S. K. Nath stated, welfare economics involves the study of "the possible effects of various economic policies on the welfare of a society."<sup>15</sup> A central concern of welfare economics is how to attain a socially efficient or optimal allocation of scarce resources within an economy.<sup>16</sup> Thus, welfare economists are concerned with developing models and prescribing measures to achieve an efficient outcome. In contrast to the normative nature of welfare economics, the other main branch of economics, positive economics, addresses itself to questions of measuring the economic impact of changes in various economic variables.

Within welfare economics, the objective of maximizing social welfare requires a 'social welfare function', which is a general statement of the factors that affect the well-being of a society as well as an approximate relative weighting of those objectives.<sup>17</sup> It is important to note that the variables of a social welfare function are those economic

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<sup>15</sup> S.K. Nath, *A Perspective of Welfare Economics* (London: MacMillan Press, 1973) at 11.

<sup>16</sup> P. Bohm, *Social Efficiency: A Concise Introduction to Welfare Economics*, 2d. ed. (London: MacMillan Education, 1987) at ix. The term "scarce resources" refers to the limited availability of virtually all entities valued by economic agents within an economy. Hence, the term implies tradeoffs or choices between competing uses of the entity.

<sup>17</sup> Nath, *supra* note 15 at 25.

conditions that affect welfare either directly or indirectly, through their impact on political, cultural and other non-economic conditions.<sup>18</sup> Thus, in essence, a social welfare function may be interpreted as a kind of rule for ranking alternative social states.<sup>19</sup> The significance of the social welfare function is that no proposition about any kind of optimal economic arrangements in a society can be formulated without implicit or explicit reliance on a social welfare function.<sup>20</sup> There are clearly considerable difficulties in constructing social welfare functions and translating them into practical guidance for economic policy;<sup>21</sup> however, for present purposes, the key point here is that some statement of the objectives of social policy is necessary before any rules for optimality can begin to be formulated.<sup>22</sup>

The concept of social efficiency or optimality<sup>23</sup> is fundamental to welfare economics because it is the discipline's central objective. "Social optimum" may be defined in general terms as the distribution of wealth, leisure and other relevant things which maximizes social welfare within a given period according to a well-defined social welfare function and subject to technical and other relevant constraints.<sup>24</sup> Although ethical judgments underpin conceptualization of all social welfare functions, there is virtual unanimity within modern welfare economics in viewing social welfare as dependent on individuals' well-being or "utility". More specifically, welfare economists almost all agree that social welfare is

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<sup>18</sup> *Ibid.* at 26.

<sup>19</sup> *Ibid.* at 27.

<sup>20</sup> *Ibid.* at 25.

<sup>21</sup> E.J. Mishan, "Welfare Criteria: Resolution of a Paradox" in E. J. Mishan, *Economic Efficiency and Social Welfare: Selected Essays on Fundamental Aspects of the Economic Theory of Social Welfare* (London: George Allen & Unwin, 1981) 33 at 33.

<sup>22</sup> Nath, *supra* note 15 at 30.

<sup>23</sup> In this paper, the two terms are synonymous.

<sup>24</sup> Nath, *supra* note 15 at 30.

improved if at least one person is made better off and no person is made worse off. This type of improvement in social welfare is called a "Paretian improvement" (named after the Italian economist, Vilfredo Pareto). Thus, a Pareto optimal allocation of resources is achieved when no person can be made better off without making someone else worse off.

The Paretian conception of optimality is almost universally accepted by welfare economists as the appropriate conceptual foundation for evaluating alternative allocations.

As Nicholas Rescher asserted:<sup>25</sup>

There is little that economists of different schools and persuasions agree on almost universally, but the Pareto Principle seems to be among the few exceptions to this rule. Virtually without exception, economists, decision theorists, social-choice theoreticians, and the like, are inclined to espouse it as a well-nigh self-evident truth. It is viewed as so secure in itself as to qualify as a touchstone by which the adequacy of social-choice mechanisms can be assessed.

Thus, within welfare economics, Pareto optimality represents a socially efficient allocation of resources, and the ideal against which alternative allocations may be assessed.<sup>26</sup>

It is clear that the Pareto criterion, which excludes changes in welfare that adversely affect *someone's* interests, is virtually impossible to meet in practice given the expansive range of interests in a pluralist society. Therefore, if the Pareto criterion were strictly applied and only those policy changes yielding Pareto improvements, or solely positive effects, were implemented, policy decisions would be severely biased towards the status quo since very few would meet the criterion. Consequently, the response of welfare economists

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<sup>25</sup> "Economics Versus Moral Philosophy: The Pareto Principle as a Case Study" in N. Rescher, *Unpopular Essays on Technological Progress* (Pittsburgh: University of Pittsburgh Press, 1980) 69 at 69.

<sup>26</sup> It is essential to note that different distributions of resources (and hence utility levels) among the individual members of the society result in different Paretian optima. Furthermore, the Paretian conception of social improvement (*i.e.* that the community is better off when at least one person is better off and no one is worse off) does not enable us to choose between two Paretian optima.

and policy analysts has been to evaluate competing policy alternatives on the basis of *potential* Pareto improvements. The less demanding criterion of potential Pareto improvement, known as the Kaldor-Hicks principle, merely requires that aggregate welfare gains exceed aggregate welfare losses. Thus, in theory, if the "gainers" are able to compensate the "losers" and still remain better off, the proposed policy change is desirable under the Kaldor-Hicks principle as increasing social welfare. As discussed in greater detail in Section IV(i)(b) below, the Kaldor-Hicks criterion does not require that compensation actually be paid for an increase in social welfare. It is important to note that, although the Kaldor-Hicks principle constitutes the practical evaluative criterion of many welfare economic analyses, the Pareto principle provides the theoretical foundation for the criterion.

Thus far, I have shown that welfare economics, in its search for social efficiency, has adopted a conception of social welfare which is based on individual utility. Moreover, there is virtual unanimity within the discipline that social efficiency occurs when it is not possible to make anyone better off without making someone else worse off, in other words, when a Paretian optimum exists. In addition, as outlined above, because of the stringency of the Paretian criteria, the practical approach adopted by most welfare economic analyses is to use the Kaldor-Hicks principle, which merely requires *net* aggregate gains.

Given certain stringent and unlikely assumptions, standard welfare economic theory demonstrates that the necessary conditions for Pareto optimality are satisfied by a perfectly competitive economy in equilibrium. In essence, the major part of the conditions that must be fulfilled to achieve Pareto optimality, and hence social efficiency, are efficient production and efficient consumption. More specifically, the allocation of commodities in the economy



should be such that, first, in producing goods, it should not be possible for one producer to be able to convert an additional unit of one good into another at a rate different than another producer of those goods (*i.e.* equal "marginal rates of transformation") and, second, in consuming goods, no consumer is more willing than another individual to sacrifice more of one good for another good (*i.e.* equal "marginal rates of substitution").<sup>27</sup> No attempt is made in this paper to present the technical analysis which leads to these conclusions about the central significance of equal marginal rates of transformation and substitution, or to the broader conclusion that the necessary conditions for Pareto optimality are met at a competitive equilibrium.<sup>28</sup> Rather, the important point for the present discussion about welfare economics is the assumptions or conditions which underlie the analysis.

The assumptions or conditions for a perfectly competitive market are that: (i) all individuals aim to maximize their utility; (ii) all firms maximize profits, including adoption of least-cost methods of production; (iii) all economic agents are rational; (iv) all economic agents have perfect knowledge about the future and about relevant present activities; (v) all economic agents are free to adjust the amount of sales and purchases that they would make and the amount of work they would like to do; (vi) no externalities<sup>29</sup> exist; (vii) markets come to equilibrium at stable prices at which there is no excess demand or supply; (viii) the number of companies is variable; and (ix) neither producers nor consumers are able to affect

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<sup>27</sup> J. Hirshleifer & A. Glazer, *Price Theory and Applications*, 5<sup>th</sup> ed. (Toronto: Prentice-Hall, 1992) at 449-450.

<sup>28</sup> For such a discussion, the reader may refer to any number of standard or introductory texts on welfare economics, for example, see Bohm, *supra* note 16 at 2-19.

<sup>29</sup> In essence, an "externality" is a cost or benefit which is imposed or conferred by one economic agent on another as an incidental result of the former's activities. The concept of externalities is discussed in greater detail in Section III below.

market prices.<sup>30</sup> Thus, the assumptions or conditions necessary for a perfectly competitive market relate to both behavioural features of participants and institutional aspects of the economy.

As the discussion above has sought to highlight, the normative goal of welfare economic theory is to maximize social welfare, measured by the private welfare of each individual in society.<sup>31</sup> Furthermore, as noted above, it is well-settled within welfare economics that a perfectly competitive market maximizes social welfare, or achieves a Pareto optimum, through a socially efficient allocation of resources. The existence of a perfectly competitive market, and thus the socially efficient allocation of resources, requires the fulfillment of several heuristic behavioural and institutional assumptions. However, as economists and policy-makers plainly realize, these necessary conditions for a perfectly competitive market very rarely, if ever, exist in practice.<sup>32</sup> One reason for the failure to attain a socially optimal allocation of resources involves the existence of externalities, a practical reality which runs contrary to assumption (vi) noted above. As Section III below will illustrate, the concept of externalities is fundamental to the economic analysis of environmental issues and is central to the field of environmental economics.

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<sup>30</sup> Nath, *supra* note 15 at 36-37; Bohm, *supra* note 16 at 19.

<sup>31</sup> R.L. Revesz, *Foundations of Environmental Law and Policy* (Oxford: Oxford University Press, 1997) at 3.

<sup>32</sup> For a detailed discussion of various reasons for market failure, including examples, see N. Hanley, J. F. Shogren & B. White, *Environmental Economics: In Theory and Practice* (London: MacMillan Press, 1997) at 22-56.

### III. EXTERNALITIES AND ENVIRONMENTAL ECONOMICS

As noted above, one important reason why markets fail to facilitate efficient allocation of resources is the existence of externalities. Before discussing the content of the concept of externalities, it is important to understand its centrality to environmental policy.

As Krister Hjalte, Karl Lidgren and Ingemar Stahl stated:<sup>33</sup>

Many, or perhaps most of the environmental issues that have been discussed in the past few years can be analyzed in terms of externalities or in terms of the price system's failure to convey correct information about a resource's relative scarcity.

In short, externalities are a significant cause of market failure.<sup>34</sup> Thus, the concept of externalities forms an important theoretical basis for environmental policy prescriptions.

Despite the centrality of externalities to environmental economics, the issue of precisely defining the concept has been the subject of some debate.<sup>35</sup> At this point, the definitional issue will not be explored in any detail because the primary concern here is to delineate the concept in broad terms and to explain in greater detail its relevance to environmental policy. An externality exists when not all of the implications or costs of a consumption or production activity are fully borne by the person undertaking the activity.

As William Baumol and Wallace Oates stated:<sup>36</sup>

An externality is present whenever some individual's (say A's) *utility* or *production* relationships include real (that is, nonmonetary) variables, whose values are chosen

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<sup>33</sup> *Environmental Policy and Welfare Economics* (New York: Cambridge University Press, 1977) at 8. Although this comment was made more than two decades ago, it remains apt today as well.

<sup>34</sup> Hanley, Shogren & White, *supra* note 32 at 29-37; M.A. Santos, *Limits and Scope of Environmental Law* (Springfield: Charles C. Thomas, 1995) at 62.

<sup>35</sup> W.J. Baumol & W.E. Oates, *The Theory of Environmental Policy*, 2d ed. (New York: Cambridge University Press, 1988) at 14, citing, in part, F.M. Bator, "The Anatomy of Market Failure" (1958) LXXII Quarterly Journal of Economics 351; J.E. Meade, "External Economies and Diseconomies in a Competitive Situation" (1952) LXII Economic Journal 54; J.E. Meade, *The Theory of Economic Externalities* (Geneva: Institut Universitaire des Hautes Études, 1973), especially Chapters 1 and 2.

<sup>36</sup> *Ibid.* at 17.

by others (persons, corporations, governments) without particular attention to the effects on A's welfare. [*Italics in original.*]

Thus, an externality involves the imposition of a cost or the conferral of a benefit on an economic agent as an incidental result of the activities of another economic agent.<sup>37</sup>

A few examples of externalities may serve more fully to illuminate their character.

Some pervasive and serious examples include the following:<sup>38</sup>

- a. Disposal of toxic wastes,
- b. Sulfur dioxide, particulates, and other contaminants of the atmosphere,
- c. Various degradable and nondegradable wastes that pollute the world's waterways,
- d. Pesticides, which, through various routes, become imbedded in food products,
- e. Deterioration of neighborhoods into slums,
- f. Congestion along urban highways,
- g. High noise levels in metropolitan areas.

Each of these examples reflect the essential nature of externalities, that is, the failure to incorporate fully social costs, or broader affected interests, into a cost calculation or decision.<sup>39</sup>

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<sup>37</sup> This definition rules out situations where someone *deliberately* acts to affect another person's welfare. As Baumol and Oates noted, "[i]f I purposely maneuver my car to splatter mud on a pedestrian whom I happen to dislike, he is given no choice in the amount of mud he 'consumes,' but one would not normally regard this as an externality": *ibid.* at 17.

<sup>38</sup> *Ibid.* at 12.

<sup>39</sup> Economic literature has distinguished several different classes of externalities. Two broad classes are public externalities and private externalities. The essence of the distinction between these two classes relates to the depletable of the external costs: *ibid.* at 19. Public externalities are "undepletable" in the sense that an increase in the number of people suffering from the external costs will not reduce the average impact of those costs. Examples of environmental externalities which take a public (undepletable) form are polluted air and water, noise and neighborhood slums. In contrast, private externalities are "depletable" in the sense that the external costs are divisible among the individuals upon whom they are imposed. One example of a private (depletable) externality, noted by Baumol and Oates, is the case of coal spilled from passing trains which fuel-needy individuals subsequently gather: *ibid.* at 20. This is a private externality because the total quantity of coal available is reduced with every additional piece found by a gatherer. Such practical examples of private environmental externalities are rare. Thus, environmental externalities can take either a public (undepletable) or a private (depletable) form; however, because the basic policy prescription is the same for public and private externalities and because of the rarity of the latter type of externality, this paper does not distinguish between the two cases in discussing the concept of externalities.

The failure to incorporate all social costs into an economic decision has significant, often detrimental, ramifications for social welfare. Generally, the impact of the activity on others may result in a divergence of the private costs of the person undertaking the activity from the full social costs. In essence, the person undertaking the activity disregards, through self-interest or ignorance, the negative impact of his or her activities on others. The result is that the person continues the activity up to a privately optimal level, or in other words, where it yields no further net benefits to him or her, regardless of the fact that, at some reduced level of activity, the welfare of the community is maximized.

With respect to environmental issues, the divergence of private costs and social costs is reflected in environmental degradation, such as excessive pollution, and, more generally, in a failure to achieve the socially optimal allocation of resources. From an economic perspective, at the root of the externality is the absence of an exchange institution in which the polluter pays an appropriate price for imposing the external costs.<sup>40</sup> Therefore, based on economic theory, the fundamental policy issue facing those seeking to restore or to achieve the socially optimal allocation of resources is how to ensure that external costs are internalized. As some commentators have observed:<sup>41</sup>

[T]he efficient resolution of environmental externalities calls for polluting agents to face a cost at the margin for their polluting activities equal to the value of the damages they produce and for victims to select their own levels of defensive activities with no compensation from polluters.

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<sup>40</sup> Hanley, Shogren & White, *supra* note 32 at 29.

<sup>41</sup> M.L. Cropper & W. E. Oates, "Environmental Economics: A Survey" (1992) XXX J. Econ. Lit. 675 at 681, reproduced in Oates, *The Economics of Environmental Regulation* (Brookfield, VT: Edward Elgar Publishing, 1996) 381.

Thus, within the context of environmental protection, the objective is to achieve a socially optimal allocation of resources by ensuring that polluters, and others whose activities may adversely affect environmental quality, bear the full costs that their activities may impose.

Based upon this theoretical foundation, environmental economics has sought to develop a number of policy prescriptions aimed at contributing to environmental policy. Although the degree of reliance and choice of economic instruments varies considerably between countries,<sup>42</sup> the underlying idea of the policy prescriptions is essentially the introduction of surrogate prices to provide the necessary allocative incentives.<sup>43</sup>

It is important to note that elimination of an externality will not result in abatement of all pollution. Some pollution will occur even at a socially optimal allocation of resources, notwithstanding the absence of external costs. Pollution, and other forms of environmental degradation, are generally an incidental result of profitable economic activity. From an economic perspective, a decrease in pollution is socially advantageous only if it increases the welfare of victims of pollution by more than the corresponding decrease in the welfare of those causing the pollution.<sup>44</sup> Therefore, even a socially efficient allocation of resources involves some degree of pollution.

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<sup>42</sup> For a comparative table listing various federal environmentally-related taxes and charges in member countries of the Organisation for Economic Co-operation and Development (OECD), see OECD, *Evaluating Economic Instruments for Environmental Policy* (Ottawa: Renouf Publishing, 1997) at 20-22. For a discussion of the potential use of economic instruments to address toxic pollution within the Great Lakes region, see Hickling Corporation, *Economic Instruments for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes Basin*, Report prepared for International Joint Commission (IJC) (Windsor: IJC, 1994). See S. Beder, "Charging the earth: The promotion of price-based measures for pollution control" (1996) 16 *Ecological Economics* 51 for an ecological economic perspective on the ways in which the theory and application of economic instruments is shaped by the interests, values and ideologies of their proponents. (For a brief introduction to the discipline of ecological economics, see note 45, below.)

<sup>43</sup> Cropper & Oates, *supra* note 41 at 675.

<sup>44</sup> Revesz, *supra* note 31 at 3.

In sum, as the foregoing discussion strives to highlight, environmental economic theory provides a prescriptive and descriptive framework for addressing environmental degradation. The prescriptive aspect of environmental economics is the goal of maximizing social welfare, including allowance of a socially optimal level of pollution. Its descriptive feature is that environmental degradation, including excessive pollution, occurs when social costs diverge from private costs for any number of reasons related to market failure, particularly the existence of externalities. Furthermore, environmental economics has prescribed several forms of economic instruments aimed at achieving efficient use of resources through the introduction of appropriate pricing signals. It is now relevant to outline, and to strive to address, some criticisms which have been levied against environmental economics and its conceptual foundations. Section IV undertakes this objective.

#### IV. CRITICISMS OF THE ECONOMIC APPROACH TO ENVIRONMENTAL ISSUES<sup>45</sup>

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<sup>45</sup> One area of study which has criticized both "mainstream" economics, particularly environmental economics, and ecology is ecological economics. Apart from the introduction to the discipline provided here, this paper will not independently examine the critiques by students of ecological economics, but rather will include ecological economic criticisms with the others outlined in Section III. As Robert Costanza stated in the inaugural issue of the *Ecological Economics* journal in "What is Ecological Economics?" (1989) 1 *Ecological Economics* 1 at 1:

Environmental and resource economics, as it is currently practiced, covers only the application of neoclassical economics to environmental and resource problems. Ecology, as it is currently practiced, sometimes deals with human impacts on ecosystems, but the more common tendency is to stick to "natural" systems. ...

[Ecological Economics] is intended to be a new approach to *both* ecology and economics that recognizes the need to make economics more cognizant of ecological impacts and dependencies; the need to make ecology more sensitive to economic forces, incentives, and constraints; and the need to treat integrated economic-ecologic systems with a common (but diverse) set of conceptual and analytical tools. [*Italics in original.*]

(i) **Criteria for Social Efficiency - Pareto and Kaldor-Hicks Principles**

(a) **Pareto Principle**

Some commentators have criticized the Pareto principle as an unjustified measure of social welfare. As noted above, the Pareto principle is that social welfare is maximized if resources are allocated such that no person may be made better off without making someone else worse off. Furthermore, the Pareto principle is almost universally accepted by economists as a "touchstone by which the adequacy of social-choice mechanisms can be assessed."<sup>46</sup>

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Thus, ecological economics seeks to develop a new analytical framework by focusing on the intersection of the disciplines of ecology and economics: C.J. Cleaveland, "Basic Principles and Evolution of Ecological Economics" in ProEdit Cassette, ed., *Ecological Economics: Emergence of a New Development Paradigm*, Proceedings of a Workshop sponsored by The Institute for Research on Environment and the Economy & The Canadian International Development Agency (Ottawa: Institute for Research on Environment and the Economy, 1993) 25 at 30. For a discussion of the methodological and conceptual issues of ecological economics, see M. Faber, R. Manstetten & J. Proops, *Ecological Economics: Concepts and Methods* (Brookfield, VT: Edward Elgar, 1996). Although the conceptual foundations of this evolving discipline will perhaps emerge with greater clarity in the future, some commentators have presently sought to distinguish ecological economics from neoclassical economics, in part, on the basis that: (i) in addition to the neoclassical goal of efficient allocation, ecological economics sets the goals of limiting economic activities to a sustainable scale and of fair distribution. As Costanza *et al.* stated in *An Introduction to Ecological Economics* (Boca Raton: St. Lucie Press, 1997) at 80-81:

We see three basic problems: allocation, distribution, and scale. Neoclassical economics deals extensively with allocation, secondarily with distribution, and not at all with scale. Ecological economics deals with all of these, and accepts much of neoclassical theory regarding allocation. Our emphasis on the scale question is made necessary by its neglect in standard economics. Inclusion of scale is the biggest difference between ecological economics and neoclassical economics.

It is clear that scale should not be determined by prices, but by a social decision reflecting ecological limits. Distribution should not be determined by prices, but by a social decision reflecting a just distribution of assets.

Also see International Joint Commission (IJC), *1995-97 Priorities and Progress under the Great Lakes Water Quality Agreement* (Windsor: IJC, 1997) at 34, for a brief comparison of ecological and neoclassical economics.

<sup>46</sup> Rescher, *supra* note 25 at 69.



Critics of the Paretian approach to social welfare argue, firstly, that the approach is founded on the untenable presupposition that individuals choose between competing social states on the basis of "blindered self-interest".<sup>47</sup> Thus, critics argue, the economic approach to social welfare leads to the questionable conclusion that widening disparities in levels of well-being are socially rational and desirable. Secondly, critics of the Pareto principle argue that, although transitive reasoning implies that successive improvements in total welfare are preferable, such reasoning cannot be used to justify increasing disparities in welfare. Rather, critics assert that a sense of justice, involving at least some modicum of egalitarianism, fatally undermines the position that Pareto improvements are always desirable, even if they result in further disparities in welfare.<sup>48</sup> Thus, critics of the Pareto principle conclude that the principle unjustifiably subordinates other important, competing principles, such as distributive justice and egalitarianism. Moreover, critics contend that elucidating and meshing competing principles relating to social welfare involve precisely the underlying issues which should be addressed, and not prejudged by undefended presuppositions, such as the Pareto principle.<sup>49</sup>

The criticism above, that the Pareto principle is unjustified as the ultimate criterion of social welfare because it ignores important ethical issues, is not new, and is recognized within the fields of welfare economics and Law and Economics as a valid concern.<sup>50</sup> As Posner acknowledged:<sup>51</sup>

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<sup>47</sup> *Ibid.* at 71.

<sup>48</sup> *Ibid.* at 73.

<sup>49</sup> *Ibid.* at 77.

<sup>50</sup> For example, see Nath, *supra* note 15 at 65-69.

<sup>51</sup> Posner, *supra* note 1 at 15.

The dependence of even the Pareto-superiority concept of efficiency on the distribution of wealth - willingness to pay, and hence value, being a function of that distribution - further limits efficiency as an ultimate criterion of the social good. If income and wealth were distributed differently, the pattern of demands might also be different and efficiency would require a different deployment of our economic resources. Economics does not answer the question whether the existing distribution of income and wealth is good or bad, just or unjust, although it can tell us a great deal about the costs of altering the existing distribution, as well as about the distributive consequences of various policies; neither does it answer the ultimate question whether an efficient allocation of resources would be socially or ethically desirable. [Footnotes omitted.]

Thus, the concept of Pareto optimality is limited by its inability to resolve distributive equity issues, which, as critics have argued, requires balancing with other principles.

Notwithstanding this limitation, however, Pareto optimality can offer valuable insights into the efficiency of an economy. Furthermore, as argued above in Section I, in focusing on efficiency as one important value of a society, economics can contribute to the clarification of value conflicts by providing a frame of reference for the assessment of competing social objectives and means to achieve those objectives. Therefore, despite economics' limitations in providing ethical guidance on issues of distributive equity, the discipline still makes an important contribution to normative as well as positive issues.

### **(b) Kaldor-Hicks Principle**

In addition to attacks on the Pareto principle, critics have challenged economists' reliance on the Kaldor-Hicks principle, which requires that any change result in a positive net benefit to society.<sup>52</sup> As many commentators have validly pointed out, the Kaldor-Hicks

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<sup>52</sup> As noted in Section I above, under the Kaldor-Hicks principle, if the increase in welfare of those who benefit from a change exceeds the decrease in welfare from those who bear costs from the change, the change is desirable from a social cost-benefit perspective.

principle does not require actual compensation by "gainers" to "losers" for policy changes. Rather, the principle merely (and unsatisfactorily, in detractors' view) requires that those who benefit *could*, if a system of perfect transfers existed, compensate those who lose. A standard criticism of the Kaldor-Hicks principle is therefore that, even though *potential* social welfare may have been increased, some individuals or groups may have actually been made significantly worse off.<sup>53</sup>

The criticism that the Kaldor-Hicks compensation criteria does not require actual compensation validly highlights a shortcoming of the principle as a instrument for social decision-making. Ultimately, the concern about compensation highlights the importance of distributive measures and raises fundamental questions about the appropriate mechanism for addressing perceived inequities.

## **(ii) Realism of Fundamental Economic Assumptions**

Some critics have challenged the validity of economic theory on the basis that its underlying assumptions are unrealistic and untenable. These criticisms are generally directed at some of the institutional and behavioural assumptions noted in Section II above,<sup>54</sup> and in particular, the assumption that economic agents act in a self-interested, rational manner.

These criticisms appear to reflect a lack of understanding about the nature of theoretical analysis. Assumptions are necessary in economics, and other fields of social and

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<sup>53</sup> An obvious extension of this point is that the Kaldor-Hicks compensation test ignores distributive effects. This criticism is discussed in Section IV(i)(b) below.

<sup>54</sup> For a discussion of the subjective values upon which neoclassical economic assumptions are founded, see R.P. Malloy, "A New Law and Economics" (Ch. 1) in Malloy & Braun, *supra* note 4 at 15-18.

scientific inquiry, for the obvious reason that some degree of abstraction is necessary to advance understanding of complex realities.<sup>55</sup> Indeed, a theory that sought to reproduce in its assumptions the complexity of reality would lose its explanatory import and become merely a description.<sup>56</sup> Thus, by founding analytical models on certain simplified behavioural attributes, economics enhances its ability to describe and explain particular phenomena and to predict outcomes. Ultimately, arguments that attack the validity of economics on the basis of its basic assumptions are misguided because they fail to recognize that theories should be judged primarily on the basis of their descriptive, predictive, and prescriptive contributions.

### (iii) Valuation of the Environment

In addition to criticisms of underlying principles and assumptions, critics have attacked the evaluation of economic costs and benefits in environmental decision-making. It is beyond the scope of this paper to examine all the subtleties of the extensive debate on environmental cost-benefit analysis. Rather, after briefly outlining some dominant approaches used in cost-benefit analysis, I will highlight some alleged deficiencies identified by critics.

Cost-benefit analysis has three major uses: (i) to assess the economic feasibility of particular projects; (ii) to rank alternative investment projects; and (iii) to optimize the scale of a given project.<sup>57</sup> As Thomas Cinti observed:<sup>58</sup>

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<sup>55</sup> A.M. Polinsky, *An Introduction to Law and Economics* (Toronto: Little, Brown & Co., 1983) at 2.

<sup>56</sup> Posner, *supra* note 1 at 18.

<sup>57</sup> T.S. Veeman, "Benefit-Cost Analysis in Environmental Decision-Making: Procedures, Perils and Promise" in Canadian Society of Environmental Biologists, Alberta Chapter, *Economy and Ecology: The Economics of Environmental Protection* (Symposium, University of Alberta, February 19-20, 1985) 129 at 130.

The underlying assumption of cost benefit analysis is that efficiency will be achieved when the marginal benefit realized from a new technology is just equal to the marginal cost incurred implementing it.

Therefore, the ultimate objective of cost-benefit analysis is to facilitate systematic decision-making on the efficient allocation of resources by identifying and assessing the proposed project's impact on environmental, economic and other interests.

The difficulty in evaluating potential impacts arises from the need to value entities, such as the environment, for which no identifiable market exists. Because of the absence of a market for particular amenities, it is necessary for decision-makers to attach values, defined in terms of how much people would be willing to pay for the amenities if they were marketed.<sup>59</sup> The two main types of approaches to non-market valuation in environmental cost-benefit analysis are direct and indirect methods.<sup>60</sup> Direct, or stated preference, methods seek to infer individuals' preferences for environmental quality by asking them to state their preferences for the environment. For example, one widely used type of direct method is the contingent valuation method, which may involve surveying individuals about their preferences between alternative scenarios or, alternatively, asking them their maximum willingness to pay for an increase in environmental quality or to accept compensation for

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<sup>58</sup> "The Regulator's Dilemma: Should Best Available Technology or Cost Benefit Analysis Be Used To Determine the Applicable Hazardous Waste Treatment, Storage and Disposal Technology?" (1990) 16 Rutgers Computer & Tech. L.J. 145 at 155, citing Haveman & Burton, "The Concept of Benefits in Cost-Benefit Analysis: With Emphasis on Water Pollution Control Activities in *Cost Benefit Analysis and Water Pollution Policy* 37 (1975).

<sup>59</sup> For a critical discussion of methodologies which may be used by the courts to assess environmental harm, see Ontario Law Reform Commission, "The Assessment of Damages for Harm to the Environment" (Ch. 3) in *Report on Damages for Environmental Harm* (Toronto: Ministry of the Attorney-General, 1990).

<sup>60</sup> For an excellent summary of both approaches, including outlines of different methods within each type and examples of applications, see Hanley, Shogren & White, "Methods for Valuing Environmental Costs and Benefits" (Ch. 13), *supra* note 32 at 383-424.

avoiding a decrease in environmental quality.<sup>61</sup> In contrast to direct methods, indirect methods seek to derive values of environmental costs and benefits involve examining individuals' behaviour in related markets.<sup>62</sup> Essentially, indirect methods focus on what individuals actually chose and what they had to forsake to obtain it. For example, in one type of indirect method of non-market valuation, hedonic modelling, individuals' valuation of air quality improvements is inferred by considering their behaviour in the related market for housing, particularly with respect to their willingness to pay for site-specific amenities.<sup>63</sup>

As alluded to above, there is a difference between direct and indirect methods. As V. K. Smith observed, the difference between the two approaches:<sup>64</sup>

arises from what the analyst does in constructing the choice elements. For indirect methods, the task parallels 'detective work' ... - trying to determine what people sought and what they had to give up to get it. By contrast, for the methods generally included under the broad heading of contingent valuation this process requires the analyst to present a credible, understandable and relevant choice option.

Nonetheless, despite this difference, the underlying logic of direct and indirect approaches to non-market valuation are the same: both involve developing a monetary measure of economic value by reconstructing the elements of a choice and identifying the tradeoff underlying each individual's decision.<sup>65</sup>

Based in part on the common underlying logic of various approaches to non-market valuation, critics have argued that cost-benefit analysis has systematic limitations that

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<sup>61</sup> *Ibid.* at 383.

<sup>62</sup> *Ibid.* at 384.

<sup>63</sup> *Ibid.*

<sup>64</sup> V.K. Smith, "Preface" in V. K. Smith, ed., *Estimating Economic Values for Nature* (Brookfield, VT: Edward Elgar, 1996) xiii at xiii-xiv.

<sup>65</sup> *Ibid.* at xiii.

seriously undermine its validity in environmental decision-making processes.<sup>66</sup> As outlined below, criticisms include the views that: (i) the application of cost-benefit analysis is too broad from an environmental ethics perspective; (ii) the identification of costs and benefits is seriously undermined by scientific uncertainty; (iii) the attempt to assign values discounts less easily assessed non-pecuniary values; (iv) cost-benefit analyses are founded on inaccurate assumptions about the way in which people value gains and losses; (v) the process of attempting to monetize non-marketed entities results in their devaluation; and (vi) cost-benefit analysis fails to address issues of equitable distribution.

First, cost-benefit analysis has been attacked on ethical grounds. In essence, criticisms based on environmental ethics perspectives challenge the moral foundations of cost-benefit analysis. Two illustrative examples of ethical criticisms are outlined briefly below. Firstly, some commentators have attacked cost-benefit analyses on the basis that there are many instances, including in environmental regulation, where a decision may be morally right even though its benefits do not outweigh its costs.<sup>67</sup> Steve Kelman, for example, argued that although there is a broad range of individual and social decisions where it is sufficient to consider whether an act's benefits exceed its costs, certain questions

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<sup>66</sup> In addition to the criticisms examined in this paper, other criticisms of cost-benefit analyses are: (i) the potential for strategic bias in contingent valuation studies; (ii) the potential for "embedding", where the value placed on a good in a contingent valuation study depends on the extent to which it is embedded in other goods; and (iii) the sensitivity of preference models to changes in individuals' information. These criticisms are largely recognized by economists, and considerable attention and debate has been devoted to attempting to address these concerns.

<sup>67</sup> S. Kelman, "Cost-Benefit Analysis: An Ethical Critique" in C. Pierce & D. VanDeVeer, *People, Penguins, and Plastic Trees*, 2d. ed. (Belmont, CA: Wadsworth, 1995) 384 at 385.

of moral judgment which should remain outside the purview of cost-benefit analysis involve the natural environment as well as some basic duties and rights.<sup>68</sup> Kelman claimed:<sup>69</sup>

... [F]or the common run of questions facing individuals and societies, it is possible to begin and end our judgment simply by finding out if the benefits of the contemplated act outweigh the costs. This very fact means that one way to show the great importance, or value, attached to an area is to say that decisions involving the area should not be determined by cost-benefit calculations. This applies, I think, to the view many environmentalists have of decisions involving our natural environment.

Thus, environmental cost-benefit analysis is criticized on the ethical basis that the natural environment should be outside the range of such calculations.

Secondly, another ethical criticism of cost-benefit analysis is based on its anthropocentric nature. For example, Douglas Booth argued that:<sup>70</sup>

under an ethics of environmental concern the scope of possible cases where cost-benefit analysis can be legitimately applied from an ethical point of view is narrower than commonly believed by environmental economists.

Clearly, these ethical critiques of environmental economics are important because they raise fundamental issues about our relationships with other natural entities and suggest that economically irrational choices may sometimes nonetheless be "right". It is well beyond the scope of this paper to attempt to reconcile these widely diverging views about humans' proper sphere of activity. Nonetheless, despite the significance of ethical critiques of cost-

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<sup>68</sup> *Ibid.* at 386-387.

<sup>69</sup> *Ibid.* at 387.

<sup>70</sup> D.E. Booth, "Ethics and the limits of environmental economics" (1994) 9 *Ecological Economics* 241 at 241. Booth analyzed two approaches to environmental ethics, one based on the view that human beings are the focus of moral concern, and another based on the notion that moral concern can also be extended to non-human entities. Booth concluded that: (i) if human beings alone are the focus of moral concern, the application of cost-benefit analysis to environmental issues is illegitimate in cases where environmental damage is harmful to human health and in cases where the natural environment is so highly valued that compensation to those who suffer losses is infeasible; and (ii) cost-benefit analysis cannot legitimately be applied where moral concern is extended to non-human entities.



benefit analysis, it is relevant to point out that such critiques do not address the pressing practical issue of how competing interests affecting the environment should be resolved or balanced.

Second, cost-benefit analysis has been attacked on the basis that its first necessary step of identifying costs and benefits of a project is seriously undermined by scientific uncertainty. Ted Schrecker's observations about obstacles in identifying benefits of health and safety regulation are also illustrative of critics' concerns within the broader environmental context.<sup>71</sup>

An extensive recent review of research on the benefits of health and safety regulation isolated several areas of scientific uncertainty or conflict: the demonstration of cause-effect relationships; limited availability of epidemiological data linking exposures with actual human illness; the limitations of models used to predict dispersion of pollutants within the environment; dose-response relationships; the validity of interspecies extrapolation; and the extent of impacts on especially sensitive individuals or groups. [Footnote omitted.]

On the basis of these and similar concerns relating to the identification of environmental impacts, critics argue that the efficacy of cost-benefit analysis in addressing environmental issues is seriously flawed.

It is plain that considerable informational limitations face policy-makers and others seeking to address environmental problems. However, the practical reality of imperfect information does not mean that no attempt should be made to identify the implications of a proposed project. Rather, in the absence of perfect knowledge, cost-benefit analysts should attempt to make explicit all scientific uncertainties or assumptions on which the assessment is based. Express recognition of the limitations of the analysis would improve its process,

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<sup>71</sup> T.F. Schrecker, *Political Economy of Environmental Hazards*, Study Paper prepared for the Law Reform Commission of Canada (Ottawa: Law Reform Commission of Canada, 1984) at 48.

albeit not necessarily its substantive content, in two ways. First, express recognition of the scientific shortcomings underpinning cost-benefit analyses would help address the concern that such analyses misleadingly appear to provide definitive results despite gaps in the knowledge base on which they are founded. Second, those involved in the development of environmental policy, including the scientific community, would have a clearer understanding of the areas in which further research is required. Thus, as argued here, the most appropriate way of dealing with the intractable problem of scientific uncertainty in cost-benefit analysis is to recognize expressly the areas of uncertainty, but not to reject altogether the process of striving to consider costs and benefits in environmental decision-making.

Third, in addition to criticisms aimed at cost-benefit analysis' broad application and the identification of impacts, critics have attacked the second primary stage of cost-benefit analysis, the assignment of values to identified costs and benefits. One persistent criticism is that cost-benefit analysis distorts or discounts less easily assessed non-pecuniary values.<sup>72</sup> The implication of this is that non-marketed "goods", such as the environment, are undervalued in decisions relating to its use or protection. Critics argue that non-pecuniary values in planning decisions, litigation and reform proposals are discounted relative to more easily appreciated and more easily measured financial data.<sup>73</sup>

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<sup>72</sup> For example, see P.C. Schulze, "Cost-benefit analyses and environmental policy" (1994) 9 *Ecological Economics* 197 at 197-198.

<sup>73</sup> See, for example, J.L. Knetsch, "Economics, Losses, Fairness, and Resource-Use Conflicts" in M. Ross & J.O. Saunders, eds., *Growing Demands on a Shrinking Heritage: Managing Resource-Use Conflicts*, Essays from the Fifth Institute Conference on Natural Resources Law (Calgary: Canadian Institute of Resources Law, 1992) 20 at 23; Kelman, *supra* note 67 at 387-388.

It is not disputed here that cost-benefit analysis is better able to deal with values which are already or easily quantified. However, because of the varied and important uses of this type of inquiry in social decision-making, critics of cost-benefit analysis must first establish that cost-benefit analysis systematically results in unjust outcomes before rejecting the process.<sup>74</sup> At present, the claim that cost-benefit analysis is systematically unjust is not founded on a compelling empirical foundation.

Fourth, another criticism of cost-benefit analysis, which is related to the issue of valuation, is that such analyses are founded on inaccurate assumptions about the way in which people value gains and losses. Under standard economic theory, an item has value only to the extent that people are willing to give up something in order to acquire or keep it.<sup>75</sup> In neoclassical welfare economic theory, individuals' willingness to pay for an increase in welfare and their willingness to accept compensation to avoid a decrease in welfare are viewed as equivalent ways of measuring either a decrease or an increase in welfare.<sup>76</sup> Critics argue that the assumption that people equally value avoided losses and foregone gains is false. Rather, they argue that increasing evidence shows that people generally value losses more highly than equivalent gains, and reductions in losses more highly than foregone gains. As Steve Kelman argued:<sup>77</sup>

[T]he attempts of economists to measure people's willingness to pay for non-marketed things assume that there is no difference between the price a person would require for *giving up* something to which he has a preexisting right and the price he would pay to *gain* something to which he enjoys no right. Thus, the analysis assumes no difference between how much a homeowner would need to be paid in

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<sup>74</sup> H.B. Leonard & R.J. Zeckhauser, "Cost-Benefit Analysis Defended" in D. VanDeVeer & C. Pierce, eds., *People, Penguins, and Plastic Trees* (Belmont, CA: Wadsworth, 1986) 249 at 252.

<sup>75</sup> Knetsch, *supra* note 73 at 25.

<sup>76</sup> Hanley, Shogren & White, *supra* note 32 at 395.

<sup>77</sup> Kelman, *supra* note 67 at 388.

order to give up an unobstructed mountain view that he already enjoys and how much he would be willing to pay to get an obstruction moved once it is already in place. Available evidence suggests that most people would insist on being paid more to assent to a worsening of their situation than they would be willing to pay to improve their situation. [*Italics in original.*]

Thus, critics argue that, in attempting to value non-marketed goods, economists ignore the disparity between people's assessment of positive and negative changes in economic well-being. Moreover, critics claim that this disparity can often seriously undermine the efficacy of cost-benefit analysis.

Fifth, cost-benefit analysis has been attacked fundamentally on the basis that the very act of attempting to monetize environmental and other non-marketed values results in their devaluation. Proponents of this view claim that the act of pricing may decrease value for two main reasons.<sup>78</sup> First, in many circumstances, non-market exchange is linked to the creation of certain values not associated with market exchange. Thus, "[i]f a good becomes less associated with the production of positively valued feelings because of market exchange, the perceived value of the good declines to the extent that those feelings are valued."<sup>79</sup> In addition, pricing may decrease value because value of non-marketed objects is based partly from the objects' position as repositories of values represented by the non-marketed sector. Second, proponents of the view that the act of pricing may decrease value claim that the value of a good purportedly may decrease by removing the possibility of proclaiming that the item is "not for sale". Moreover, when an object is priced, the issue of its perceived value constantly arises, which may lead to an erosion of individuals'

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<sup>78</sup> *Ibid.* at 388-390.

<sup>79</sup> *Ibid.* at 389.

assessment of the object's worth.<sup>80</sup> On these grounds, some have argued that economic valuation of non-marketed objects can result in their devaluation.

The view that the assignment of economic value to a non-marketed item may result in its devaluation, however, is based on the premise that non-marketed sectors yield special value to humans. Proponents of the argument that pricing *per se* may reduce value therefore place central, but implicit, importance on a dichotomy between the marketed<sup>1</sup> and non-marketed sectors. However, their argument does not provide any insight into the origins of the boundaries of these sectors. In other words, the argument fails to address the basic issue of why markets exist and the source of economic value. Thus, the argument that pricing *per se* reduces value is considerably undermined by its implicit and undefended assumption that markets and prices are necessary for economic value. Rather, as Steven Edwards observed:<sup>81</sup>

Indifference is the cornerstone of rigorous definitions of economic values. Something's economic value - whether it be a marked commodity, an unpriced environmental resource, or sympathy for future generations - is determined entirely by its ability to yield personal utility. ... [M]arkets and prices are not necessary conditions for economic value. Rather, markets and prices emerge from collective economic behaviour when people can be excluded from the use and benefits of things unless they pay for them. ... Traditional markets and prices provide only one mechanism whereby these values are revealed. Limiting economics to the analysis of traditional markets is arbitrary.

Therefore, as illustrated above, cost-benefit analysis raises fundamental issues about the nature of economic value. Moreover, the argument that the assignment of economic values to non-marketed items may result in their devaluation ignores the basis of economic value,

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<sup>80</sup> *Ibid.*

<sup>81</sup> S. Edwards, "In Defense of Environmental Economics" (1987) 9 *Environmental Ethics* 73 at 76-77.

and is premised on the untenable assumption that the division between marketed and non-marketed sectors is rigid and static.

Finally, cost-benefit analysis has been criticized on the basis that it fails to address social problems associated with inequitable distributions of costs and benefits. Critics argue that the Kaldor-Hicks principle, which requires that any change result in a positive net benefit to society, incorrectly assumes that those who bear costs under one decision will eventually benefit from another.<sup>82</sup> Hence, they claim that the principle assumes that, over the long run, everyone will ultimately benefit sufficiently to compensate for their losses. In their view, the position that "losers" under one policy will be "winners" under another is false because the analysis depends upon the existing wealth and entitlement distributions in society.<sup>83</sup> As Cinti noted, cost-benefit analysis usually fails to consider the entitlements of the parties, even though "the initial asset positions of the parties can affect the outcome of the analysis if the cost is great enough to be a substantial portion of the nonentitled party's asset position."<sup>84</sup> On this basis, critics claim that the Kaldor-Hicks principle, which is central to cost-benefit analysis, ignores distribution effects.

There are two compelling responses to the criticism that cost-benefit analysis accords insufficient attention to distribution issues. First, the charge has little to do specifically with the methodology of cost-benefit analysis. In principle, there is no reason why equitable

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<sup>82</sup> This criticism is related to the criticism that the Kaldor-Hicks principle does not require actual compensation of "losers" by "gainers". This latter criticism was discussed in Section IV(i)(b) above.

<sup>83</sup> For example, see Cinti, *supra* note 58 at 161.

<sup>84</sup> *Ibid.* at 161-162. However, as Cinti also acknowledged, the criticism that outcomes in cost-benefit analysis are affected by, but usually fail to consider, the initial asset positions of the parties can be largely mooted by considering the purpose of environmental legislation. Cinti suggested that, because the express purpose of most environmental legislation is to protect human and/or the environment, the effects of the prior distribution of wealth are lessened substantially: *ibid.* at 162.

concerns cannot be incorporated into the cost-benefit decision framework.<sup>85</sup> Rather, the issue of distribution is closely related to the identification and weighting of costs and benefits, and these concerns should reflect society's view of the relative merit of competing interests. Thus, there is no theoretical reason why distribution concerns could not be systematically included in cost-benefit analyses.

Second, even if distribution concerns could not be systematically included in cost-benefit analyses, there are other means, such as taxes and direct expenditures, to address inequities caused by changes in policy. Thus, although decision-makers should include distributional issues in their assessments of costs and benefits, other wider public programs exist to effect redistribution if project-based efforts are not fully effective. Some proponents of cost-benefit analysis have argued it is generally not a good idea to attempt to address distribution concerns in cost-benefit analysis, and that alternate means are more efficient for redistribution.<sup>86</sup> However, in this author's view, efforts to address distribution concerns should also occur at the project-based level because it is at this level that stakeholders can present information with sufficient detail and focus that the project's ramifications can be more clearly understood.

Thus, the argument that cost-benefit analysis accords insufficient attention to distributive issues validly highlights the importance of equitable considerations. However,

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<sup>85</sup> Leonard & Zeckhauser, *supra* note 74 at 250.

<sup>86</sup> For example, Leonard & Zeckhauser, argued that only one tax and expenditure package should be used to address equitable concerns because: (i) efforts to address distribution issues within cost-benefit analyses would be inefficient; (ii) treating distributional concerns within each project would lead to transfers within a small subset of the community; and (iii) the view that distributional issues should be addressed on an individual project basis reflects an unsubstantiated presumption that some groups systematically lose out more than others: *ibid.* at 250-251.

the argument does not seriously undermine the methodology of cost-benefit analysis because there is no reason, in principle, why such concerns could not be included in cost-benefit analysis. Furthermore, even though every effort should be made to include distribution issues in project-based cost-benefit analyses, distributional concerns may also be addressed in broader public programs.

In sum, as outlined in the foregoing section, the economic approach to environmental issues has been criticized on a number of grounds. This section has examined three groups of criticisms aimed at: (i) the criteria for social efficiency, specifically, the Pareto and Kaldor-Hicks principles; (ii) the realism of fundamental economic assumptions; and (iii) valuation of the environment through cost-benefit analysis. Only some of these criticisms are valid, and as noted above, such criticisms involve: concerns with limitations of efficiency principles with respect to distributive equity and compensation; ethical questions about the moral foundations of cost-benefit analysis; and concerns about traditionally inaccurate assumptions about the way in which people value gains and losses. All of the criticisms examined, even those that are not compelling for the reasons advanced above, are significant because they help to place the field of economics in perspective relative to other social concerns. This chapter does not purport to provide a response to all of the criticisms examined. Rather, notwithstanding the criticisms, it has sought to demonstrate the general relevance of economics to environmental law and policy.



## V. CONCLUSION

In attempting to demonstrate the general environmental relevance of economics, this chapter has sought to achieve three main goals. First, it has attempted to justify the use of economics in analyzing the law. Economics can contribute to our understanding of law by: (i) providing a necessary external perspective; (ii) clarifying value conflicts by demonstrating the inefficiency of particular types of activities and placing values, albeit imperfectly, on environmental goods, and (iii) explaining legal rules, outcomes and institutions, and facilitating empirical analysis. Second, this chapter has sought to provide a broad overview of welfare economics and environmental economics, and particularly, to highlight the meaning and centrality of the concept of social efficiency in these fields. As outlined above, welfare economics seeks to maximize social welfare, measured in terms of aggregate individual utility. However, a significant reason, particularly within the environmental context, for failing to achieve a socially optimal allocation of resources is the existence of externalities. Finally, a third main objective of this chapter was to outline, and respond to, some criticisms of the economic approach to law, particularly environmental law. Ultimately, this chapter has attempted to illustrate that, despite some important criticisms, economics remains a useful analytical approach to environmental issues.

In the following chapters, the analysis will shift to an examination of Great Lakes environmental policy. Specifically, Chapter 3 will attempt to identify some key principles and themes underpinning Great Lakes toxic water pollution policy. Chapter 4 will strive to illustrate how some of the economic concepts discussed above are reflected in a fundamental principle of Great Lakes environmental policy, the ecosystem approach, which is an

integrated and comprehensive approach to environmental management. In analyzing the economic content of the ecosystem approach, this dissertation will proceed on the basis that economic theory is essentially sound. Thus, the analytical focus will be on the policy principle, rather than on a critical assessment of economic theory.

### **CHAPTER THREE:** **TOXIC POLLUTION POLICY FRAMEWORK IN GREAT LAKES BASIN**

#### **I. INTRODUCTION**

In addition to the institutions and organizations in the Great Lakes regime outlined in Chapter 1, numerous legal agreements and legislation form an important part of the Great Lakes governance system. As noted, the policy frameworks addressing toxic water pollution in the Great Lakes basin are established primarily by bilateral agreements between Canada and the United States, intranational agreements, and federal, provincial and state legislation. This chapter focuses on the conceptual underpinnings of four key intergovernmental instruments which form the foundation of the existing policy framework relating to toxic water pollution in the Great Lakes basin: (i) the *Great Lakes Water Quality Agreement*;<sup>1</sup> (ii) the *Great Lakes Binational Toxics Strategy*;<sup>2</sup> (iii) the *Canada-Ontario Agreement*;<sup>3</sup> and (iv) the *Final Water Quality Guidance for the Great Lakes System*.<sup>4</sup> It is important to note that each of these agreements operates on either a binational or domestic level.<sup>5</sup> The chapter

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<sup>1</sup> *Agreement Between Canada and the United States of America on Great Lakes Water Quality*, 15 November 1978, 30 U.S.T. 1383, [hereinafter *1978 GLWQA*], as amended by *Agreement Amending the Agreement of November 15, 1978, as amended, on Great Lakes Water Quality*, United States and Canada, 18 November 1987, T.I.A.S. 11551, [Present Agreement hereinafter referred to as *GLWQA*]; [1987 amendment hereinafter referred to as *1987 Protocol*].

<sup>2</sup> *Canada-United States Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes Basin*, Canada and United States, 7 April 1997, online: USEPA <<http://www.epa.gov/glnpo/p2/bns.html>> (last modified: 6 January 1998) [hereinafter *Great Lakes Binational Toxics Strategy* or *BTS*].

<sup>3</sup> *Canada-Ontario Agreement respecting the Great Lakes Basin Ecosystem*, Canada and Ontario, 1 April 1994 [hereinafter *Canada-Ontario Agreement* or *COA*].

<sup>4</sup> 40 C.F.R. pts. 9, 122, 123, 131 and 132 (1995) [hereinafter *Guidance*].

<sup>5</sup> The *Great Lakes Water Quality Agreement* and the *Great Lakes Binational Toxics Strategy* are binational instruments, whereas the *Canada-Ontario Agreement* and the *Final Water Quality Guidance for the Great Lakes System* concern Canadian and American domestic approaches respectively.

attempts first to outline and highlight the principles underpinning each of the following four key intergovernmental instruments and subsequently to identify common themes running through the collective environmental policy structure.

It is prudent to note at the outset that, based on considerable similarities in the principles identified below, one may be tempted to conclude that there is little progress from instrument to instrument in Great Lakes policy development and, furthermore, that repetition of principles has replaced action. In this author's view, these conclusions would be erroneous. Rather, a more accurate characterization of the Great Lakes policy framework is that there is substantial consensus on policy objectives and approaches and that the instruments examined collectively represent a hierarchy of commitments or obligations, ranging in scope from international to domestic applications. More specifically, as noted in Section III(ii) of Chapter 1, at the international level, the 1909 *Boundary Waters Treaty*<sup>6</sup> provides the foundation for bilateral resource management by Canada and the United States. The *Boundary Waters Treaty* was later supplemented by the *GLWQA*, a bilateral agreement between Canada and the United States, which presently stands as the primary operational agreement relating to Great Lakes environmental management. The fundamental purpose of the *GLWQA* is to "restore and maintain the chemical, physical, and biological integrity" of the waters of the Great Lakes ecosystem.<sup>7</sup> In essence, the ultimate goal of the agreement is to protect the ecological integrity of the Great Lakes ecosystem. This goal is expressly

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<sup>6</sup> *Treaty Between the United States and Great Britain Relating to Boundary Waters, and Questions Arising Between the United States and Canada (1909)*, United States and Great Britain, 11 January 1909, 36 U.S. Stat. 2448, U.K.T.S. 1910 No. 548 [hereinafter *Boundary Waters Treaty*].

<sup>7</sup> *Supra* note 1, Art. II.

adopted in the *Great Lakes Binational Toxic Strategy*, a bilateral agreement between Canada and the United States. The *Great Lakes Binational Toxic Strategy* builds on the *GLWQA* by focusing particularly on one of the primary means of protecting ecological integrity set out in the latter agreement, specifically, virtual elimination of persistent toxic substances.

In addition to these bilateral commitments, Canada and the United States have agreements at the national level. The *Canada-Ontario Agreement* and the *Final Water Quality Guidance for the Great Lakes System* each seek to coordinate federal-provincial or -state actions within Canada and the United States respectively. It is also important to note that these coordinating instruments are also supplemented by domestic environmental legislation, which often provides specifics on enforcement and procedural matters.<sup>8</sup>

## II. OUTLINE OF THE POLICY FRAMEWORK

### (i) *Great Lakes Water Quality Agreement*<sup>9</sup>

The origins of the *GLWQA* are directly rooted in the *Boundary Waters Treaty*. As noted in Chapter 1, fundamental purposes of the Treaty were to protect boundary waters, including the Great Lakes, against unilateral diversions and to secure a right of navigation.

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<sup>8</sup> For example, in Canada, at the federal level, the revised *Canadian Environmental Protection Act*, Bill C-32, *An Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development*, 1<sup>st</sup> Sess., 36<sup>th</sup> Parl., 1999, sets out investigation procedures, enforcement powers, and rights for public participation relating to toxic substances.

<sup>9</sup> An understanding of key principles in the present *GLWQA* requires knowledge of the agreement's evolution because the process of negotiation and amendment, particularly in 1978, is highly revealing about the nature and intent of the resulting agreement. Thus, the discussion in this section briefly outlines the events culminating in the *Agreement Between the United States of America and Canada on Great Lakes Water Quality*, United States and Canada, 15 April 1972, 23 U.S.T. 301 [hereinafter 1972 *GLWQA*] and delineates, with particular focus on the 1978 *GLWQA*, the subsequent evolution of the agreement to its present form.

Under the Treaty, the binational IJC was established as the primary institution to assist in carrying out these purposes by providing formal dispute resolution processes aimed at resolving water issues along the common border. Two of the most important roles of the IJC are its fact-finding and reporting functions under Article IX, and several issues have been jointly referred to the institution by Canada and the United States.<sup>10</sup>

In 1964, an investigation reference under the *Boundary Waters Treaty* indicated that eutrophication was causing serious degradation of Lakes Erie and Ontario, including massive growths of algae resulting in fish kills, deterioration of beaches and clogging of water intakes. The reference led directly to the development of the 1972 *GLWQA*.<sup>11</sup> Increasing public concern about the very ostensible effects of water pollution<sup>12</sup> and scientific research on the lakes' deterioration resulted in the formation of a joint working group to negotiate an agreement for Great Lakes cleanup.<sup>13</sup> Thus, the 1972 *GLWQA* "resulted from scientific consensus that reduction of phosphorus could slow eutrophication, and from political consensus that there was political support for action."<sup>14</sup>

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<sup>10</sup> S.J. Toope & J. Brunnée, "Freshwater Regimes: The Mandate of the International Joint Commission" (1998) 15 *Arizona J. Int'l & Comp. L.* 273 at 282.

<sup>11</sup> L. Botts & P. Muldoon, *The Great Lakes Water Quality Agreement: Its Past Successes and Uncertain Future* (Dartmouth College, 1996) at sec. 2.4, online: Canada Centre for Inland Waters <<http://www.cciw.ca/glwqa/GLREPORT.html>> (date accessed: 12 November 1998). For a detailed account of the evolution of U.S. water pollution control policy in the Great Lakes basin prior to the development of the 1972 *GLWQA*, see T. Kehoe, *Cleaning Up the Great Lakes: From Cooperation to Confrontation*, (DeKalb: Northern Illinois University Press, 1997).

<sup>12</sup> For instance, wide media coverage of the flaming Cuyahoga River in 1967, characterization of eutrophication as the death of Lake Erie and huge deposits of decaying algae and wildlife dieoff on beaches. See Botts & Muldoon, *supra* note 11 at sec. 2.4.

<sup>13</sup> *Ibid.* at sec. 2.4.

<sup>14</sup> *Ibid.* at sec. 3.2. Also see M. Gilbertson, "Are causes knowable? Some consequences of successional versus toxicological interpretations of the Great Lakes Water Quality Agreement" (1997) 54 *Can. J. Fish. Aquat. Sci.* 483 at 483-484.

The primary objective of the 1972 *GLWQA* was to reverse eutrophication by sufficiently altering water chemistry. The 1972 *GLWQA* called for restoration and enhancement "of water quality in the Great Lakes System" by improving water chemistry.<sup>15</sup> The terms of the 1972 *GLWQA* required a "comprehensive review of the operation and effectiveness ... during the fifth year after its coming into force."<sup>16</sup> This mandated review triggered negotiations leading to the revised 1978 *GLWQA*.<sup>17</sup> One of the primary differences between the 1972 *GLWQA* and the 1978 *GLWQA* is the shift in attention from eutrophication to toxic pollution in the latter agreement. As Botts and Muldoon noted:<sup>18</sup>

Several convergent factors have been suggested as reasons for the political commitment to change the [1972] Agreement. These factors included a sense of success in slowing eutrophication but growing recognition by agency officials, scientists, and policy-makers of the problems posed by toxic chemicals. The expanding involvement of environmental organizations and the absence of a strong lobby against the changes helped create a favorable political climate. [Footnotes omitted.]

Thus, negotiation of the 1978 *GLWQA* occurred within a different scientific and political context than that in which the 1972 *GLWQA* was developed.<sup>19</sup>

Negotiation of the 1978 *GLWQA* between Canada and the United States began in April, 1977, and many issues were resolved by March, 1978. Preparation of advance recommendations by each side was followed by consultation and preliminary negotiation by agency staff prior to final review and negotiations by teams of six negotiators on each side.<sup>20</sup>

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<sup>15</sup> 1972 *GLWQA*, *supra* note 9.

<sup>16</sup> 1972 *GLWQA*, *ibid.*, Art. IX.

<sup>17</sup> *Supra* note 1.

<sup>18</sup> Botts & Muldoon, *supra* note 11 at sec. 3.2.

<sup>19</sup> This point is elaborated upon in Chapter 4.

<sup>20</sup> Botts & Muldoon, *supra* note 11 at sec. 3.2.

In the final review and negotiations, there were two major issues relating specifically to toxic pollution in the Great Lakes basin.<sup>21</sup> First, the United States proposed controversial modifications to Canada's process of setting and reviewing effluent standards.<sup>22</sup> Ultimately, Canada rejected these proposals.<sup>23</sup> Second, both sides sought to develop an "ecosystem approach" to management of the Great Lakes basin and to incorporate into the agreement the concept of "virtual elimination" of toxic contaminants. In contrast to the controversy over effluent standards, the ecosystem approach to management and the concept of "virtual elimination" were accepted without controversy on both sides.

The ecosystem approach and virtual elimination concepts were reflected, in part, in Article II of the 1978 *GLWQA*, which was revised to state:<sup>24</sup>

The Purpose of the Parties is to **restore and maintain the chemical, physical, and biological integrity of the water of the Great Lakes Basin Ecosystem.**

...

Consistent with the provisions of this Agreement, it is the policy of the Parties that:

(a) The discharge of toxic substances in toxic amounts be prohibited and the **discharge of any or all persistent toxic substances be virtually eliminated;**

... [Emphasis added.]

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<sup>21</sup> A third major issue in the negotiations was the proposal by the United States that the IJC Great Lakes Regional Office in Windsor be eliminated on the basis that resources could be better used by government agencies of the parties. Ultimately, the Windsor Office was not eliminated; however, its responsibilities were re-defined. See *ibid.* at sec. 3.2.

<sup>22</sup> The United States proposed that: (i) Canada adopt an industrial pollution control program similar to the American approach of effluent limits for direct discharges, rather than continuing to set water quality objectives on the basis of the assimilative capacity of the receiving water; (ii) both sides adopt basin-wide water quality standards; and (iii) the 1972 *GLWQA* be modified in a manner that would compel Canada to open its pollution control system to public scrutiny similar to requirements under U.S. law.

<sup>23</sup> Canadian opposition to the proposed effluent limit approach was based on the view that the existing Canadian approach to water quality objectives was more compatible with the equal rights of each country to use of the Great Lakes than the effluent limit approach, which would have required similar source-by-source reductions despite the disparity in total loadings from each country: Botts & Muldoon, *supra* note 11 at sec. 3.2.

<sup>24</sup> 1978 *GLWQA*, *supra* note 1, Art. II. "Great Lakes Ecosystem" is defined in Art. I as "the interacting components of air, land, water and living organisms, including man, within the drainage basin of the St. Lawrence River at or upstream from the point at which this river becomes the international boundary between Canada and the United States."



Several factors contributed to the inclusion of the ecosystem approach in the 1978 *GLWQA*, including heightened awareness of the multi-media nature of pollution through the research of groups such as the IJC's Research Advisory Board and an IJC Reference Group on Pollution from Land Use Activities, and the support of the Great Lakes Fishery Commission.<sup>25</sup> Although it is unclear whether the implications of the ecosystem approach were fully understood when the 1978 *GLWQA* was being negotiated, the change in perspective was of profound significance because ecological integrity, rather than merely water chemistry, became the accepted objective.<sup>26</sup> From an ecological perspective, the acceptance of the ecosystem approach represented a radical conceptual change. Thenceforth, all ecological media, such as air, water, and land, were significant because their interconnectedness was now acknowledged at the level of policy development as well as in scientific circles. The acceptance of the ecosystem approach was also politically significant in two respects. First, it represented political recognition of the need for a change in managerial perspective. Second, it legitimized the role of social scientists in water management.<sup>27</sup> The adoption of the concept of "virtual elimination" was also highly significant because it signaled explicit recognition of, and commitment to, the need to remove toxic loadings for achieving and preserving ecological integrity.

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<sup>25</sup> See Botts & Muldoon, *supra* note 11 at sec. 3.2.

<sup>26</sup> *Ibid.* at sec. 3.2.

<sup>27</sup> See J.R. Vallentyne & M. Munawar, "From aquatic science to ecosystem health: a philosophical perspective" (1993) 2 J. Aquat. Ecosyst. Health 231 at 232.

Thus, the negotiation of the 1978 *GLWQA* highlights the increasing awareness and importance of addressing toxic pollution in the Great Lakes basin. In particular, the relative lack of controversy over inclusion in the agreement of the concepts of ecosystem management and virtual elimination reflects the emerging binational recognition of the transboundary, basin-wide and enduring effects of toxic contamination.<sup>28</sup>

In addition to the inclusion of the concepts of ecosystem management and virtual elimination, substantive changes to the 1978 *GLWQA* included: (i) a call for revised water quality objectives, including specific water quality standards involving persistent toxic substances; (ii) new deadlines for adoption of municipal and industrial abatement programs; and (iii) inclusion of a program to identify sources of pollutants to the atmosphere.<sup>29</sup> With specific reference to persistent toxic substances, the parties agreed in Annex 12 of the 1978 *GLWQA* to cooperate with state and provincial governments to develop specified types of programs and measures to eliminate such substances.<sup>30</sup> Specified programs include: (i) identification of raw materials, processes, products and wastes involving persistent toxic substances; (ii) establishment of close coordination between air, water and solid waste programs to assess total input of toxic substances and to define comprehensive controls; (iii) development of joint disposal programs for hazardous materials; (iv) establishment of

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<sup>28</sup> In fact, as IJC Commissioner C.F. Murphy observed, the revised statement of purpose in the 1978 *GLWQA* "marked the first time that two nations explicitly recognized that a comprehensive approach was required to cope successfully with human made pollution": IJC Great Lakes Water Quality Agreement Public Forum, November 1, 1997, Transcript at 7.

<sup>29</sup> Botts & Muldoon, *supra* note 11 at sec. 3.2. Despite these substantive changes, the 1978 *GLWQA* retained essentially the same format and joint institutional arrangements as the 1972 *GLWQA*.

<sup>30</sup> "Persistent toxic substance" is defined in Annex 12 of the 1978 *GLWQA* and the present *GLWQA* as "any toxic substance with a half-life in water of greater than eight weeks": *supra* note 1.

monitoring and research programs to identify concentration trends, impact and sources of persistent toxic substances; (v) establishment of an early warning system with enumerated elements; (vi) establishment of action levels to protect human health; (vii) intensification of research to determine pathways and fate of persistent toxic substances.<sup>31</sup>

The 1978 *GLWQA* continued to evolve following its formal signing on November 22, 1978. It is beyond the scope of this paper to review the numerous political developments which contributed to pressure to refine the agreement.<sup>32</sup> Rather, the point to be stressed here is that when a new review of the 1978 *GLWQA* began in 1986, the consensus was that the fundamental features of the agreement should be retained, but that changes were needed to address better toxic contamination. The agreement was ultimately amended in 1987 under the 1987 *Protocol*.<sup>33</sup>

The most significant changes under the 1987 *Protocol* related to the role of the parties and their relationship with the IJC. In essence, the 1987 *Protocol* provided that the lead agencies of the parties should pursue activities jointly and communicate directly with each other, rather than through the IJC.<sup>34</sup> The 1987 *Protocol* also provided that the governments would develop and implement "remedial action plans" (RAPs) to work towards elimination of the 42 "Areas of Concern", specific local areas of the Great Lakes with

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<sup>31</sup> 1978 *GLWQA*, *ibid.*, Annex 12, ss. 3-7.

<sup>32</sup> Developments included a larger and more unified network of environmental groups, greater public involvement in IJC activities, and increased support from regional philanthropic foundations. See Botts & Muldoon, *supra* note 11 at sec. 3.2.

<sup>33</sup> *Supra* note 1.

<sup>34</sup> Governmental agencies accepted this change because of their prevailing view that participation in IJC joint institutions was inefficient. Non-governmental observers accepted the change because they believed it would increase governments' accountability. See Botts & Muldoon, *supra* note 11 at sec. 3.3.

serious degradation problems.<sup>35</sup> Moreover, the governments committed in the *1987 Protocol* to develop a "Lakewide Management Plan" (LaMP) for each of the Great Lakes.<sup>36</sup> Under the *1987 Protocol*, LaMPs must embody a systematic and comprehensive ecosystem approach to restoring and protecting beneficial uses in open lake waters. Thus, in addition to attempting to strengthen the operation of the framework established under the *1978 GLWQA*, the *1987 Protocol* established initiatives which ideally would result in implementation of the ecosystem approach and local decision processes.<sup>37</sup>

In establishing an operational framework for Great Lakes governance, the *GLWQA* is based upon several significant principles relating to management of toxic substances. First, the *GLWQA* stresses that the overall goal of the environmental management of the Great Lakes basin should be framed in terms of holistic ecological quality. As noted, this principle is reflected in the statement of purpose of the *GLWQA*: "to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Ecosystem."<sup>38</sup>

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<sup>35</sup> *1987 Protocol*, *supra* note 1, Annex 2. This amendment occurred after the IJC's Water Quality Board found in 1985 that the programs in place at the time were inadequate to solve the particular environmental problems of the areas, and recommended the establishment of RAPs for each area: Canadian Environmental Law Association, Great Lakes United & National Wildlife Federation, *Treading Water: A Review of Government Progress Under the Great Lakes Water Quality Agreement* (October, 1997) at 90.

<sup>36</sup> *Supra*, note 1, Annex 2, s. 6.

<sup>37</sup> See P. Muldoon, "Bilateral and Multilateral Dimensions of International Environmental Law" (Chap. 15) in E.L. Hughes, A.R. Lucas & W.A. Tilleman, eds., *Environmental Law and Policy*, 2d. ed. (Toronto: Emond Montgomery Publications, 1998) at 587. Nonetheless, as the IJC observed, RAPs and LaMPs "provide community-based opportunities to identify and solve environmental problems, restore beneficial uses and achieve the [GLWQA's] purpose", but "RAP and LaMP development has been slow": *Ninth Biennial Report on Great Lakes Water Quality* (Windsor: IJC, 1998) at 27. For a critical assessment of governments' progress in implementing RAPs and LaMPs, see Canadian Environmental Law Association, Great Lakes United & National Wildlife Federation, *supra* note 35, Chs. 3 and 4.

<sup>38</sup> *Supra* note 1, Art. II.

The concept of ecosystemic management, using an ecosystem approach, is one of the most important foundational principles of the *GLWQA*.

The strategy of virtual elimination of persistent toxic substances is a second cornerstone principle of the *GLWQA*. This principle, rooted in concern about the deleterious effects of toxic substances noted above, constitutes the conceptual basis of numerous programs aimed at immediate or gradual cessation of use, generation or release of these substances. One should note, however, that 'virtual elimination' is a contested concept, and has been the subject of considerable debate among stakeholders, who continue to have difficulty in reaching consensus positions on implementation strategies.<sup>39</sup>

The third principle underpinning the *GLWQA* is the recognition of the need for information about the nature, pathways, and impact of toxic substances. As noted, the *GLWQA* promotes development of numerous research, monitoring and surveillance programs aimed at increasing understanding of toxics.<sup>40</sup>

Fourth, the *GLWQA* plainly represents binational acceptance of the need for coordinated action to address transboundary environmental problems within the Great Lakes basin. Recognition of the need for concerted action is rooted in the diffuse nature of pollution and the multi-jurisdictional structure of the region.

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<sup>39</sup> In the late-1980s, the Canadian Chemical Producers Association developed recommendations for virtual elimination which helped provide a basis of the Accelerated Reduction and Elimination of Toxics program, a Canadian federal government multi-stakeholder process. See G. Wever, "Alternative Strategies to Reduce Effects of Persistent Toxic Chemicals in the Natural Environment: A Great Lakes Regional Perspective" (1993) 1 Buff. Env. L. J. 317 at 320-321.

<sup>40</sup> For a discussion of the reasons for the limited understanding of the effects of toxic substances on Great Lakes biota (despite extensive monitoring and surveillance) as well as recommendations to improve assessments, see M.S. Evans, "Toxic contaminants and Great Lakes ecosystem health: current understandings and strategies for improved assessments" (1993) 2 J. Aquat. Ecosyst. Health 87.

Finally, in seeking to achieve the absolute objective of virtual elimination, the *GLWQA* has adopted an 'incremental' approach to environmental protection, first, by establishing *interim* action strategies, such as water quality objectives setting out permissible maximum levels of specified persistent toxic substances,<sup>41</sup> and, second, by advocating *gradual* phase-outs of the most dangerous pollutants.<sup>42</sup> The point to be underscored here is that the decision not to seek immediate and outright cessation of pollution plainly reflects a choice by policymakers to balance other social needs, such as using products resulting from manufacturing processes which generate some level of pollution.

As noted in Section I, the *GLWQA* constitutes the primary operational binational agreement on Great Lakes water quality. This agreement has provided a strong conceptual foundation for subsequent agreements, such as the *Great Lakes Binational Toxics Strategy* (*BTS*). This latter agreement builds upon the *GLWQA* by focusing on one of its key objectives, specifically, the virtual elimination of persistent toxic substances.

**(ii) *Great Lakes Binational Toxics Strategy***

The *BTS* was signed on April 7, 1997, and was developed jointly by Canada and the United States in 1996 and 1997.<sup>43</sup> The purpose of the *BTS* is to establish a binational collaborative process aimed at achieving virtual elimination of persistent toxic substances from the Great Lakes ecosystem. As the *BTS* states, in part:<sup>44</sup>

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<sup>41</sup> *GLWQA*, *supra* note 1, Annex 1, s. 1.A.

<sup>42</sup> IJC, *Sixth Biennial Report under the Great Lakes Water Quality Agreement of 1978* (Windsor: IJC, 1992) at 24-30.

<sup>43</sup> Canada & United States, (Environment Canada & USEPA), *Introduction to the Great Lakes Binational Toxics Strategy*, online: USEPA <<http://www.epa.gov/glnpo/p2/bnsintro.html>> (last modified: 2 April 1998) [hereinafter *Introduction to BTS*].

<sup>44</sup> *Supra* note 2 at 1.

**In keeping with the objective of the [GLWQA] to restore and protect the Great Lakes, the purpose of this binational strategy ... is to set forth a collaborative process** by which Environment Canada (EC) and the United States Environmental Protection Agency (USEPA), in consultation with other federal departments and agencies, Great Lakes states, the Province of Ontario, Tribes, and First Nations, will work in cooperation with their public and private partners **toward the goal of virtual elimination of persistent toxic substances resulting from human activity, particularly those which bioaccumulate, from the Great Lakes Basin, so as to protect and ensure the health and integrity of the Great Lakes ecosystem.** [Emphasis added.]

"Virtual elimination" is not defined in the *BTS*; however, the Strategy expressly refers to the *GLWQA*'s objective of restoring and protecting the Great Lakes and to the countries' commitment in the *GLWQA* that the discharge of all persistent toxic substances be virtually eliminated. The *BTS* also adopts the definition of "toxic substance" set out in the *GLWQA*.<sup>45</sup>

"Persistent toxic substances" is defined in the *BTS* as:

Those substances which have a long half-life in the environment. Substances identified in the Strategy have been nominated from multiple selection processes. It is recognized that there are different definitions of persistence which are used in the various U.S. and Canadian domestic programs.

In seeking to advance the objective of virtual elimination of persistent toxic substances from the Great Lakes ecosystem, the *BTS* sets out reduction challenges<sup>46</sup> for an initial list of "Level 1" persistent toxic substances<sup>47</sup> targeted for virtual elimination. The Level 1 substances targeted under the *BTS* have been associated with wide-spread and

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<sup>45</sup> *Ibid.* at 25; 1987 Protocol, *supra* note 1. "Toxic substance" is defined in the *GLWQA* and *BTS* as: "Any substance which can cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological or reproductive malfunctions or physical deformities in any organism or its offspring, or which can become poisonous after concentration in the food chain or in combination with other substances."

<sup>46</sup> *BTS*, *supra* note 2 at 8 and 15-24.

<sup>47</sup> *BTS*, *ibid.*, Appendix 1. Level 1 substances are: aldrin/dieldrin, benzo(a)pyrene, chloradane, DDT, hexachlorostyrene, alkyl-lead, mercury and compounds, mirex, octachlorostyrene, PCBs, dioxins and furans, and toxaphene.

enduring adverse impacts on wildlife in the Great Lakes and, through bioaccumulation, on human health.<sup>48</sup> The Strategy also includes actions for a second set of substances, referred to as "Level 2" substances,<sup>49</sup> which "have been identified by one or both countries as having the potential to significantly impact the Great Lakes ecosystem through their use and/or release."<sup>50</sup> With respect to Level 2 substances, Canada and the United States agreed to encourage pollution prevention activities generally and to encourage conformity with the legislation of each country regarding those substances nominated by only one country. Thus, the *BTS* seeks to further the objective of virtual elimination through agreement on, and implementation of, a set of reduction targets to be reflected in regulatory programs and encouraged in voluntary efforts.

Implementation of the goal of virtual elimination under the *BTS* is set out in a four-step analytical framework involving: (i) information gathering; (ii) analysis of current regulations, initiatives and programs, which manage or control substances; (iii) identification of cost-effective options to achieve further reductions; and (iv) implementation of actions to work toward goal of virtual elimination.<sup>51</sup> An implementation plan recently developed by Canada and the United States, in consultation with stakeholders, sets out a structure and

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<sup>48</sup> *Introduction to BTS*, *supra* note 43.

<sup>49</sup> *BTS*, *supra* note 2, Appendix 1. Level 2 substances are: cadmium and compounds, 1,4-dichlorobenzene, 3,3'-dichlorobenzidine, dinitropyrene, endrin, heptachlor, hexachlorobutadiene, hexachlorocyclohexane, 4,4'-methylenebis (2-chloroaniline), pentachlorobenzene, pentachlorophenol, tetrachlorobenzene (1,2,3,4- and 1,2,4,5-), tributyl tin, and PAHs as a group including anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, perylene, and phenanthrene.

<sup>50</sup> *Ibid.* at 7.

<sup>51</sup> *Ibid.* at 4-5.



process for implementation of the *BTS*.<sup>52</sup> As indicated in the Implementation Plan, activities and discussions relating to implementation of the *BTS* will take place either through the substance or chemical-specific work groups or at a bi-annual Binational Strategy Stakeholder Forum.

There are several principles upon which the *BTS* is founded. These include: (i) recognition of the multiple-media nature of toxic substances; (ii) importance of binationalism; (iii) importance of concerted effort involving public and private partners; (iv) support of regulatory, voluntary and incentive-based approaches; (v) recognition of sovereignty; and (vi) recognition of the importance of information.

First, the *BTS* recognizes that the enduring existence of persistent toxic substances is the result of multiple pathways into the environment. As the *BTS* states:<sup>53</sup>

The continuing presence of these persistent toxic substances is the result of atmospheric deposition, release from contaminated bottom sediments, releases from various industrial processes, releases from non-point sources, and continuous cycling of naturally-occurring and anthropogenic substances within the Great Lakes themselves. In some cases, there may also be illegal or accidental discharge of stored substances for which production and use has previously been cancelled or banned. All of these factors highlight the need for more to be done.

Second, binational efforts are necessary to achieve virtual elimination. This principle is reflected in several ways within the *BTS*: (i) the *BTS* explicitly states that it is a collaborative process involving Environment Canada and the USEPA;<sup>54</sup> (ii) recognition that the movement of persistent toxic substances does not respect jurisdictional or geographic

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<sup>52</sup> Canada & United States, (Environment Canada & USEPA), *Great Lakes Binational Toxics Strategy Implementation Plan and Structure*, online: USEPA <<http://www.epa.gov/glnpo/bns/implplan.html>> (last modified: 30 December 1997).

<sup>53</sup> *BTS*, *supra* note 2 at 2.

<sup>54</sup> *Ibid.* at 1.

borders;<sup>55</sup> (iii) express commitment to the need for a binational strategy in accordance with the framework outlined in *Agenda 21: A Global Action Plan for the 21<sup>st</sup> Century*,<sup>56</sup> in which Canada and the United States (and other nations) committed, in part, to undertake concerted activities to reduce risks for toxic chemicals.<sup>57</sup>

Third, cooperation and collaboration with public and private partners is necessary to address the challenge of virtual elimination. As the *BTS* states: "An underlying tenet of this Strategy is that governments cannot by their actions alone achieve the goal of virtual elimination. This Strategy challenges all sectors of society to participate and cooperate to ensure success."<sup>58</sup> In addition to Environment Canada, the USEPA and other federal departments and agencies, key participants recognized in the *BTS* include Ontario, the Great Lakes States, First Nations and Tribes.<sup>59</sup>

Fourth, regulatory, voluntary and incentive-based initiatives are appropriate means of achieving virtual elimination. As the *BTS* states:<sup>60</sup>

**Virtual elimination will be sought within the most expedient time frame and the most appropriate, common sense, practical and cost-effective blend of voluntary, regulatory or incentive-based actions.** All feasible options will be considered including pollution prevention, phase-outs and bans. [Footnote: In the U.S., existing and currently planned regulatory actions will contribute to meeting the goal of virtual elimination; however, this Strategy is not a regulatory action, nor is it expected, in and of itself, to lead to the promulgation of any rule or regulation. To the extent that regulatory actions are taken with regard to Strategy substances, they will be governed by the statutes authorizing the actions.] [Emphasis added.]

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<sup>55</sup> *Ibid.* at 3 and 5.

<sup>56</sup> United Nations, *Agenda 21: Programme of Action for Sustainable Development, Rio Declaration on Environment and Development, and Statement of Forest Principles - Final Text of Agreements Negotiated by Governments at the United Nations Conference on Environment and Development (UNCED), 3-14 June 1992, Rio de Janeiro, Brazil* (New York: United Nations Department of Publications, 1992).

<sup>57</sup> *BTS*, *supra* note 2 at 3 and 5.

<sup>58</sup> *Ibid.* at 1.

<sup>59</sup> *Ibid.*

<sup>60</sup> *Ibid.* at 4.

In addition, the *BTS* "acknowledges and builds on the existing Canadian and U.S. regulatory programs which address the targeted substances."<sup>61</sup> As noted above, the *BTS* identifies two categories of substances, Levels 1 and 2, and establishes action plans which, depending on the classification, may include reduction targets, phase-outs, promotion of pollution prevention and assessment.

Fifth, in addition to affirmation of the parties' existing regulatory regimes, the *BTS* is also based on recognition of the unique domestic context of each country. More specifically, the parties agreed in the *BTS*:<sup>62</sup>

to recognize that the two countries' respective domestic measures to achieve [virtual elimination] **must respect the institutional, environmental and socio-economic context of each country. Each country has discretion to include and act in accordance with its domestic national policies in meeting the commitments of this Strategy**, recognizing the need for flexibility in determining how to meet these commitments and the possibility that some actions and challenges will evolve over time as information about opportunities, and their associated costs and benefits becomes available. [Emphasis added.]

Finally, information about the sources, nature and impact of persistent toxic substances is essential to developing effective responses in furtherance of the goal of virtual elimination. As noted above, information gathering is one of the steps in the general analytical framework expressly adopted by Environment Canada and the USEPA.<sup>63</sup> The importance of information about persistent toxic substances is also reflected in: (i) the recognition of the importance of LaMPs and RAPs;<sup>64</sup> (ii) the need to share information on

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<sup>61</sup> *Ibid.* at 2.

<sup>62</sup> *Ibid.* at 5.

<sup>63</sup> *Ibid.* at 4.

<sup>64</sup> *Ibid.* at 6.

targeted substances with a view to assessing the appropriateness of substance classifications;<sup>65</sup> (iii) the need for ongoing surveillance and monitoring programs;<sup>66</sup> and (iv) the commitment to reporting on progress at appropriate fora.<sup>67</sup>

In addition to the international efforts under the *GLWQA* and the *BTS*, there have been national initiatives aimed at coordinating domestic environmental activities, including those related to toxic pollution. In Canada, the *Canada-Ontario Agreement (COA)* is the primary intra-national agreement on Great Lakes environmental quality.

### (iii) *Canada-Ontario Agreement*

Although the *COA* originally constituted a federal-provincial environmental cost-sharing arrangement, the agreement has evolved as an instrument for meeting Canadian obligations under the *GLWQA*.<sup>68</sup> The *COA* now establishes a framework for Canadian federal and provincial cooperation and coordination of responsibilities for environmental management of the Great Lakes basin.<sup>69</sup> The agreement sets out a plan of action that

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<sup>65</sup> *Ibid.* at 7.

<sup>66</sup> *Ibid.* at 9.

<sup>67</sup> *Ibid.*

<sup>68</sup> The first *COA* was signed in 1971, and was renewed or renegotiated in 1976, 1982, 1986 and 1991. The rationale for the development of the *COA* is rooted in the fact that the federal government relies on the provinces for implementation of international environmental agreements because the provinces have the bulk of legislative authority needed for implementation. Bilateral federal-provincial agreements often facilitate the requisite cooperation. The 1971 *COA*, like those of 1982 and 1986, established cost-sharing mechanisms and provided "a considerable degree of harmony in federal and provincial goals and actions for the Great Lakes": Botts & Muldoon, *supra* note 11 at sec. 3.1. The 1994 *COA* differs from its predecessors in primarily three respects: (i) adoption of an ecosystem perspective and measurable targets for achieving basic objectives; (ii) shared federal-provincial responsibility for achieving objectives; and (iii) no specification of federal share of costs: *ibid.* at sec. 3.3.

<sup>69</sup> *COA*, *supra*, note 3.

establishes Canadian priorities, targets and schedules for environmental issues of concern in the Great Lakes basin.<sup>70</sup>

Three main objectives are identified in the *COA*: (i) restoration of degraded areas; (ii) prevention and control of pollution; and (iii) conservation and protection of human and ecosystem health.<sup>71</sup> To achieve these three objectives, Canada and Ontario agreed upon program targets for each of the objectives.<sup>72</sup> With respect to the objective of pollution prevention and control, the *COA* states:<sup>73</sup>

**The ultimate goal of Canada and Ontario is to achieve the virtual elimination of persistent, bioaccumulative and toxic substances from the Great Lakes Basin Ecosystem** by encouraging and implementing strategies consistent with the philosophy of zero discharge. [Emphasis added.]

The means by which Canada and Ontario seek to achieve measurable progress towards the objective of virtual elimination is summarized in the *COA* as follows:<sup>74</sup>

Canada and Ontario will work with the producers and sources of pollutants in the Great Lakes Basin Ecosystem to establish schedules and to achieve significant interim reductions (90% by 2000) in the releases of persistent, bioaccumulative and toxic substances by adopting the philosophy of zero discharge. In addition

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<sup>70</sup> Canada & Ontario, (Environment Canada & Ministry of the Environment and Energy), *Second Report of Progress under the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (1995-1997)* (1997) at 1, online: Canada Centre for Inland Waters <<http://www.cciw.ca/glimr/data/coa-second-report/intro.html>> (last modified: 18 December 1997) [hereinafter *Second Progress Report under COA*].

<sup>71</sup> *COA*, *supra* note 3 at Art. 3.

<sup>72</sup> *Ibid.*, Art. 4. This discussion focuses only on the second *COA* objective of pollution prevention and control because the programs and targets under the second objective most closely relate to the issue of toxic contamination. In addition, because the present work focuses on the underlying principles of selected legal instruments, it does not attempt to outline actual activities undertaken by parties, or progress achieved, in connection with their commitments. For an outline of parties' progress under the *COA*, see: Canada and Ontario, Environment Canada and Ministry of the Environment and Energy, *First Progress Report under the 1994 Canada-Ontario Agreement respecting the Great Lakes Basin Ecosystem*, (1995), online: Canada Centre for Inland Waters <<http://www.cciw.ca/glimr/data/coa-first-report/intro.html>> (last modified: 16 February 1996); *Second Progress Report under COA*, *supra*, note 70; and, for a critical assessment of governments' progress under *COA*, see Canadian Environmental Law Association, Great Lakes United & National Wildlife Federation, *supra* note 37 at 41-47.

<sup>73</sup> *COA*, *supra* note 3 at Art. 4(2).

<sup>74</sup> *Ibid.* at Art. 3(2).

industries and others will be challenged to reduce the use, release or generation of other toxic substances which will contribute to the goal of virtual elimination.

More specifically, the *COA* identifies two types of toxic substances, Tiers I and II, on the basis of the substance's potential for harm, and outlines joint commitments by Canada and Ontario aimed at virtual elimination. The lists of Tier I and Tier II substances are open to modification on the basis of emerging information, using "a weight-of-evidence approach and through a process of stakeholder consultation."<sup>75</sup> The Tier I substance list consists of thirteen persistent, bioaccumulative and toxic substances that are of immediate concern in the Great Lakes basin.<sup>76</sup> This list is identical to the *BTS* Level 1 list. Tier I substances are targeted in the *COA* as requiring "immediate action to eliminate their use, generation or release in the Great Lakes environment."<sup>77</sup> To this end, Canada and Ontario agreed in the *COA* to the following commitments regarding Tier I substances: (i) confirm by 1996 that zero discharge has been achieved for five priority substances; (ii) seek to decommission 90 per cent of high level PCBs in Ontario, to destroy 50 per cent of the high-level PCBs now in storage, and to accelerate the destruction of stored low-level PCB waste, by the year 2000; (iii) seek a 90 per cent reduction in the use, generation or release of seven Tier I substances

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<sup>75</sup> *Ibid.* at Art. 4(2).

<sup>76</sup> *Ibid.* The Tier I listing is: aldrin/dieldrin, benzo(a)pyrene, chlordane, DDT, hexachlorobenzene, alkyl-lead, mercury, mirex, octachlorostyrene, PCBs, dioxins, furans, toxaphene. As Appendix 2 to the *COA* indicates, Tier I substances include the eleven critical pollutants identified by the IJC, plus critical pollutants identified in the Niagara River and Lake Ontario Toxic Management Plans and the Lake Superior Binational Program.

<sup>77</sup> *Ibid.* at Art. 4(2).

by the year 2000;<sup>78</sup> (iv) jointly designate Lakes Superior and Nipigon as exceptional bodies of water, and consider designations for other exceptional waters.<sup>79</sup>

Tier II substances, consisting of 26 pollutants,<sup>80</sup> "have a demonstrated potential to impair the Great Lakes Basin Ecosystem".<sup>81</sup> The Tier II list is substantially similar to the Level II list of the *BTS*. In respect of Tier II substances, Canada and Ontario agreed in the *COA* to: (i) collaborate with, and provide support for, voluntary programs by industry and others to reduce the use, release or generation of Tier II substances, and to establish specific timelines and targets for achieving their virtual elimination; (ii) provide essential knowledge on the fate and effects of Tier II substances from industrial, municipal and other sources; (iii) conduct a coordinated review and evaluation of registered and scheduled pesticides.<sup>82</sup>

In addition to the actions targeting either Tier I or Tier II substances, Canada and Ontario agreed in the *COA* to actions to address both types of substances. Such actions include: (i) commitment to work with industry to attain commitments to achieve *COA* targets through formal arrangements such as Memoranda of Understanding, and through informal arrangements; (ii) recognition of developing targets such as under binational initiatives; (iii) commitment to work with U.S. federal and state governments to establish a common strategy, by 1996, to eliminate the discharge of persistent, bioaccumulative and

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<sup>78</sup> This is one of the key commitments of Canada and Ontario under the *COA*. See Canadian Environmental Law Association, Great Lakes United & National Wildlife Federation, *supra* note 37 at 42.

<sup>79</sup> *COA*, *supra* note 3 at Art. 4(2).

<sup>80</sup> Tier II substances are: anthracene, cadmium, 1,4-dichlorobenzene, 3,3'-dichlorobenzidine, dinitropyrene, hexachlorocyclohexane, 4,4"-methylenebis(2-chloraniline), pentachlorophenol, tributyl tin, plus seventeen PAHs as a group, including but not limited to benz(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, perylene, phenanthrene.

<sup>81</sup> *COA*, *supra* note 3 at Art. 4(2).

<sup>82</sup> *Ibid.*

toxic substances to the entire Great Lakes ecosystem, a target achieved through the signing of the *BTS*; (iv) incorporation of Toxic Reduction Plans into LaMPs for Lakes Ontario and Superior by 2000; (v) commitment to promote implementation by 1998 of pollution prevention programs at targeted industrial facilities through variety of instruments, including specified programs; (vi) use cooperative activities with waste generators to achieve significant, measurable reductions in the generation and release of hazardous wastes from all sources; and (vii) support international negotiations to reduce loadings in Great Lakes ecosystem through identification of atmospheric inputs of toxic chemicals and their impacts, and through improvement and integration of existing air toxic data networks and management systems.<sup>83</sup>

The *COA* is founded on several underlying principles, which include: (i) commitment to virtual elimination and zero discharge; (ii) recognition of the multi-media nature of pollution and interdependence of ecological and economic welfare; (iii) need for concerted action; (iv) primacy of pollution prevention over restoration; (v) adoption of existing regulatory framework and support for voluntary initiatives; and (vi) adoption of an incremental approach to virtual elimination. These principles all reflect a common concern with promoting a comprehensive approach to the issue of pollution prevention. The *COA* adopts and reflects the general ecosystem orientation of the *GLWQA*, but does not appear to make substantial conceptual additions to the foundation established by that agreement. Nonetheless, the *COA* strengthens the regional environmental management regime by

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<sup>83</sup> *Ibid.*



securing the commitment of the sole Canadian province bordering on the Great Lakes to pursuing associated targets and actions.<sup>84</sup> Within the Canadian federal context, such federal-provincial coordination is a necessary step in achieving comprehensive application of environmental initiatives, such as pollution prevention and reduction programs.<sup>85</sup>

With respect to the first principle, the *COA* explicitly adopts the objectives in the *GLWQA* of virtual elimination and zero discharge. As noted above, these two objectives are fundamental to one of the *COA*'s ultimate goals, specifically, pollution prevention and control.<sup>86</sup>

Second, the *COA* expressly recognizes the interconnectedness of ecological media and biota of the Great Lakes basin. Moreover, the prosperity of the economy is recognized as dependent on the welfare of the ecosystem. The *COA* articulates the commitments of Canada and Ontario to an ecosystem approach to environmental management in the following terms:<sup>87</sup>

**The Great Lakes Basin Ecosystem is a complex web of connections, involving the air, the water bodies, and the land and their biota, including humans.** The well-being of this Ecosystem, and all Basin residents, is integral to a healthy and vigorous economy. The goal of the federal and provincial governments is a healthy and sustainable Great Lakes Basin Ecosystem. **Canada and Ontario commit to restore, protect and sustain the Great Lakes Basin Ecosystem through joint action using an ecosystem approach.** [Emphasis added.]

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<sup>84</sup> As noted in subsection II(i) of this chapter discussing the 1978 *GLWQA*, Annex 12 of the agreement sets out the parties' commitment to cooperate with state and provincial governments to develop specified types of programs and measures for the elimination of persistent toxic substances.

<sup>85</sup> See *supra* note 68. The mutual reliance of the two levels of governments is recognized in the *COA* at Art. 2.

<sup>86</sup> See *supra* note 73 and accompanying text.

<sup>87</sup> *COA*, *supra* note 3 at Art. 2.

Third, the *COA* is based on the principle that environmental management requires coordinated government action and concerted participation from both public and private sectors, and that no constituency can effectively act in isolation. In this regard, the *COA* states:<sup>88</sup>

Canada and Ontario recognize their shared responsibility for managing the Great Lakes and that neither government can succeed alone. Programs and activities resulting from this Canada-Ontario Agreement will be shared in such a way as to reflect the unique roles and responsibilities of each government, to minimize cost and to avoid duplication or overlap. Furthermore, while governments must lead, the responsibility for action is shared by all sectors of society.

...

Collaborative arrangements and collective action are crucial to successful protection of the Great Lakes Basin Ecosystem.

In addition, as a corollary to the concept of shared responsibility, the *COA* is founded on the principle that the process of environmental management must be participatory. This principle is reflected in the *COA*'s explicit commitment to encouragement of stakeholder involvement in program development and implementation.<sup>89</sup>

Fourth, the *COA* reflects, and expressly adopts, the principle that pollution prevention is preferable to *ex post facto* restorative approaches to environmental protection. This principle is linked in the *COA* to the costs and effectiveness of the two approaches. As the *COA* states:<sup>90</sup>

The Canadian and Ontario governments recognize that **restoration of the degraded ecosystem is costly and that some features of the ecosystem, once degraded, are lost forever. Preventing pollution at the source is key to conserving and preserving ecosystem health.** Conservation and pollution prevention activities avoid further degradation to the Great Lakes Basin Ecosystem. [Emphasis added.]

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<sup>88</sup> *Ibid.*

<sup>89</sup> *Ibid.*

<sup>90</sup> *Ibid.*

Fifth, the principle underpinning the programs and targets developed in the *COA* is that the existing regulatory framework, including bans and restrictions on the generation or use of particular substances, is essentially effective. Moreover, the *COA* is based on the view that voluntary initiatives are effective and should be encouraged as the primary means of achieving virtual elimination. The *COA* states:<sup>91</sup>

Through both voluntary actions and regulatory programs, significant reductions in the levels of other toxic substances have taken place.

**Without precluding the use of regulations, further voluntary and cooperative initiatives by responsible parties will be the primary mechanisms to achieve real and measurable reductions in the use, generation or release** of both persistent, bioaccumulative and toxic substances, and other substances impairing the Great Lakes Basin Ecosystem. Canada and Ontario will, if necessary, use existing tools or develop new ones to regulate and legislate sources of persistent, bioaccumulative and toxic substances province-wide, and other toxic or undesirable substances locally or regionally. [Emphasis added.]

Finally, the *COA*, through its development of target percentage reductions of specified substances, is founded on the principle that a gradual, or incremental, approach to environmental protection is appropriate, rather than an approach that results in complete cessation of targeted substances' generation, use or release within a relatively short timeframe. For example, with respect to achieving virtual elimination of Tier II substances through voluntary programs, the *COA* states:

In recognition that Tier II substances have the potential to harm the Great Lakes Basin Ecosystem, **it is essential to move toward virtual elimination, at a rate which is technically and economically feasible.** Voluntary initiatives in partnership with responsible agencies will progress towards **interim targets** which consider the characteristics of the sector, source, substance (synthetic compound or natural element), process, impacts, and the availability of replacement technologies. [Emphasis added.]

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<sup>91</sup> *COA*, *supra* note 3 at Art. 4(2).

Hence, the *COA* adopts an incremental approach in striving ultimately for achievement of the "absolute" objective of virtual elimination.

Similar to Canadian concerns with coordinating environmental management by different levels of government, the United States has also sought to achieve a more harmonious approach to addressing Great Lakes water quality issues. The *Final Water Quality Guidance for the Great Lakes System* is a recent intra-national American effort to coordinate federal and state environmental activity.

**(iv) *Final Water Quality Guidance for the Great Lakes System***

The *Guidance* is a set of regulations aimed at promoting consistency and greater effectiveness in state water quality standards,<sup>92</sup> and was developed by the USEPA from 1989 to 1995 in consultation with the Great Lakes states and stakeholders. The development of the *Guidance* stems from the *Toxic Substances Control Agreement*, a 1986 agreement signed by the Governors of the Great Lakes states in an effort to coordinate regional action on, and understanding of, toxic substances.<sup>93</sup> Under 1990 amendments to U.S. federal legislation,<sup>94</sup>

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<sup>92</sup> For a historical review of interstate water disputes, see L.K. Kunkle, "Interstate Water Quality Conflicts and the Great Lakes Initiative: Is it the Solution to Calming the Waters?" (1994) 25 U. Tol. L. Rev. 457 at 460-466.

<sup>93</sup> See United States, USEPA, *Water Quality Guidance for the Great Lakes System: Supplementary Information Document*, EPA-820-B-95-001 (March, 1995) at 11 [hereinafter *Guidance Supplementary Information Document*]. The purpose of the *Toxic Substances Control Agreement* was to establish a framework for coordinated regional action in controlling toxic substances entering the Great Lakes System; to further the understanding and control of toxic contaminants; and to develop common goals, practices and strategies for toxics. Coordinated efforts between the Great Lakes States aimed at implementing the *Toxic Substances Control Agreement* contributed to the formation of the Great Lakes Initiative, a process initiated in 1989 by the USEPA and the Great Lakes states to provide a forum for the development of uniform water quality criteria and implementation procedures in the Great Lakes basin. In 1990, the ongoing Great Lakes Initiative was codified into the *Clean Water Act*, 33 U.S.C. §121 *et seq.* with the enactment of the *Great Lakes Critical Programs Act of 1990*, 33 U.S.C. §101. Section 101 of the *Great Lakes Critical Programs Act* requires the USEPA to publish proposed and final water quality guidance for the Great Lakes system which

the *Guidance* was required to specify minimum requirements for the waters of the Great Lakes system in three areas: (i) water quality criteria, including numerical limits on pollutants in ambient Great Lakes waters to protect human health, aquatic life and wildlife; (ii) antidegradation policies; and (iii) implementation procedures.<sup>95</sup> The Great Lakes states were also required to adopt water quality standards, antidegradation policies and implementation procedures consistent with the final *Guidance* within two years of its publication by the USEPA, or to be subject to USEPA promulgation of the provisions within the same two-year period.<sup>96</sup> The USEPA published a proposed *Guidance* in 1993,<sup>97</sup> provided a preliminary analysis of costs and benefits associated with implementation of the *Guidance*, and engaged in public consultation hearings on the proposal.<sup>98</sup> After challenges in numerous comments and public hearings, the final *Guidance* was published by the USEPA on March 23, 1995.<sup>99</sup>

The *Guidance* seeks to establish consistent Great Lakes environmental management by focusing on the following three areas: (i) minimum water quality standards to protect

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conforms with the objectives and provisions of the *GLWQA* and is no less restrictive than the *Clean Water Act* and national water quality criteria and guidance.

<sup>94</sup> See *supra* note 93.

<sup>95</sup> *Clean Water Act*, *supra* note 93, §118(c)(2).

<sup>96</sup> *Ibid.*

<sup>97</sup> *Proposed Water Quality Guidance for the Great Lakes System*, 40 C.F.R. pts. 9, 122, 123, 131, 132 (1993).

<sup>98</sup> United States, USEPA, *Great Lakes Water Quality Initiative: A Summary* (March 1995), online: USEPA, Office of Water <<http://chagriner.epa.ohio.gov/gli/gli7.html>> (last modified: 5 June 1998) [hereinafter *GLI Summary*]. For one account of parties' reactions to the proposed *Guidance*, see Kunkle, *supra* note 92 at 466-481. Also see an analysis, which evaluates the proposed *Guidance* on the basis of its economic and environmental impacts, prepared for the Council of Great Lakes Governors: DRI/McGraw-Hill, *The Great Lakes Water Quality Initiative: Cost Effective Measures to Enhance Environmental Quality and Regional Competitiveness* (San Francisco: DRI/McGraw-Hill, 1993).

<sup>99</sup> *Supra* note 4. For a detailed discussion of the major changes from the proposal and an analysis of issues raised in comments received on the proposed *Guidance*, see *Guidance Supplementary Information Document*, *supra* note 93, Sections III to VIII.

human health, aquatic life and wildlife within the Great Lakes system; (ii) antidegradation policies; and (iii) implementation procedures.

First, with respect to water quality standards generally, the *Guidance* specifies numeric criteria for particular contaminants and establishes methodologies to derive numeric criteria for other pollutants. One should note, however, that there are separate sets of provisions each relating to human health, aquatic life and wildlife.

With regard to human health, the *Guidance* contains numeric human health criteria for eighteen pollutants.<sup>100</sup> In addition, the *Guidance* sets out two types of methodologies, Tier I and Tier II, for states to derive human health criteria for additional pollutants.<sup>101</sup> As stated in the Preamble to the *Guidance*:<sup>102</sup>

Tier I human health criteria are derived to establish ambient concentrations of chemicals which, if not exceeded in the Great Lakes System, will protect individuals from adverse health impacts from that chemical due to consumption of aquatic organisms and water.

In contrast, the Tier II methodology converts *narrative* criteria into numeric values that are "intended to provide a conservative, interim level of protection in the establishment of a permit limit".<sup>103</sup> Hence, Tier II values are used "when the minimum Tier I data requirements are not met but a value equivalent to a water quality criterion needs to be derived in order to make the permitting and control decisions necessary to address a pollutant discharge."<sup>104</sup>

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<sup>100</sup> The eighteen chemicals selected for development of criteria were chosen from a list of chemicals of concern identified in the Great Lakes Initiative, and represent a broad spectrum of the types of chemicals found in the Great Lakes basin: *Guidance Supplementary Information Document*, *supra* note 93 at 148.

<sup>101</sup> The purpose of selecting particular chemicals was to test the final methodologies against a range of chemicals and to demonstrate how the criteria development process will transpire: *ibid.*

<sup>102</sup> *Guidance*, *supra* note 4 at §§132.3(c), 132.4(a)(4), Table 3 to Pt. 132, Appendix C to Pt. 132.

<sup>103</sup> *Ibid.*, Preamble to the *Guidance*.

<sup>104</sup> Kunkle, *supra* note 92 at 471.

In addition to criteria to protect human health, the *Guidance* establishes two sets of criteria to protect aquatic life<sup>105</sup> and wildlife.<sup>106</sup> These sets of criteria are used to establish ambient concentrations of pollutants in the Great Lakes which, if not exceeded, will protect fish and other aquatic life, and wildlife from adverse effects. The *Guidance* uses a two-tier approach similar to that used in deriving criteria to protect human health.<sup>107</sup>

The second primary area addressed by the *Guidance* is antidegradation. "Antidegradation policy" refers to the policy that a state or tribe must follow when a proposed action, such as construction of a new facility that will discharge into a waterbody or increased discharges from an existing facility, may lower water quality in a river, lake or stream. The *Guidance* seeks to strengthen existing national regulations<sup>108</sup> by providing additional detail to the antidegradation standard, by outlining antidegradation implementation procedures and by specifying minimum requirements for antidegradation demonstrations of project justification and antidegradation decisions.<sup>109</sup> Key *Guidance* antidegradation requirements include: (i) identification of high quality waters on a pollutant-by-pollutant basis; (ii) Tribal and state requirements to adopt an antidegradation

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<sup>105</sup> *Guidance*, *supra* note 4 at §§132.3(a), 132.4(a)(2), Table 1 to Pt. 132, Appendix A to Pt. 132.

<sup>106</sup> *Ibid.*, §§132.3(d), 132.4(a)(5), Table 4 to Pt. 132, Appendix D to Pt. 132.

<sup>107</sup> The USEPA asserts that "use of the 2-tiered methodologies ... improves the current practice where regulatory authorities translate narrative criteria in their standards on a case-by-case basis to calculate total maximum daily loads and individual discharge permit limits": *GLI Summary*, *supra* note 98.

<sup>108</sup> *Minimum Requirements for Water Quality Standards Submission*, 40 C.F.R. §131.6, and *Anti-Degradation Policy*, 40 C.F.R. §131.12. The *Minimum Requirements for Water Quality Standards Submission* specify that Tribal or state water quality standards must include an antidegradation policy. Under the *Anti-Degradation Policy*, the required elements of an antidegradation policy are: protection of water quality necessary to maintain existing uses, protection of high quality waters and protection of water quality in water bodies identified as outstanding national resources. See *Guidance Supplementary Information Document*, *supra* note 93 at 203.

<sup>109</sup> For a detailed discussion of the proposed and final *Guidance* on antidegradation policy, see *ibid.*, Section VII.

standard consistent with the *Guidance* for bioaccumulative chemicals of concern; (iii) minimum requirements for conducting an antidegradation review of any activity anticipated to result in a significant decrease in water quality due to bioaccumulative chemicals of concern; (iv) minimum requirements for notification of regulatory authorities of increases in discharges of bioaccumulative chemicals of concern; and (v) minimum requirements for an antidegradation demonstration (consisting of a pollution prevention analysis, an alternative treatment analysis and a showing that the significant lowering of water quality will allow for important social and economic development).<sup>110</sup>

The third general area addressed by the *Guidance* is implementation procedures, which involve translating water quality standards into regulatory controls. Under the *Clean Water Act*,<sup>111</sup> all dischargers to surface waters in the United States must obtain a permit from the appropriate permitting authority. The permit specifies the types and amounts of pollutants that may be discharged by a facility to ensure that water quality standards are met in the receiving waters.<sup>112</sup> Before the *Guidance* was developed, the process for determining the permissible amounts of pollutant discharges varied among the Great Lakes states. Thus, the *Guidance* implementation procedures are "designed to ensure a more consistent method for calculating allowable pollutant discharges based on water quality standards."<sup>113</sup>

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<sup>110</sup> *Ibid.* at 206-225.

<sup>111</sup> *Supra* note 93.

<sup>112</sup> *GLI Summary*, *supra* note 98.

<sup>113</sup> *Ibid.*



As identified by the USEPA, specific implementation procedures in the *Guidance* include:<sup>114</sup>

- How much *mixing and dilution*, if any, is to be allowed in calculating discharge permit limits.
- How discharge permit limits should be *expressed, monitored and evaluated* when the amount that can be discharged is below levels that can be quantified by analytical techniques.
- How *Total Maximum Daily Loads (TMDLs)* should be calculated for waters not expected to meet water quality standards after the implementation of technology-based controls. This is a computation of the amounts of pollutants that can be added to a waterbody while still, with a margin of safety, maintaining water quality standards. They are the basis for limiting point and nonpoint source discharges.
- How adjustments to water quality criteria should account for the *unique characteristics* of particular locations with the Basin.
- How *background concentrations* (i.e. chemicals already in a waterbody) should be considered when determining discharge limits.
- How and when *variances* from water quality standards should be granted.
- When *water quality based permit limits* will be required for dischargers.
- How the various water quality criteria will be *applied* to different types of waterbodies, and
- How much time dischargers will be given to come into compliance with new controls. [Italics in original.]

Thus, as outlined above, the *Guidance* seeks to establish consistent environmental management by U.S. states in the Great Lakes basin through the establishment of minimum water quality standards, antidegradation policies, and implementation procedures with which states must comply. The *Guidance* is explicitly based on six principles.<sup>115</sup>

First, the *Guidance* is underpinned by the principle that the best available science should be used to provide protection to human health, wildlife, and aquatic life.<sup>116</sup> As noted

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<sup>114</sup> *Ibid.* For a detailed discussion of the proposed *Guidance*, public comments and the final *Guidance* relating to implementation procedures, see the *Guidance Supplementary Information Document*, *supra* note 93, Section VIII.

<sup>115</sup> *Guidance Supplementary Information Document*, *supra* note 93 at 12-17.

<sup>116</sup> This principle is incorporated into the *Guidance* through: (i) development of new criteria and methodologies specifically for wildlife protection; (ii) incorporation of updated data on bioavailability of metals into aquatic life criteria and methodologies; (iii) incorporation of Great Lakes-specific data on fish

above, the genesis of the *Guidance* is rooted in recognition in the mid-1980s that the issue of persistent toxic substances was the most prominent environmental issue facing the Great Lakes, and that regulation of toxic substances was scientifically complex.<sup>117</sup> The principle of using the best available science is reflected in the development of the *Guidance*, in part, through the collection of new data on the impact of pollutants, establishment of new criteria and methodologies specifically to protect wildlife, and refinement of methodologies to determine bioaccumulation properties of individual pollutants.<sup>118</sup>

Second, the principle that the unique nature of the Great Lakes ecosystem should be recognized underlies the *Guidance*.<sup>119</sup> In particular, this principle is reflected in the *Guidance* in the establishment of special provisions<sup>120</sup> for bioaccumulative chemicals of concern, which pose documented, enduring and serious threats to the Great Lakes ecosystem. In essence, recognition of the uniqueness of the Great Lakes is reflected in the *Guidance's* purported establishment of a coordinated and comprehensive ecosystem approach for addressing possible pollutant problems.<sup>121</sup>

Third, the *Guidance* is guided by the principle of promoting consistency in standards and implementation procedures while allowing appropriate flexibility to states and tribes.<sup>122</sup>

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consumption rates and lipid contents into human health criteria; and (iv) provision of a better methodology to determine bioaccumulation properties of individual pollutants: *ibid.* at 12-13.

<sup>117</sup> *Ibid.* at 12-13.

<sup>118</sup> *Ibid.* at 13.

<sup>119</sup> *Ibid.*

<sup>120</sup> These provisions include: more stringent antidegradation procedures; general phase out and elimination of mixing zones for existing discharges of bioaccumulative chemicals of concern after twelve years; more extensive data generation requirements; and development of water quality criteria to protect wildlife that feed on aquatic prey. See *ibid.* at 13 and Section II.C.8.

<sup>121</sup> *Ibid.* at 13; S.M. Siros, "Transboundary Pollution in the Great Lakes: Do Individual States Have Any Role to Play in its Prevention?" (1996) 20 S. Ill. U.L.J. 287 at 298.

<sup>122</sup> *Guidance Supplementary Information Document*, *supra* note 93 at 13.

As noted above, a key motivation underlying the Great Lakes Initiative and in developing the *Guidance* was the recognition of the need to promote consistency in the minimum water quality standards, antidegradation policies, and implementation procedures.<sup>123</sup> Prior to the *Guidance*, disparities existed, for example, in states' acute and chronic ambient water quality criteria, states' procedures to derive individual discharge permits from water quality criteria, and states' methodologies in deriving numeric values from narrative water quality criteria.<sup>124</sup> However, in addition to the primary goal of improved consistency in water programs, the *Guidance* also seeks to provide appropriate flexibility to states and Tribes in the development and implementation of water programs. As the USEPA has observed, "reasonable flexibility is not only necessary to accommodate site-specific situations and unforeseen circumstances, but it is also appropriate to enable innovation and progress as new approaches and information become available."<sup>125</sup>

Fourth, the USEPA asserts that development of the *Guidance* was underpinned by the principle of establishing equitable strategies to control pollution sources.<sup>126</sup> This principle relates to the appropriate balance between targeting point and non-point sources of pollutant discharges. During the development of the *Guidance*, many commentators argued that the proposed *Guidance* unfairly focused on point source discharges, and that nonpoint discharges were, in fact, responsible for most of the loadings of particular pollutants. In

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<sup>123</sup> *Supra* note 92.

<sup>124</sup> For further details on disparate state regulatory approaches, see *Guidance Supplementary Information Document*, *supra* note 93 at 14.

<sup>125</sup> *Ibid.*

<sup>126</sup> *Ibid.* at 16.

response, the final *Guidance* included provisions more fully addressing nonpoint source pollution. The point to be stressed here is that development of the *Guidance* involved highly contested political and economic considerations relating to the appropriate level and focus of environmental protection.

Fifth, the principle of promoting pollution prevention practices underpins the *Guidance*.<sup>127</sup> This principle is consistent with U.S. national environmental policy that reducing the sources of pollution is the preferred approach to environmental protection.<sup>128</sup> In furtherance of this approach, the *Guidance* promotes the development of pollution minimization programs<sup>129</sup> and special provisions for bioaccumulative chemicals of concern, which reduce future discharges of these pollutants.

Finally, the development of the *Guidance* was underpinned by the principle of providing an accurate assessment of costs and benefits.<sup>130</sup> In developing the *Guidance*, the USEPA evaluated the estimated costs and benefits of the major provisions of both the proposed and final *Guidance*. Aggregate costs were estimated for all direct and indirect dischargers in the Great Lakes system.<sup>131</sup> Benefits and costs were also evaluated for direct

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<sup>127</sup> *Ibid.* at 17.

<sup>128</sup> *Ibid.*

<sup>129</sup> Such programs are evident in sections of the *Guidance* relating to levels of detection, mixing zone elimination and antidegradation policies.

<sup>130</sup> *Guidance Supplementary Information Document*, *supra* note 93 at 17.

<sup>131</sup> The USEPA conducted this analysis by selecting 50 sample facilities to represent the estimated 588 major dischargers and 9 facilities to represent the 3,207 minor dischargers in the Great Lakes basin. After calculating new effluent limits conforming to the *Guidance* requirements, the USEPA conducted an engineering analysis of each facility to estimate compliance options and costs. Treatment, monitoring and one-time costs at each facility were combined into a single annualized cost for the facility under four different compliance scenarios, and the annualized facility costs were aggregated to obtain a cost estimate for the entire universe of facilities. For an in-depth outline of the USEPA's methodology for estimating the costs imposed by the *Guidance*, see *ibid.* at 436-440 and 442-444.

industrial and municipal point source dischargers at three case study sites in the Great Lakes basin.<sup>132</sup> With reference to the origins of the regulatory impact analysis of the *Guidance*, it is important to note that, in the United States, federal agencies are required to perform an analysis comparing the benefits and costs of a proposed and final major regulation, analyze alternative approaches to the regulation, and identify the need for the regulation for each major rule proposed or promulgated.<sup>133</sup>

Section II has sought to highlight key principles underlying each of four key legal instruments which largely define intergovernmental relationships, both binationally and nationally, within the Great Lakes region. Section III discusses several themes common to the four legal instruments.

### III. COMMON THEMES

#### (i) Ecosystem Approach

The ecosystem approach constitutes the analytical and organizational means by which the primary objectives of environmental management, such as the virtual elimination of toxic substances, are pursued. An ecosystem approach is a holistic orientation (in this

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<sup>132</sup> The three case study areas were: the lower Fox River and Green Bay in northeastern Wisconsin (Lake Michigan); the Saginaw River and Saginaw Bay in Michigan (Lake Huron); and the Black River in Ohio (Lake Erie). The upshot of the case study analysis was that "the costs imposed by implementing the Guidance will almost certainly be offset by the projected benefits", including improved human health, enhanced recreation and tourism, and an increase in commercial fishing: United States, USEPA, *Protecting the Great Lakes: The Costs and Benefits of Reducing Toxic Pollution in Three Communities*, EPA-820-F-95-004 (November, 1995) at 6. For a detailed discussion of the case studies, see United States, USEPA, *Regulatory Impact Analysis of the Great Lakes Water Quality Guidance - Final Report*, (March 1995), Ch. 7.

<sup>133</sup> *Regulatory Planning and Review*, Exec. Order No. 12866, 58 Fed. Reg. 51735 (1993). Also see *Guidance Supplementary Information Document*, *supra* note 93, Section IX.

case, to environmental management) which seeks to cover all significant interactions present in the system.<sup>134</sup> The concept also has strong organizational or institutional implications because it signifies that:<sup>135</sup>

action affecting the lakes, taken or authorized by the governments, shall proceed on the understanding that the bounded field of policy is no less than the basinwide watershed of the Great Lakes and the multifarious relationships interacting within and intruding from without.

As noted in Section II(i) above, one of the most significant modifications to the 1972 *GLWQA* was the inclusion of the concept of ecosystem management in the 1978 *GLWQA*. Similarly, the *COA* recognized the interconnectedness of ecological media and biota, and explicitly adopted the ecosystem approach to Great Lakes environmental management. The *Guidance* objective of establishing a coordinated and comprehensive regulatory framework is also highly reflective of an ecosystem approach. In contrast to these three instruments, the *BTS* does not explicitly adopt the ecosystem approach to environmental management of toxic substances. Nonetheless, the *BTS* is expressly premised on the need for, and develops, a coordinated binational strategy to achieve virtual elimination of toxic substances from the entire Great Lakes basin. Thus, the *BTS* advances an ecosystem approach to basin management by establishing a collaborative binational process for addressing transboundary toxic pollution. Therefore, the legal framework governing toxic contamination within the

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<sup>134</sup> IJC, *Indicators to Evaluate Progress under the Great Lakes Water Quality Agreement* (Windsor: IJC, 1996) at 16.

<sup>135</sup> L.K. Caldwell, "Introduction: Implementing an Ecological Systems Approach to Basinwide Management" in Caldwell, ed., *Perspectives on Ecosystem Management for the Great Lakes - A Reader* (Albany: State University of New York Press, 1988) at 3.

Great Lakes basin clearly promotes a comprehensive and holistic approach to the issue of toxic contamination.<sup>136</sup>

## (ii) Virtual Elimination of Toxic Substances

The virtual elimination of persistent toxic substances, a primary goal of the existing framework, is closely linked to the ecosystem approach because of the cyclical, multi-media nature of such chemicals.<sup>137</sup> Specifically, because of the reality that many toxic chemicals cycle through various environmental media, it is impossible effectively to address the issue of toxic contamination without viewing and acting upon the problem in a holistic manner. The goal of virtual elimination is clearly articulated in the *GLWQA*,<sup>138</sup> and is expressly and unequivocally adopted in the *BTS*<sup>139</sup> and the *COA*.<sup>140</sup> In contrast, there does not appear to be direct reference to the objective of virtual elimination in the *Guidance*. However, the absence of direct references to this objective does not, however, suggest repudiation of the objective. Rather, the *Guidance* upholds the objective through the establishment of methodologies for deriving effluent standards for bioaccumulative chemicals of concern and through the attempt to develop more consistent water quality standards among the Great Lakes States. Hence, the legal framework established by the three agreements and the *Guidance* promotes the primary objective of virtual elimination of persistent toxic

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<sup>136</sup> Some commentators have argued that, despite acceptance and inclusion of the ecosystem approach in the Great Lakes regime, the concept has not been implemented in practice. For example, W.J. Christie argued that resistance to regional approaches, adversarial traditions and public ignorance are the most significant impediments to application of the ecosystem approach: "The Ecosystem Approach to Managing the Great Lakes: New Ideas and Problems Associated With Implementing Them" (1995) 26 U. Tol. L. Rev. 279.

<sup>137</sup> See Chapter 1, Subsection III(i)(b).

<sup>138</sup> *Supra* note 1, Art. II(a).

<sup>139</sup> *Supra* note 2 at 1.

<sup>140</sup> *Supra* note 3, Art. 4(2).

substances, an essential element of the ultimate goal of restoring and maintaining ecological integrity.

### **(iii) Encouragement of Coordinated Initiatives**

As an extension of the concept of ecosystem management, the four legal instruments all strongly reflect a collaborative approach to Great Lakes resource management. The commitment to coordinated intergovernmental action is rooted in provincial, state and federal concern with transboundary water pollution, a concern which is a strong motivating factor underlying each of the four legal instruments. As noted in the discussion of the ecosystem approach in Section III(ii) above, a basinwide orientation and application of policy is essential aspect of addressing environmental issues, such as toxic pollution.

### **(iv) Acceptance of Existing Regulatory Structures**

Each of the legal instruments examined above build upon or accept existing regulatory structures, and do not seek to alter substantially the types of instruments used to achieve regulatory objectives.<sup>141</sup> In particular, the *BTS* and *COA* expressly acknowledge the

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<sup>141</sup> It is beyond the scope of this paper to delineate the extensive and interesting debate about the relative merits of regulation and other types of environmental policy measures, such as voluntary programs and incentive-based instruments. However, one should note that this debate is very active within the Great Lakes community. For example, in advocating greater use of voluntary partnerships between businesses and other stakeholders, the Council of Great Lakes Governors argues that the current compliance-based regulatory system has three negative impacts: (i) minimal or no positive impact on the environment; (ii) misallocation of resources to non-value-added areas; and (iii) diversion of resources from investments bringing greater efficiency that would likely be more effective in protecting the environment: C.L. Bach & J. Edstrom, "Achieving Environmental Protection in a High-Performance Economy: A Great Lakes Perspective" (1995) 26 U. Tol. L. Rev. 305 at 305-306. Other proponents of industry-initiated measures argue that, despite potential difficulties, greater business participation in formulating environmental policy has the potential to provide greater benefits than the command-and-control approach: D.R. Allardice, R.H. Mattoon & W.A. Testa, "Industry Approaches to Environmental Policy in the Great Lakes Region" (1994) 25 U. Tol. L. Rev. 357. In contrast, environmental groups, such as the Canadian Environmental Law Association, Great Lakes United & National Wildlife Federation, have questioned the effectiveness of voluntary initiatives in protecting the



existing regulatory frameworks, and support a blend of regulatory, voluntary and incentive-based initiatives. One should note, however, that the *COA* appears to place greater weight on voluntary initiatives than does the *BTS* by specifically identifying such initiatives as the "primary mechanisms" to achieve virtual elimination.<sup>142</sup> It is also important to note that, despite their acceptance of the existing regulatory structures, neither the *BTS* nor the *COA* preclude the possibility of developing new initiatives aimed at better addressing toxic contamination.

**(v) Recognition of Importance of Ongoing Monitoring and Surveillance**

Another common theme permeating each of the legal instruments examined is the recognition of the need for ongoing monitoring and surveillance. As specified, for example, in the *GLWQA*, the purposes for which such activities are to be undertaken include compliance, achievement of general and specific objectives, evaluation of water quality trends, identification of emerging problems and development of programs.<sup>143</sup> The existence of this theme is hardly surprising given the complexity of the ecological and socio-economic issues involved. Nonetheless, it is important to note the importance of information in regulating toxic substances. The need for accurate and detailed information is also closely related to the ecosystem approach to environmental management because, under such a holistic approach, it is essential to understand extent of the numerous interconnections within the ecosystem as an integral part of effectively managing the system.

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environment on the basis that such initiatives lack public participation in their negotiation, pre-empt regulatory programs, and do not promote accountability: *supra* note 35 at 61.

<sup>142</sup> *COA*, *supra* note 3, Art. 4(2).

<sup>143</sup> *GLWQA*, *supra* note 1, Annex II, s. 1(e).

**(vi) Incremental Targets to Achieve Goal of Virtual Elimination**

As noted above, the objective of virtual elimination of persistent toxic substances is a primary objective of the existing framework. One of the basic means used by the instruments to achieve this goal is the development of target reductions, or phase-outs, for many chemicals. For example, the *COA* seeks a 90 per cent reduction in the use, generation or release of seven toxic substances by 2000.<sup>144</sup> These phase-outs represent an incremental approach to achieving virtual elimination because the targeted percentage reduction will presumably be made more stringent as the objectives are obtained. Given the absolute goal of virtual elimination, the alternative to an incremental approach is to require *immediate* cessation of use, generation or release of the targeted chemicals. The existing framework is thus based on an incremental approach requiring increasingly stringent target reductions to achieve the ultimate objective. It is important to note that an incremental approach is closely linked to the ecosystem approach because, from an anthropocentric perspective, the latter theme inherently involves balancing competing human uses of resources within the system.

In summary, common themes running through the existing policy framework include: (i) adoption of an ecosystem approach to environmental management; (ii) universal acceptance of the goal of virtual elimination of persistent toxic substances; (iii) commitment to coordinated action; (iv) acceptance of existing regulatory structures; (v) clear recognition of informational requirements; (vi) an incremental approach to virtual elimination using specific target reductions. As noted, the similarities between the instruments' approaches are

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<sup>144</sup> *Supra*, note 3, Art. 4(2).

not surprising given the high degree of binational consensus on environmental protection reflected in the *GLWQA*. In addition, the ecosystem approach serves as an overarching theme of the policy framework. The central role of the concept is reflected in its importance to the goal of virtual elimination and other fundamental themes, such as coordination of initiatives, recognition of the importance of information, and incrementalism.

#### IV. CONCLUSION

This chapter has sought to underscore foundational principles underpinning four key instruments and to highlight common themes running through the collective policy framework on toxic pollution established by the *Great Lakes Water Quality Agreement*, the *Canada-Ontario Agreement*, the *Final Water Quality Guidance for the Great Lakes System*, and the *Great Lakes Binational Toxics Strategy*. As this chapter seeks to establish, the ecosystem approach constitutes an overarching notion among the themes of the policy framework. The significance of the ecosystem approach's centrality in relation to these themes is that the concept serves as an analytical and organizational approach both with respect to the manner in which environmental issues are perceived and the way in which resources are marshaled in an attempt to address those issues. It is therefore critical to the success of environmental management in the region to gain an enriched understanding of the ecosystem approach from all relevant perspectives. As argued in Chapter 2, economics constitutes a useful analytical approach to environmental issues. Moreover, the economic content of the ecosystem approach appears to have been neglected, thus far, by those

concerned with Great Lakes environmental issues. It is therefore necessary to examine the ecosystem approach from an economic optic. This analysis is undertaken in the following chapter, which examines the extent to which fundamental welfare and environmental economic concepts are reflected in the ecosystem approach.

#### **CHAPTER FOUR:** **AN ECONOMIC PERSPECTIVE ON THE ECOSYSTEM APPROACH**

As observed in Chapter 3, political acceptance of the ecosystem approach as a cornerstone principle of environmental management occurred in 1978 with the revision of the 1972 *GLWQA*.<sup>1</sup> An ecosystem approach may superficially appear to be a simple concept entailing, in the case of freshwater management, merely basinwide application of policy. However, as those involved with its implementation have recognized, the concept involves fundamental contributions from several disciplines, including ecology, law, and political science. The purpose of this chapter is to examine the ecosystem approach and, in particular, to highlight some important economic concepts embodied within it. The chapter is divided into three main sections. Section I explores the origins and evolution of the ecosystem approach both generally and within the Great Lakes basin. Section II argues that the Great Lakes ecosystem approach is composed of five key components. Section III explores the economic content of each component and highlights the relevance of economic theory to the concept. The central argument of this chapter is that economic theory constitutes an important, albeit not sole, aspect of key components of the ecosystem approach.

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<sup>1</sup> *Agreement Between Canada and the United States of America on Great Lakes Water Quality*, 15 November 1978, 30 U.S.T. 1383 [hereinafter 1978 *GLWQA*], amending *Agreement Between the United States of America and Canada on Great Lakes Water Quality*, United States and Canada, 15 April 1972, 23 U.S.T. 301 [hereinafter 1972 *GLWQA*].

## I. MULTIDISCIPLINARY AND GREAT LAKES ECOSYSTEM APPROACHES

This section briefly delineates the origins and evolution of the ecosystem approach by, first, outlining its roots in a variety of disciplines prior to its explicit adoption in the Great Lakes region<sup>2</sup> and, second, examining its emergence in Great Lakes environmental policy.

### (i) Multidisciplinary Usage of Ecosystem Approaches

The ecosystem approach did not originate in Great Lakes environmental policy. Rather, ecosystem approaches historically had diverse applications, throughout the twentieth century, in several disciplines, including anthropology, human ecology, planning, management, political science, organization science, and psychology.<sup>3</sup> Despite the diversity of their applications in social and scientific fields, ecosystem approaches ultimately stem from ecological principles. As D. Scott Slocombe observed:<sup>4</sup>

Most generally, an ecosystem approach is a methodology for studying an entity (a "system") that models it, its environment, and the interactions between them. The word ecosystem is used analogously to its use in ecosystem science; but the ecosystem is usually larger and of more varied composition. It may combine ecological and human dimensions or even be defined purely socially. Ecosystem approaches really seek to do two things: to define an "ecosystem" as the unit of study and to apply ecological concepts and analysis outside the traditional domain of ecology.

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<sup>2</sup> The purpose of this discussion is to provide a broad overview of ecosystem approaches historically with the overall intent of illustrating that the Great Lakes ecosystem approach occurs within a much larger, multidisciplinary context.

<sup>3</sup> D.S. Slocombe, "Environmental Planning, Ecosystem Science, and Ecosystem Approaches for Integrating Environment and Development" (1993) 17 *Environmental Management* 289 at 294 [hereinafter *Integrating Environment and Development*]. For a comprehensive, multidisciplinary review of ecosystem approaches, see D.S. Slocombe, *Ecosystem Approaches: An Annotated Multidisciplinary Bibliography*, Working Paper No. 1 (Waterloo: Wilfred Laurier University & International Union for Conservation of Nature and Natural Resources, 1991).

<sup>4</sup> *Integrating Environment and Development*, *supra* note 3 at 294.

Therefore, a common theme across its diverse applications is that an ecosystem approach represents both a definitional and analytical process which draws on ecological principles.

Historically, an ecosystem approach likely was first applied in the field of human ecology, during the 1920s.<sup>5</sup> In studying people, their activities, and interactions, human ecologists used similar methods and goals to those of early ecologists.<sup>6</sup> According to Slocombe, "[t]he goal was to understand how people fit into their surroundings and distribute themselves and their groups in space, given particular resources and environments."<sup>7</sup> Modern human ecology continues to apply and refine ecosystem approaches.

Cultural anthropology was also another area of early application. Early applications of the concept occurred within the context of the 'nature versus nurture' debates. Later, in the 1940s and 1950s, ecology began to emerge more distinctly in anthropology as the field of cultural ecology evolved, and ecological approaches were subsequently widely applied and developed from the 1960s through the 1980s.<sup>8</sup> Presently, anthropological ecosystem approaches take a number of forms in anthropology, ranging from a strongly empirical and equilibril orientation to strongly theoretical and change-oriented approaches.<sup>9</sup>

From the 1960s, ecosystem approaches have also been applied in several humanities

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<sup>5</sup> *Ibid.*.

<sup>6</sup> *Ibid.*, citing R.E. Park, E.W. Burgess & R.W. McKenzie, eds., *The City* (Chicago: Univ. of Chicago Press, 1925), O.D. Duncan, "Social organization and the ecosystem" in R.F.I. Faris, ed., *Handbook of Modern Sociology* (Chicago: Rand McNally, 1964), and O.D. Duncan & L.F. Schnore, "Cultural, behavioral, and ecological perspectives in the study of social organization" (1959) 65 *Amer. J of Sociology* 132.

<sup>7</sup> *Integrating Environment and Development*, *supra* note 3 at 294.

<sup>8</sup> *Ibid.*, citing J.W. Bennett, *Northern Plainsmen: Adaptive Strategy and Agrarian Life* (Chicago: Aldine, 1969), and D.L. Hardesty, "The ecological perspective in anthropology" (1980) 24 *Behavioral Scientist* 107.

<sup>9</sup> *Integrating Environment and Development*, *supra* note 3 at 296.

and the social sciences. For example, in psychology, counselors and therapists have adopted ecosystem approaches focusing on the way a person perceives and relates to his or her environment, which is described in primarily ecological systems terms.<sup>10</sup>

In addition, during this same period, environmental planning began to show some interest in ecosystem approaches. The primary motivations underlying growth in interest in ecosystem approaches were perceived parallels between the dynamics and intricacies of ecological systems and human societies as well as a concern with managing human societies within their ecological context and limitations.<sup>11</sup>

In sum, ecosystem approaches have had diverse applications in a variety of disciplines. Some applications date back to the early-twentieth century, but most are rooted in the growing influence of ecological ideas during the 1960s and 1970s. Thus, although there are presently few explicit ecosystem approaches to regional environmental planning and management,<sup>12</sup> the ecosystem approach to Great Lakes environmental management was not an entirely new concept when it was adopted into the *GLWQA* in 1978.

## (ii) Emergence of the Great Lakes Ecosystem Approach

Although the Great Lakes ecosystem approach was first formally recognized in the

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<sup>10</sup> *Ibid.* at 295. For example, as Slocombe noted *ibid.* at 297, some psychologists have "emphasized processes and structures at different scales, spatial locations, and hierarchical positions with effects on the individual" (e.g. U. Bronfenbrenner, *The Ecology of Human Development: Experiments by Nature and Design* (Cambridge, Mass.: Harvard Univ. Press, 1979)), and others have focused on family structure, organization, and environments and on functioning and adaptation within and among these elements (e.g. B. Paolucci, O.A. Hall & N.W. Axinn, *Family Decision-Making - An Ecosystem Approach* (New York: Wiley, 1977)).

<sup>11</sup> *Integrating Environment and Development*, *supra* note 3 at 295, citing F.F. Darling & R.F. Dasmann, "The ecosystem view of human society" (1969) 19 *Impact of Science on Society* 109. Also see R.S. Dorney, "Role of ecologists as consultants in urban planning and design" (1973) 1 *Human Ecology* 183, and Dorney & P.W. McClellan, "The urban ecosystem: Its spatial structure, its scale relationships, and its subsystem attributes" (1984) 16 *Environments* 9.

<sup>12</sup> *Integrating Environment and Development*, *supra* note 3 at 295.



1978 GLWQA, the concept's early genesis may have been in the ideal of comprehensive or integrated river basin management.<sup>13</sup> This goal dates back to the nineteenth century.<sup>14</sup> Susan MacKenzie argued that American water resource planning and management has undergone four distinct periods.<sup>15</sup> For present purposes, the third phase of water resource planning and management identified by MacKenzie is most germane.

This phase, occurring from the mid-1960s to the late-1970s, was characterized, in part, by increasing recognition of humans' key role within natural ecological processes.<sup>16</sup> As the National Research Council of the United States and the Royal Society of Canada observed, from the late-1950s, ecosystem studies<sup>17</sup> in the Great Lakes developed in the context of comparative limnology and fisheries limnology.<sup>18</sup> Vallentyne and Munawar argued that, during this period from the 1960s, the context of limnology changed "from a

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<sup>13</sup> National Research Council of the United States & Royal Society of Canada, *The Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management* (Washington: National Academy Press, 1985) at 28.

<sup>14</sup> S.H. MacKenzie, *Integrated Resource Planning and Management: The Ecosystem Approach in the Great Lakes Basin* (Washington: Island Press, 1996) at 17 [hereinafter *Integrated Resource Planning*].

<sup>15</sup> *Ibid.* at 17-21. First, during the nineteenth century to the New Deal era, the ideals of unified river basin management, particularly at the federal level, were articulated in several reports on engineering, navigation, and flood control. Second, from the New Deal era to the mid-1960s, there was intense regional economic planning and public works projects, which relied heavily on river basin development. Nonetheless, regional approaches remained plagued by fragmented and pluralistic at the state and substate levels. Third, the mid-1960s to the late-1970s involved a growth of public interest in protecting natural resource integrity as well as emerging recognition by some scientists of humans' key role within natural ecological processes. In addition, during the latter portion of this period, some legislative amendments sought to solve widespread water pollution problems. Finally, the early-1980s to present witnessed a decline in government environmental spending and a subsequent resurgence of public interest in proactive natural resource management and planning.

<sup>16</sup> Eugene P. Odum was an early and foresightful proponent of the view that humans must consider themselves an integral part of, rather than separate from, the environment. For instance, see E.P. Odum, "The Strategy of Ecosystem Development" (1969) 164 *Science*. Also, see S.H. Spurr, "The Natural Resource Ecosystem" (Ch. 1) in G.M. Van Dyne, ed., *The Ecosystem Concept in Natural Resource Management* (New York: Academic Press, 1969) 3.

<sup>17</sup> These studies focused on the interaction between environmental factors, living organisms, and human beings in a holistic, sustainable system.

<sup>18</sup> *Supra* note 13 at 28.

focus on water to a higher level of integration ... that took account of lakes and rivers as parts of larger ecosystems and, ultimately, The Biosphere."<sup>19</sup> During the 1960s and 1970s, technical or scientific advances based on an ecosystem approach included:<sup>20</sup> (i) initiation by the Great Lakes Basin Commission in 1967 of comprehensive documentation and publication of information on the Great Lakes basin as a human-nature ecosystem; (ii) application of mathematical simulation techniques (developed in the International Biological Program, which operated for a decade from the mid-1960s) to Great Lakes ecosystem analysis;<sup>21</sup> (iii) application of human-environment studies (originally initiated by the Organisation for Economic Cooperation and Development) to environmental planning in the Lake Erie basin in 1970;<sup>22</sup> (iv) development of an International Field Year of the Great Lakes, including a fairly comprehensive, multidisciplinary study of Lake Ontario, in 1972-1973;<sup>23</sup> (v) publication of an expansive and innovative natural resource system model.<sup>24</sup>

Thus, by the late-1970s, there was significant interest in, and experimentation with, scientific analysis within an ecosystem framework.

Scientific evidence of environmental stresses in the Great Lakes played an important

<sup>19</sup> J.R. Vallentyne & M. Munawar, "From aquatic science to ecosystem health: a philosophical perspective" (1993) 2 J. Aquat. Ecosyst. Health 231 at 231.

<sup>20</sup> National Research Council of the United States & Royal Society of Canada, *supra* note 13 at 28-29.

<sup>21</sup> J.F. Kitchell, D.J. Stewart & D. Weininger, "Applications of a bioenergetic model to yellow perch (*Perca flavescens*) and Walleye (*Stizostedion vitreum vitreum*)" (1977) 34 J. Fish. Res. Board Can. 1922; D. Scavia & A. Robertson, eds., *Perspectives on Lake Ecosystem Modeling* (Ann Arbor, MI: Ann Arbor Science Publishers, 1979); and B.J. Shuter, J.F. Koonce & H.A. Regier, *Modeling the Lake Erie Walleye Population: A Feasibility Study*, GLFC Rep. 32 (Ann Arbor, MI: Great Lakes Fishery Commission, 1979).

<sup>22</sup> M.D. Mesarovic, D. Macko & Y. Takahara, *Theory of Hierarchical Multilevel Systems* (New York: Academic Press, 1970).

<sup>23</sup> E.J. Aubert & T.L. Richards, eds., *IFYGL - The International Field Year for the Great Lakes* (Ann Arbor, MI: Great Lakes Environmental Research Laboratory and National Oceanic and Atmospheric Administration, 1981).

<sup>24</sup> C.S. Holling, ed., *Adaptive Environmental Assessment and Management*, International Series on Applied

role in stimulating policy-related consideration of the most effective means of addressing the pressing issues in the region. As noted in Chapter 3, the 1972 *GLWQA* largely sought to reverse eutrophication by focusing on water quality.<sup>25</sup> Later in the decade, as growing scientific evidence of the need to address toxic pollution in the Great Lakes emerged, policy-makers began to recognize the limitations of a single-media approach focusing on water quality, and particularly that approach's inability to take full account of interactions within the ecosystem or of stressors external to water. Interest in extending the technical ecosystem approach to policy-related questions surfaced from the early-1970s.<sup>26</sup> By the late-1970s, there was general recognition of the need to adopt a policy approach that reflected the diversity and complexity of environmental stresses within the total ecosystem.<sup>27</sup>

Recognition of the need for a broader, multi-media approach was plainly stated in the

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Systems Analysis #3 (Chichester, England: John Wiley & Sons, 1978).

<sup>25</sup> The water quality approach of the 1972 *GLWQA* involved setting objectives not to be exceeded for certain chemicals in water, based on the most sensitive use of water.

<sup>26</sup> Three Canada-United States university seminars focused initially on the use of a multi-purpose resource management (river basin) system approach to plan Great Lakes basin development and later sought to address more comprehensive aspects of the ecosystem approach: National Research Council of the United States & Royal Society of Canada, *supra* note 13 at 29-30, citing L.B. Dworsky & G.R. Francis, *A Proposal for Improving the Management of the Great Lakes of the United States and Canada*, Hearings of the Subcommittee of Inter-American Affairs, U.S. House of Representatives, 93<sup>rd</sup> Congress, 1<sup>st</sup> Session, March 1973, 634-713; L.B. Dworsky, G.R. Francis & C.F. Sweeney, "Management of the International Great Lakes" (1974) 14 Nat. Resources J. 5; L.B. Dworsky, "The International Joint Commission - A Critique" in J.E. Carroll & D.C. Carroll, eds., *Proceedings of Canada-United States Natural Resources and Environmental Symposium* (Durham, N.H.: University of New Hampshire, 1977); and G.R. Francis, J.J. Magnuson, H.A. Regier & D.R. Talhem, *Rehabilitating Great Lakes Ecosystems*, Great Lakes Fishery Commission Tech. Rep. No. 37 (Ann Arbor: GLFC, 1979).

<sup>27</sup> J.R. Vallentyne argued that the three main factors leading to the development of the ecosystem approach were: (i) lengthy residence times of water in the lakes; (ii) pollution from demotechnic growth; and (iii) institutional arrangements under the *Boundary Waters Treaty* and the *GLWQA*, which facilitated joint resolution of problems: "The Ecosystems Approach to Pollution in the Great Lakes" (Paper presented at Third Annual International Conference: Lake, River and Coastal Pollution - Can it be Contained?, Cork, Ireland, November 5-6, 1987) vol. 4:9 [hereinafter *Ecosystems Approach to Great Lakes Pollution*].

following terms by the Great Lakes Research Advisory Board in a 1977 report to the IJC:<sup>28</sup>

Within the 1972 Great Lakes Water Quality Agreement the Governments of Canada and the United States agreed to develop and implement programs and other measures to restore and enhance the water quality in the Great Lakes System. Extensive surveillance programs have been undertaken since to evaluate the progress of the Agreement. These programs have stressed predominantly chemical and physical water quality parameters. Planning and management of such a priceless resource as the Great Lakes requires more than a knowledge of the chemical and physical water quality; it requires an understanding of the total ecosystem and the diverse interactions which occur within its chemical, physical, biological and societal components. Although water quality is a part of such an understanding, by itself it can be misleading and can hinder us from achieving the full understanding required for effective management and restoration of the lakes.

Ultimately, after further analysis and endorsement in an influential report by the Great Lakes Research Advisory Board in 1978,<sup>29</sup> the concept of an ecosystem approach to environmental management was adopted into the 1978 *GLWQA*. The ecosystem approach thus superseded the single-medium water quality approach of the 1972 *GLWQA*.<sup>30</sup>

<sup>28</sup> Great Lakes Research Advisory Board, *Annual Report to the International Joint Commission* (Windsor: IJC, 1977).

<sup>29</sup> Great Lakes Research Advisory Board, *The Ecosystem Approach: Scope and Implications of an Ecosystem Approach to Transboundary Problems in the Great Lakes Basin*, Special Report to the IJC (Windsor: IJC, 1978). The report responded to a request from the IJC to assess and advise on: (i) difficulties in melding the ecosystem and water quality objective approaches; (ii) practical means of implementing the combined concept; and (iii) future research needs. This report provided the basis for the ecosystem commitment in the 1978 *GLWQA*: L.K. Caldwell, "Introduction: Implementing an Ecological Systems Approach to Basinwide Management" at 4 [hereinafter *Implementing an Ecological Systems Approach*] in Caldwell, ed., *Perspectives on Ecosystem Management for the Great Lakes: A Reader* (Albany: State University of New York Press, 1988) [hereinafter *Ecosystem Management Perspectives*].

<sup>30</sup> The adoption of the ecosystem approach was politically significant in two respects. First, it gave political acknowledgment to the need for a change in managerial perspective. Second, it legitimized the role of social scientists in water management. See Vallentyne & Munawar, *supra* note 19 at 232. Michael Gilbertson argued that one significant consequence of the common, broad interpretations of the 1978 *GLWQA* ecosystem approach as involving all social, economic, and cultural aspects of human activity was to allow professionals from other peripheral disciplines and apparently unrelated fields to legitimize their studies and sometimes to obscure the main focus relating to pollution and water quality: "Are causes knowable? Some consequences of successional versus toxicological interpretations of the Great Lakes Water Quality Agreement" (1997) 54 Can. J. Fish. Aquat. Sci. 483 at 486. Thus, he suggests that the expansive interpretation commonly applied to the ecosystem approach has served many interests, but possibly not the public interest relating to transboundary pollution: *ibid.* at 486.

Canada and the United States articulated their commitment to the ecosystem approach in the following terms in the 1978 *GLWQA*:<sup>31</sup>

The purpose of the Parties is to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem. In order to achieve this purpose, the Parties agree to make a maximum effort to develop programs, practices and technology necessary for a better understanding of the Great Lakes Basin Ecosystem and to eliminate or reduce to the maximum extent practicable the discharge of pollutants into the Great Lakes System.

"Great Lakes Basin Ecosystem" is defined in the 1978 *GLWQA* as:<sup>32</sup>

[T]he interacting components of air, land, water and living organisms, including man, within the drainage basin of the St. Lawrence River at or upstream from the point at which this river becomes the international boundary between Canada and the United States.

In sum, the ecosystem approach to environmental management in the Great Lakes basin evolved, at least in part, within the historical context of more widespread efforts to achieve integrated and comprehensive river basin management. In addition, analysis of Great Lakes issues from an ecosystem perspective occurred first in scientific studies, which subsequently led to broader recognition of the need for a more comprehensive, integrated approach to environmental policy in the region. It is now relevant to consider the elements of an ecosystem approach. Section II undertakes this objective and argues that the concept consists of five key components.

## II. CORE ELEMENTS OF THE GREAT LAKES ECOSYSTEM APPROACH

As discussed above, the key reason for the adoption of the ecosystem approach was

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<sup>31</sup> *Supra* note 1, Art. II.

<sup>32</sup> *Ibid.*, Art. I(g).

the recognition that a comprehensive and integrated approach to environmental management was necessary. It is no surprise that, as a unifying theme in Great Lakes environmental policy,<sup>33</sup> the concept of ecosystem approach has been the starting point of considerable discussion on environmental management. The following are many of the attributes of the ecosystem approach identified by various commentators<sup>34</sup> over the past three decades: (i) Recognition that living organisms and abiotic environment are inseparable;<sup>35</sup> (ii) Includes notion of ecosystem carrying capacity;<sup>36</sup> (iii) Entire basin is geographic field of policy;<sup>37</sup> (iv)

<sup>33</sup> As observed in Section III of Chapter 3, the ecosystem approach occupies an overarching role in the policy framework by unifying other important themes such as the goal of virtual elimination, coordination of initiatives, recognition of the importance of information, and incrementalism.

<sup>34</sup> Great Lakes Research Advisory Board, *supra* note 29; B.J. Lee, H.A. Regier & D.J. Rapport, "Ten Ecosystem Approaches to the Planning and Management of the Great Lakes" (1982) 8 J. Great Lakes Res. 505; J.R. Vallentyne, "Workshop on 'Implementing an Ecosystem Approach to Management in the Great Lakes Basin', Held at Hiram College, Hiram, Ohio, During 22-24 March, 1983" (1983) 10 Environmental Conservation 273 [hereinafter *Report on Hiram Workshop*]; IJC, *Second Biennial Report Under the Great Lakes Water Quality Agreement of 1978* (Windsor: IJC, 1984) [hereinafter *IJC Second Biennial Report*]; National Research Council of the United States & Royal Society of Canada, *supra* note 13; W.J. Christie, M. Becker, J.W. Cowden & J.R. Vallentyne, "Managing the Great Lakes Basin as a Home" (1986) 12 J. Great Lakes Res. 2; *Ecosystems Approach to Great Lakes Pollution*, *supra* note 27; *Ecosystem Management Perspectives*, *supra* note 29; J.H. Hartig & J.R. Vallentyne, "Use of an Ecosystem Approach to Restore Degraded Areas of the Great Lakes" (1989) 18 *Ambio* 423; Royal Commission on the Future of the Toronto Waterfront, *Regeneration - Toronto's Waterfront and the Sustainable City: Final Report* (Toronto: Supply and Services Canada, 1992) (discusses ecosystem approach in harbourfront urban planning context); *Integrating Environment and Development*, *supra* note 3; Vallentyne & Munawar, *supra* note 19; Canada, (Environment Canada), *Reviewing CEPA - The Issues #3: The Ecosystem Approach* (Ottawa: Supply and Services, 1994) (discusses ecosystem approach within context of reforming the *Canadian Environmental Protection Act*); T.F.H. Allen, B.L. Bandurski & A.W. King, *The Ecosystem Approach: Theory and Ecosystem Integrity*, Report to the Great Lakes Science Advisory Board (Windsor: IJC, 1994); United States & Canada, (USEPA & Environment Canada), *Practical Steps to Implement an Ecosystem Approach in Great Lakes Management*, Workshop Report (Detroit: Wayne State Univ., 1995); *Integrated Resource Planning*, *supra* note 14; J.H. Hartig, R.L. Thomas & E. Iwachewski, "Lessons from practical application of an ecosystem approach in management of the Laurentian Great Lakes" (1996) 2 *Lakes & Reservoirs: Research and Management* 137; and S.H. MacKenzie, "Toward Integrated Resource Management: Lessons About the Ecosystem Approach from the Laurentian Great Lakes" (1997) 21 *Environmental Management* 173 [hereinafter *Lessons from the Laurentian Great Lakes*].

<sup>35</sup> Great Lakes Research Advisory Board, *supra* note 29 at 3; Lee, Regier & Rapport, *supra* note 34 at 516; Royal Commission on the Future of the Toronto Waterfront, *supra* note 34 at 34-38; National Research Council of the United States and Royal Society of Canada, *supra* note 13 at 32-33; *IJC Second Biennial Report*, *supra* note 34 at 13; and *Integrating Environment and Development*, *supra* note 3 at 296-297.

<sup>36</sup> Great Lakes Research Advisory Board, *supra* note 29 at 3.

Integration of social, economic and environmental interests;<sup>38</sup> (v) Recognition that person is integral part of ecosystem;<sup>39</sup> (vi) Human behaviour with respect to nature should be anticipatory and ethical;<sup>40</sup> (vii) Approach can be advanced by appealing to "enlightened self-interest";<sup>41</sup> (viii) Ecological principles are fundamental;<sup>42</sup> (ix) Requirement to develop ecosystem objectives;<sup>43</sup> (x) Institutional reorganization may be necessary;<sup>44</sup> (xi) Need for interdisciplinary study;<sup>45</sup> and (xii) Need for flexibility.<sup>46</sup> Hence, the ecosystem approach

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<sup>37</sup> *Ibid.*; Lee, Regier & Rapport, *supra* note 34 at 516-517; Royal Commission on the Future of the Toronto Waterfront, *supra* note 34 at 40-45; *Implementing an Ecological Systems Approach*, *supra* note 29 at 3; *Lessons from the Laurentian Great Lakes*, *supra* note 34 at 173; and *Integrating Environment and Development*, *supra* note 3 at 297.

<sup>38</sup> *Report on Hiram Workshop*, *supra* note 34 at 273; Lee, Regier & Rapport, *supra* note 34 at 516-517; Royal Commission on the Future of the Toronto Waterfront, *supra* note 34 at 38-40; National Research Council of the United States & Royal Society of Canada, *supra* note 13 at 32-33; Allen, Bandurski & King, *supra* note 34 at 13-15, 27-29; Hartig & Vallentyne, *supra* note 34 at 424; USEPA & Environment Canada, *supra* note 34 at 8; and

<sup>39</sup> Great Lakes Research Advisory Board, *supra* note 29 at 23; *Report on Hiram Workshop*, *supra* note 34 at 273; Lee, Regier & Rapport, *supra* note 34 at 516; Royal Commission on the Future of the Toronto Waterfront, *supra* note 34 at 32-33; Allen, Bandurski & King, *supra* note 34 at 9-15, 27-29; Hartig & Vallentyne, *supra* note 34 at 424; and *Integrating Environment and Development*, *supra* note 3 at 296.

<sup>40</sup> *Report on Hiram Workshop*, *supra* note 34 at 274; Hartig & Vallentyne, *supra* note 34 at 424; and Lee, Regier & Rapport, *supra* note 34 at 517.

<sup>41</sup> Christie *et al.*, *supra* note 34 at 9-11; and USEPA & Environment Canada, *supra* note 34 at 8.

<sup>42</sup> Lee, Regier & Rapport, *supra* note 34 at 516; *Lessons from the Laurentian Great Lakes*, *supra* note 34 at 173; and Environment Canada, *supra* note 34 at 2-3.

<sup>43</sup> T.B. Reynoldson, "The development of ecosystem objectives for the Laurentian Great Lakes" (1993) 2 J. Aquat. Ecosyst. Health 81 at 82.

<sup>44</sup> Lee, Regier & Rapport, *supra* note 34 at 505-506, 517; Royal Commission on the Future of the Toronto Waterfront, *supra* note 34 at 45-46; *IJC Second Biennial Report*, *supra* note 34 at 13; *Implementing an Ecological Systems Approach*, *supra* note 29; M.J. Donahue, "Institutional Arrangements for Great Lakes Management" in *Ecosystem Management Perspectives*, *supra* note 29; L.W. Milbraith, "A Governance Structure Designed to Learn Would Better Protect the Great Lakes Ecosystem" in *Ecosystem Management Perspectives*, *supra* note 29; D. Munton, "Toward a More Accountable Process: The Royal Society - National Research Council Report" in *Ecosystem Management Perspectives*, *supra* note 29; G.R. Francis, "Great Lakes Governance and the Ecosystem Approach: Where Next?" [hereinafter *Where Next?*] in *Ecosystem Management Perspectives*, *supra* note 29; *Integrated Resource Planning*, *supra* note 14; *Lessons from the Laurentian Great Lakes*, *supra* note 34 at 173-174; Hartig & Vallentyne, *supra* note 34 at 425; *Integrating Environment and Development*, *supra* note 3 at 296-297; and Allen, Bandurski & King, *supra* note 34 at 46.

<sup>45</sup> Lee, Regier & Rapport, *supra* note 34 at 516-517; National Research Council of the United States & Royal Society of Canada, *supra* note 13 at 32; Allen, Bandurski & King, *supra* note 34 at 46, 48; and *Integrating Environment and Development*, *supra* note 3 at 296-297.

<sup>46</sup> Lee, Regier & Rapport, *supra* note 34 at 517; Allen, Bandurski & King, *supra* note 34; and *Implementing an Ecological Systems Approach*, *supra* note 29 at 6.

constitutes a 'cluster concept' that is composed of multiple sub-concepts.

Within the cluster of concepts identified in the literature on the ecosystem approach in the Great Lakes, there appear to be two unifying themes. In essence, the ecosystem approach involves a holistic perspective of, and flexible approach to, environmental issues. First, many commentators have recognized the centrality of a holistic perspective to an ecosystem approach. Indeed, holism appears to be the fundamental feature of the ecosystem approach. As MacKenzie observed:<sup>47</sup>

At its basic level, then, the ecosystem approach is comprehensive and integrated. It suggests that resource planning and management must recognize the influence and interactions of all elements of the ecosystem in order to create an ecologically sound and sustainable sociophysical system.

The need for an integrated, comprehensive perspective underlies delineation of the scope and variables of analysis, scientific studies of chemical, physical and biological processes in the basin, discussions on regional governance systems, and efforts to balance numerous competing interests.

The second unifying theme running through the literature on the Great Lakes ecosystem is the need for flexibility. Recognition of the need for flexibility permeates discussions about the bounds of the ecological system, analyses of institutional reform, and efforts to foster interdisciplinary study of issues. In emphasizing the need for flexibility in typing and bounding the ecological system, one group of commentators stated:<sup>48</sup>

In the ecosystem approach, there is not one material ecosystem to which our definitions must conform. Rather, the human actor must accept responsibility for erecting definitions and be prepared to change them when the purpose of the description changes.

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<sup>47</sup> *Lessons from the Laurentian Great Lakes*, *supra* note 34 at 173.

<sup>48</sup> Allen, Bandurski & King, *supra* note 34 at 5.



Thus, the ecosystem approach requires definitional flexibility. In addition, the importance of flexibility has been emphasized from an institutional or managerial perspective:<sup>49</sup>

In practice an ecosystem approach means much more than is stated in its more restrictive, scientific definitions. It means that management for the lakes should evolve in response to a growth in understanding of the factors that influence the quality of the environment within the Great Lakes Basin and determine the quality of the waters that unify the ecosystem and define its boundaries. [Footnote omitted.]

In addition to definitional and institutional flexibility, the theme of flexibility is reflected in the numerous calls for multidisciplinary analysis. The following statement in a report analyzing various ecosystem approaches to Great Lakes issues plainly reflects recognition of the need for 'academic flexibility':<sup>50</sup>

The ecosystem approaches promoted by the authors of each of [the documents studied] have bridged disciplines of natural and human ecology to form an integrated or transdisciplinary approach to the study of natural ecosystems.

...

It would be neither possible nor feasible to specify a unique, unitary, unified, universal "ecosystem approach."

Therefore, perhaps ironically, flexibility constitutes an important unifying theme of the ecosystem approach.

In this author's view, the themes of holistic perspective and flexibility underpin five core elements or principles of the ecosystem approach. These principles are: (i) Institutional reorganization may be necessary to effect management based on ecological principles, rather than anthropocentric boundaries; (ii) Living organisms and the abiotic environment are inseparable; (iii) Entire basin forms unit of analysis; (iv) "Enlightened self-

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<sup>49</sup> *Implementing an Ecological Systems Approach*, *supra* note 29 at 6.

<sup>50</sup> Lee, Regier & Rapport, *supra* note 34 at 516-517.

interest" may serve to advance the ecosystem approach; and (v) Interdisciplinarity is necessary to advance requisite understanding and action.<sup>51</sup>

First, with respect to institutional reform, it is apparent that management and coordination must be improved to effect ecosystem-oriented policies. As Slocombe stated:<sup>52</sup>

The [Great Lakes ecosystem] approach has a strong administrative and institutional orientation, in large part aimed at improving management and coordination by the many institutions with management responsibilities in the Basin.

In emphasizing the institutional aspect of the ecosystem approach, the IJC made the following statement in 1984:<sup>53</sup>

Because existing environmental and resource programs are separated, compartmentalized and spread throughout various bureaus, agencies, ministries and departments, the new approach requiring a holistic overview entails, at the very least, a reorganization of thinking, and perhaps a reorganization of institutional arrangements.

A seemingly unrecognized dimension is the extent to which institutional arrangements limit the ability of scientists and scientific institutions to focus on relevant research leading to the technical resolution of environmental problems. Compartmentalization is often associated with rigid interpretations of "missions" or "mandates" as expressed by legislation or regulations which authorize programs. The restrictions of the "mandate" or regulation are then translated into limitations on the style of technical solutions. This approach has led to considerable frustration on the part of individuals who have recognized the importance of holistic approaches to solving environmental problems.

...

The Commission believes an ecosystem approach will produce greater appreciation for the overall impacts of environmental management decisions and man's activities generally. It may also lead to changes in existing methods of analysis and actions which are currently constrained by geographical, disciplinary, functional, institutional or jurisdictional compartmentalizations.

Despite the importance of institutions, there appears to have been insufficient attention to the

<sup>51</sup> It is important to note that, although adaptability (and particularly the system's ability to evolve and respond to new developments and knowledge) also constitutes an important aspect of the ecosystem approach, this attribute is considered here to form a part of principles (i) and (v) relating to institutional reform and interdisciplinarity.

<sup>52</sup> *Integrating Environment and Development*, *supra* note 3 at 296.

<sup>53</sup> *IJC Second Biennial Report*, *supra* note 34 at 13.

ecosystem approach's institutional implications.<sup>54</sup> One observer has argued that participation of appropriate actors, development of mutually agreed upon decision-making process, and legitimacy are three preconditions to ecosystem management.<sup>55</sup> Nonetheless, regardless of the inadequacy of discussions on institutional reform, institutional organization remains a key issue under the ecosystem approach.

Second, the notion that living organisms are inseparable from the environment is also an important element of the ecosystem approach. This element includes the notions that humans are an integral part of the ecosystem, that social, economic and environmental interests must be integrated, and that management of the ecosystem must be guided by ecological principles. As MacKenzie noted:<sup>56</sup>

The ecosystem boundary is determined by the nature of the resource to be managed rather than by the arbitrary jurisdiction of a political unit. Within the ecosystem, *all* biological, physical, and chemical matter exist in a complex relationship of interdependence. [Italics in original.]

Thus, this element focuses holistically on all interactions within, or affecting, the ecosystem.

In addition, this element highlights the strongly ecological orientation of the ecosystem

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<sup>54</sup> *Lessons from the Laurentian Great Lakes*, *supra* note 34 at 173-174. MacKenzie suggested that the following are some key, but presently unresolved, institutional questions: How do government agencies move from a fragmented institutional structure and incremental policy process to one that is comprehensive and integrated? What incentives can be used to promote intergovernmental coordination and interdisciplinary cooperation in an ecosystem-based resource management exercise? What type of decision-making process is appropriate when multiple parties with different statutory goals are expected to work together? What is the appropriate role for nongovernmental organizations and the private and public sector under the ecosystem approach? How does one facilitate resource management along an ecologically determined boundary rather than a political jurisdiction?

<sup>55</sup> *Integrated Resource Management*, *supra* note 14 at 23-33. Also see S.H. MacKenzie, "Ecosystem Management in the Great Lakes: Some Observations from Three RAP Sites" (1993) 19 J. Great Lakes Res. 136 at 137-138 [hereinafter *RAP Site Observations*].

<sup>56</sup> *Integrated Resource Management*, *supra* note 14 at 7. Also see *RAP Site Observations*, *supra* note 55 at 137.

approach to policy and management.<sup>57</sup>

The issue of inseparability raises a related but distinct issue about the overall scope of analysis under the ecosystem approach. Specifically, the ecosystem approach includes a geographic element under which the entire Great Lakes basin forms the ultimate unit of analysis.<sup>58</sup> As Caldwell stated:<sup>59</sup>

An ecosystem approach means, therefore, that action affecting the lakes, taken or authorized by the governments, shall proceed on the understanding that the bounded field of policy is no less than the basinwide watershed of the Great Lakes and the multifarious relationships interacting within and intruding from without.

In asserting this element, it is important to note that, although the entire basin forms the overall subject of policy, the ecosystem approach does not preclude programs operating on scales smaller than the entire watershed. Indeed, as noted in Chapter 3, RAPs and LaMPs, introduced in the *1987 Protocol*, represent efforts to implement an ecosystem approach on a more localized level.<sup>60</sup>

A fourth key element of the ecosystem approach relates to the strategy for increasing the acceptability of measures undertaken under its rubric in the Great Lakes community. As

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<sup>57</sup> Lynton K. Caldwell was a foresightful proponent of increasing the role of ecology in public policy. See Caldwell, "Problems of Applied Ecology: Perceptions, Institutions, Methods, and Operational Tools" (1966) 16 *BioScience* 524.

<sup>58</sup> The ecosystem approach to environmental management in the Great Lakes region is a prominent example of a larger trend toward "place-driven", rather than "program-driven", strategy of environmental protection. See O.J. Gonzalez, "Formulating an Ecosystem Approach to Environmental Protection" (1996) 20 *Environmental Management* 597. Gonzalez argues that the USEPA will need to (1) determine how to define and delineate ecosystems, and (2) categorize threats to individual ecosystems and priority rank ecosystems at risk. He also proposes a multi-variable ranking system for prioritizing responses to ecosystems at risk.

<sup>59</sup> *Implementing an Ecological Systems Approach*, *supra* note 29 at 3.

<sup>60</sup> For analyses of the effectiveness of RAPs and the extent to which they embody an ecosystem approach, see Hartig & Vallentyne, *supra* note 34; *Integrated Resource Management*, *supra* note 14; *RAP Site Observations*, *supra* note 55; A. Gurtner-Zimmermann, "A Mid-Term Review of Remedial Action Plans: Difficulties With Translating Comprehensive Planning Into Comprehensive Action" (1995) 21 *J. Great Lakes Res.* 234; and Hartig, Thomas & Iwachewski, *supra* note 34.

the discussion in Chapter 1 seeks to underscore, this vast community is comprised of very diverse, competing human interests. These interests underpin several major obstacles to attaining an ecosystem approach. A multi-stakeholder workshop on the ecosystem approach<sup>61</sup> identified numerous constraints, stemming from various perspectives, to implementation of an ecosystem approach.<sup>62</sup> Major constraints, which were common to all groups, were: (i) lack of a holistic perspective; (ii) predominance of "egosystem" thinking; and (iii) lack of a preventative approach.<sup>63</sup>

A strategy for overcoming these obstacles related to human interests is "enlightened self-interest".<sup>64</sup> This strategy is founded on the basis that all individuals in the Great Lakes basin share a common cause in the level of risk facing them. "Enlightened self-interest" therefore involves self-protection and does not rely on altruism or traditional environmental protection.<sup>65</sup> Furthermore, as Christie *et al.* argued:<sup>66</sup>

With self-defense as the primary concern, it becomes considerably easier to convince people of the need for more holistic views. Once done, they will have automatically converted some of their "egosystem" precepts to ecosystem thinking. People could be receptive to a management system that avoids nasty surprises, just as they have turned to systems of preventative dentistry and medicine.

The thrust of the foregoing is that the best strategy is *enlightened self-interest*.

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<sup>61</sup> Workshop on Implementing an Ecosystem Approach to Management in the Great Lakes Basin, Held at Hiram College, Hiram, Ohio, March 22-24, 1983.

<sup>62</sup> From participants' personal perspectives, major constraints were feelings of hopelessness, fear, confusion on complex issues, differing perspectives and opinions, and mistrust of organizations. From industries' perspectives, major constraints were the desire for growth, competition and secrecy, conflicts between society's interests and business efficiency, mistrust of competitors, environmental organizations and government. From the point of view of voluntary organizations, insufficient organizational and financial bases and inadequate representation. From the standpoint of governments, major constraints included lack of legislation incorporating the ecosystem concept, lack of public support in translating environmental concerns into wider ecosystem concerns, and lack of trans-institutional networking: Christie *et al.*, *supra* note 34 at 7; and *Report on Hiram Workshop*, *supra* note 34 at 274.

<sup>63</sup> Christie *et al.*, *supra* note 34 at 7-9.

<sup>64</sup> *Ibid.* at 9.

<sup>65</sup> *Ibid.*

<sup>66</sup> *Ibid.*

It says first of all that, because all citizens in the basin share a common problem, they must be committed in their own interest to its solution. It extends the Golden Rule to the ecosystem in recognition of the essential need for self-preservation, "Do unto the ecosystems you share with others as you would have others do to the ecosystems they share with you." Enlightenment not only refers to appreciation of these realities; it recognizes the need for improved understanding and anticipatory management. [*Italics in original.*]

Therefore, the strategy of using "enlightened self-interest" to advance an ecosystem approach essentially involves using enhanced understanding of individual interdependencies to promote practices which are both self- and ecosystem-preserving. "Enlightened self-interest" thus constitutes an important strategical component of the ecosystem approach.

Finally, interdisciplinarity constitutes a core element of the ecosystem approach. As many commentators have recognized, the complexity of environmental issues in the Great Lakes, and elsewhere, involve interconnections between several different systems, including social and scientific phenomena. The U.S National Research Council and the Royal Society of Canada identified the following three major interacting subsystems as requiring consideration under an ecosystem approach in a large regional system: (i) physical, chemical, and biological phenomena; (ii) responsible institutions and their interactions; and (iii) and the socioeconomic system that utilizes the resources and receives benefits or bears burdens of management actions.<sup>67</sup> In emphasizing the interdependencies of the three subsystems, these commentators stated:<sup>68</sup>

Advancing the technical understanding of the hydrology, hydrodynamics, chemistry, and ecology of the Lakes serve only to identify continuing problems if institutions and actions are not also linked to the characteristics of the basin ecosystem. The future potential for economic development of the Great Lakes basin is related to the quality of the water; the habitat value of the shoreline and

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<sup>67</sup> National Research Council of the United States & Royal Society of Canada, *supra* note 13 at 32.

<sup>68</sup> *Ibid.* at 33.

foreshore for wildlife, waterfowl, and fish; and the aesthetic and recreational amenities offered to human communities by the system as a whole. The use of the term "Great Lakes basin ecosystem" in the context of a comprehensive statement of purpose in the 1978 Agreement seems to mandate the use of a full understanding of the interconnections within the basin.

Thus, environmental complexities demand interdisciplinary responses under the ecosystem approach that transcend broad areas of study, such as the physical sciences, social sciences, and even the humanities. MacKenzie's observations about disciplinary representation in the RAP program are also applicable to basinwide management.<sup>69</sup>

In the Great Lakes a full complement of physical scientists participate in most RAPs. This is both noteworthy and laudable. ...

Thus far, the level of participation by social scientists is more limited, and few humanists are involved in the RAP. ... Barriers to interdisciplinary environmental management clearly remain.

This is unfortunate for at least two reasons. First, in order to make a real contribution to problem solving, scientific information must be translated into public policy and framed within the legal structures that govern society. Individuals with a social science background are uniquely situated to link data to policy. Second, an ethic that recognizes the inherent value of ecological integrity underlies the ecosystem approach. The ethic is poorly articulated at this time and would no doubt benefit from greater humanist reflection and insight.

Therefore, the need for interdisciplinarity under the ecosystem approach stems from the complexity of the issues and the need to ensure that values and knowledge are translated into policy.

Thus far, I have argued that the following principles constitute key elements of the ecosystem approach to Great Lakes environmental management: (i) Institutional reorganization may be necessary to effect management based on ecological principles; (ii) Living organisms and the abiotic environment are inseparable; (iii) Entire basin forms unit

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<sup>69</sup> *Lessons from the Laurentian Great Lakes*, *supra* note 34 at 176-177.

of analysis; (iv) "Enlightened self-interest" is a strategy for advancing the ecosystem approach; and (v) Interdisciplinarity is necessary to advance the ecosystem approach.

The relevance and contributions of certain disciplines, such as ecology and political science, to the Great Lakes ecosystem approach is reflected in much of the literature referenced above. However, the contributions of economic theory has received substantially less attention within the context of the ecosystem approach. It is perhaps ironic that the economic content of the ecosystem approach has been neglected in light of the concept's emphasis on holism and flexibility. Thus, Section III seeks to highlight some parallels between welfare and environmental economic theory and the ecosystem approach within the framework of the key elements analyzed above. The focus will be on four of the five elements, and one of the elements, institutional reform, will not be analyzed further because, unlike the other elements, this aspect involves primarily *procedural* issues of resource management.<sup>70</sup> The upshot of the analysis below is that economic theory forms an important aspect of the conceptual basis of the ecosystem approach.

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<sup>70</sup> Key areas involved in Great Lakes institutional reform are: (i) participation by appropriate actors (including government agencies, organizations and individuals); (ii) development of a consensual decision-making process (involving decision-making, development of common objectives, and dispute resolution); (iii) legitimacy (involving political support, public participation, and funding); and (iv) ensuring system flexibility and adaptability: *Integrated Resource Planning*, *supra* note 14; *Lessons from the Laurentian Great Lakes*, *supra* note 34; *Implementing an Ecological Systems Approach*, *supra* note 29; Donahue, *supra* note 44; Milbrath, *supra* note 44; *Where Next?*, *supra* note 44; G. Francis, "Flexible Governance" [hereinafter *Flexible Governance*] in C.J. Edwards & H.A. Regier, eds., *An Ecosystem Approach to the Integrity of the Great Lakes in Turbulent Times*, Great Lakes Fisheries Commission (GLFC) Spec. Pub. 90-4 (Ann Arbor: GLFC, 1988) 195.



### III. ECONOMIC CONTENT OF THE GREAT LAKES ECOSYSTEM APPROACH

The principle that living organisms and the abiotic environment are inseparable essentially signifies an integrated view of all ecologically relevant interactions occurring within the basin. As noted, under this principle, humans are not separate from the environment, but rather form an integral part of the larger ecosystem. In contrast to this holistic perspective, welfare economic theory is founded on individualism, and more specifically, on the notion that social welfare is fundamentally dependent on individuals' well-being. Thus, some may argue that economics is irrelevant to the ecosystem approach, and particularly the principle of inseparability, because of a purported basic difference in perspectives. In other words, some may claim that the holistic orientation of the ecosystem approach is incompatible with the individualism of economics.

However, despite the holism of the ecosystem approach, there remains a strong need to consider competing, individual human activities. An integrated approach for the Great Lakes mandates, first, an overview of the numerous, often conflicting activities occurring within the basin and, second, compromise and balance among diverging human interests. As argued below, although it may occur in a broader ecological context, balancing holistically perceived interests inherently requires consideration of the marginal, or incremental, impact of individual actions, a process that is central to environmental valuation.

Under the ecosystem approach, the need to consider economic activity on an incremental scale is fundamentally implicated through the goal of virtual elimination of

persistent toxic substances, a primary objective of the existing policy framework.<sup>71</sup> As observed in Chapter 3, the present environmental policy framework strongly reflects an incremental approach through the development of target reductions for many toxic chemicals. Such an approach stands in stark contrast to an alternative, non-incremental approach involving immediate cessation of the use, generation, or release of the targeted chemicals. Although the latter approach would not be feasible on political or economic grounds, the more important point for present purposes is that the existing framework is founded upon an implicit and essential reliance upon balancing the interests of environmental preservation and restoration against often competing industrial interests. Virtual elimination, as a primary objective of the ecosystem approach, therefore fundamentally requires consideration of incremental socio-economic impacts.

On a more localized level, socio-economic studies undertaken in implementing the RAP process<sup>72</sup> is another example of the need to consider incremental effects within a broader holistic approach. Socio-economic analysis has been an important component of the RAP process since the process' initiation under the *1987 Protocol*.<sup>73</sup> In particular, socio-

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<sup>71</sup> As noted in Section III(i) of Chapter 3, the ecosystem approach constitutes the analytical and organizational means to achieve primary goals, such as the virtual elimination of persistent toxic substances. Virtual elimination of toxic substances is an important step in the ultimate goal of restoring and maintaining ecological integrity.

<sup>72</sup> The RAP process consists of three distinct stages: (i) identification of the sources of environmental problems; (ii) evaluation and selection of remedial actions; and (iii) demonstration of restored beneficial uses leading to the removal of the site from the IJC's list of Areas of Concern.

<sup>73</sup> Early socio-economic activities included preparation of initial socio-economic profiles for Areas of Concern, a preliminary overview economic assessment of RAPs, and a range of studies exploring the theme of sustainability. The second phase of socio-economic activities were largely aimed at supporting Stage 2 of the RAP process, which focuses on evaluation and selection of remedial actions. Socio-economic activities at this stage included the provision of direct assistance on economic issues to RAP teams, updating cost estimates on a program-wide level, and identifying potential funding mechanisms: K.A. Schaefer & S. Bailey, "Socio-Economic Considerations in Remedial Action Planning in the Great Lakes Basin" in *Coastal Zone Canada*

economic analyses helped provide a basis for cost-benefit evaluations later in the process. Valuation of environmental benefits related to restoration of degraded areas continues to play an important role in Great Lakes remedial efforts.<sup>74</sup> Socio-economic analysis, and particularly cost-benefit analysis, reflect the continued relevance of, and need for, balancing competing interests, including economic pursuits.

As noted above, the inseparability of living organisms and the abiotic environment is related to the principle that the entire basin forms the overall unit of study under the ecosystem approach. This latter principle is closely tied to the economic concept of externalities, which, as discussed in Chapter 2, essentially involves an individual's failure fully to incorporate broader affected interests into a cost calculation or decision. As the discussion in Chapter 3 strives to highlight, political commitment to collaborative intergovernmental resource management is strongly reflected in all four instruments examined. In recognizing the entire Great Lakes basin as the ultimate field of policy concern under the ecosystem approach, the instruments seek to strengthen the ability of governments within both Canada and the United States to address trans-jurisdictional pollution. In essence, the instruments represent attempts to reduce externalities between jurisdictions.

The notion of externalities is traditionally applied to individual economic agents

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1994, ed., *Co-operation in the Coastal Zone*, Conference Proceedings, vol. 2 (Dartmouth: Coastal Zone Canada Association, 1994) 663 at 664-667.

<sup>74</sup> For example, the Northeast-Midwest Institute, in cooperation with the National Oceanic and Atmospheric Administration, is currently preparing a major analysis of environmental valuation methods in the Great Lakes region: A. Cangelosi, "Economic Valuation of Environmental Benefits" (Sept./Oct. 1998) Northeast Midwest Economic Review 7.

whose welfare is dependent on another agent's activities. Policy prescriptions at this micro-level generally aim at internalizing the external costs faced by the individuals. In contrast, in the case of transboundary pollution in the Great Lakes, the policy approach, in part, has been to internalize costs by creating a basinwide, or at least, larger regional entity. Resistance to regional approaches, adversarial traditions, and public ignorance present significant impediments to eliminating externalities under the ecosystem approach. Nonetheless, the economic notion of externalities is strongly present at the macro-level in the ecosystem approach.

Another element of the ecosystem approach is the strategy of using enlightened self-interest to advance ecosystem management. As noted, self-interest also constitutes a fundamental characteristic of economic agents as utility- or profit-maximizing individuals. Self-concern is thus a somewhat superficial parallel between enlightened self-interest and economic self-interest. Prior to illustrating that the economic content of enlightened self-interest is rooted in both its function as a bridge between parochial interests and ecological considerations and the notion of externalities, it is first necessary to examine the underlying concept of rationality.

Some commentators have argued that rationality in an ecological context is a fundamental type of reason that has precedence over other forms of reason, including economic rationality.<sup>75</sup> Robert Bartlett argued that ecological rationality is a form of practical reason that draws extensively on ecology and is derived from the inherent logic of

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<sup>75</sup> R.V. Bartlett, "Ecological Rationality: Reason and Environmental Policy" (1986) 8 *Environmental Ethics* 221.

living systems. In his view, ecological rationality is distinct from, and paramount over, economic, technical, social, legal, and political rationality because:<sup>76</sup>

only the preservation and maintenance of ecological life support capability makes possible the preservation and improvement of decision structures and, hence, political rationality and all other forms of rationality.

Bartlett recognized that ecological rationality does not necessarily preempt other forms of rationality, but argued that it conflicts with other forms, particularly in the ecological short-run. In contrasting economic and ecological rationality, Bartlett claimed that:<sup>77</sup>

The possible incongruities between economic and ecological reasoning extend beyond the negative consequences for environmental quality caused by "market failures" such as externalities ... These two forms of reason entail sharply different metaphysical assumptions and values which produce different ways of "seeing." Economic rationality is strongly anthropocentric, utilitarian, and materialistic, for example, whereas ecological reasoning is not. Economic rationality may fail to coincide with ecological rationality because of the vastly different time scales or horizons inherent in the logic of each - the very long term for economic reasoning rarely extends as far as fifty years, whereas fifty years is an ecologically brief period of time.

Also, like social, legal, and political rationality, economic rationality can conflict with ecological rationality by ignoring it. Economic rationality is applicable only to values that can be made tangible and commensurable - it is inapplicable or unapplied to much of the physical and nonphysical world, which explains why other forms of rationality are possible and necessary.

In other words, economic reasoning's purportedly strong anthropocentrism, utilitarianism, materialism, much shorter time scales, and limited applicability starkly distinguish its metaphysical foundations from those of ecological reasoning.

Barlett's observation, noted above, that basic decision structures rely on ecological life support is unassailable, and few would dispute the fundamental importance of ecological health to human institutions. Nonetheless, regardless of the existence of a fundamental form

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<sup>76</sup> *Ibid.* at 235.

<sup>77</sup> *Ibid.* at 236-237.

of reasoning, the rationality of any action is closely tied to the goal sought to be achieved, which, in turn, depends upon the interests of the agent. Traditionally, within the economic sphere, the interests of rational economic agents are framed in terms of maximizing utility or profit. The significance of the strategy of enlightened self-interest stems from its focus on expanding the type of interests recognized by stakeholders. As noted above, "enlightened" under the ecosystem approach, refers to appreciation both of one's interdependencies within the ecosystem and of the need for anticipatory behaviour. Thus, an enlightened stakeholder ideally will perceive his or her economic interests from a broader perspective, particularly involving greater awareness of interrelationships with other ecosystem organisms (both human and non-human) and longer time horizons.<sup>78</sup>

The economic content of the strategy of enlightened self-interest, which focuses on stakeholders' own interests, therefore is rooted, in part, in the notion of rationality. Furthermore, by focusing on broadening perspectives, the strategy of enlightened self-interest strives to reconcile, or at least to reduce incongruities between, economic and environmental interests. Despite the paramountcy of ecological concerns, the strategy of enlightened self-interest properly recognizes the importance of economic, and other, interests and seeks to use them as a means of furthering ecosystem management. The strategy thus seeks to link more parochial interests to ecological considerations. Therefore, the strategy of promoting enlightened self-interest also serves to begin bridging any

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<sup>78</sup> It is important to note that the strategy of enlightened self-interest does not reject particular interests, such as economic interests. Rather, the strategy seeks to work within the framework of the stakeholder's interests, and focuses instead on increasing his or her awareness.

fundamental gaps, if these do exist as claimed by observers such as Bartlett, between economic and ecological rationality.

In addition to bridging gaps between purportedly different modes of reasoning, enlightened self-interest also closely reflects the notion of externalities at a micro-level. Enlightened self-interest seeks to achieve greater appreciation of interrelationships within the ecosystem, including the interdependencies between humans. The strategy of enlightened self-interest aims at getting people to recognize their environmental impacts more broadly and, within the economic sphere, to change their behaviour with respect to consumption and production activities. The concept of externalities therefore is strongly present at the micro-level in the concept of enlightened self-interest because external costs arise when an economic agent's utility is directly affected by another agent's consumption or production activities. At a policy level, policy-makers can help individuals to understand and respect their interconnected well-being through various instruments, such as public education, higher taxes on activities with high pollution impacts, and legislation. Thus, through several types of policy instruments, the concept of enlightened self-interest can seek to use individuals' own economic interests to eliminate, or at least reduce, the external costs created by those pursuits. The economic content of enlightened self-interest thus stems both from its function as a bridge between parochial interests and ecological considerations and from the notion of externalities.

Another important element of the ecosystem approach is interdisciplinarity. As noted above, sustainable resolution of environmental issues involves an understanding of

interacting subsystems, and particularly: (i) physical, chemical, and biological phenomena; (ii) responsible institutions and their interactions; and (iii) and the socioeconomic system that utilizes the resources and receives benefits or bears burdens of management actions.<sup>79</sup>

The need for interdisciplinarity highlights two salient points. First, despite the objections of some detractors, economics can and should play an important role in developing Great Lakes environmental policy. In developing and refining policy responses to Great Lakes ecological issues, policy-makers must recognize the relevance of economic theory to the ecosystem approach and other fundamental policy principles. Second, notwithstanding its relevance to the ecosystem approach, economics does not provide all the answers, and many other disciplines must be drawn upon to effect sustainable objectives. Thus, the contributions of all relevant disciplines must be recognized, but no one discipline should dominate the development of environmental policy. Ultimately, welfare and environmental economic theory forms an important, albeit previously largely unrecognized, aspect of the ecosystem approach, and students of Great Lakes environmental policy must recognize its relevance in addition to other contributions from the sciences, social sciences, and humanities.

#### IV. CONCLUSION

Ecosystem approaches have been developed and applied in a variety of disciplines over the past century. Ecosystem approaches are much rarer, however, as a regional

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<sup>79</sup> National Research Council of the United States & Royal Society of Canada, *supra* note 13 at 32.



approach to environmental policy. Key aspects of the ecosystem approach to Great Lakes environmental management are institutional reform, inseparability, basinwide perspective, enlightened self-interest, and interdisciplinarity. In arguing that economics forms an integral part of the ecosystem approach's conceptual foundations, this paper has highlighted: (a) the policy framework's reliance on an incremental approach and the related importance of socio-economic analyses and environmental valuation; (b) the strong presence of the notion of externalities, at a macro-level, from an inter-jurisdictional perspective and, at a micro-level, in the notion of enlightened self-interest; and (c) the basic importance of economic self-interest under the strategy of enlightened self-interest regardless of purported fundamental gaps between ecological and economic reasoning. Economic theory therefore plays an important role in the conceptual foundations of the ecosystem approach. Effective operationalization of the ecosystem approach requires commitment from, and innovative links between, the sciences, social sciences, and humanities within the spirit of holism and flexibility of the ecosystem approach. Chapter 5 suggests some directions for further research which ultimately may help to advance our understanding of, and ability to address, the evolving environmental issues of the Great Lakes region.

**CHAPTER FIVE:**  
**CONCLUSION AND FUTURE DIRECTIONS**

This thesis has focused on the conceptual foundations of environmental policy in the Great Lakes region. One objective of the present work has been to defend the view that economic theory has general analytical and practical relevance to environmental law and policy, despite some limitations of the perspective. Another objective has been to identify some key principles and common themes in key agreements and regulatory instruments in the Great Lakes toxic pollution policy framework. Finally, this thesis has sought to illustrate that welfare and environmental economic theory constitutes an important aspect of the ecosystem approach, a fundamental concept in the existing policy framework.

One of the attractions, and occasional frustrations, of attempting to analyze environmental law and policy in the Great Lakes region is the complexity and fluidity of the system. It is not surprising that Great Lakes environmental policy has been the subject of vast debate on many different aspects, ranging from scientific to institutional issues. This thesis does not purport or seek to be the final word on any aspect of Great Lakes environmental policy. Rather, the thesis has sought to contribute to the ongoing discussion by providing a conceptual overview of the toxic pollution policy framework and by focusing on an apparently neglected aspect of the framework, specifically, the economic content of the ecosystem approach. It is hoped that the present work will provide some basis for further debate in these areas.

One implication of a principal argument in this thesis, specifically, that economics forms an integral aspect of the ecosystem approach, relates to the vital role of information in effectively operationalizing the concept. More specifically, the economic notion of externalities highlights the importance of information both in addressing transboundary pollution and in enlightening individuals about their interconnected interests in preserving their ecosystem. In both cases, full and accurate information about the specific sources and environmental impact of contaminants is essential to developing effective responses. Therefore, the notion of externalities serves to underscore the need for more scientific research on toxic contamination combined with greater public dissemination of information and education as significant steps in achieving effective implementation of the ecosystem approach.

As observed in the foregoing chapters, there is a generally recognized need to develop interdisciplinary approaches to research, policy development, and management. Thus, one fruitful direction for further research flowing from the present work is development of economic theory specifically related to the environmental policy framework of the Great Lakes region. For example, environmental economists could seek to illustrate the particular relevance and limitations of economic concepts within the context of some of the themes identified in Chapter 3. Research in these areas may help to generate and facilitate interdisciplinary dialogue ultimately aimed at developing effective environmental policy.

Several other significant promising areas of inquiry arise from the present work. First, given that, as this thesis has sought to establish, economic theory constitutes one of

several important disciplines relevant to the conceptual underpinnings of the ecosystem approach, it is crucial that a "common lens" be established for viewing environmental issues in the region. Furthermore, because operationalization of the ecosystem approach requires interdisciplinary analysis and cooperation, it is important to develop an effective way of facilitating this within the context of extremely complex issues which appear to demand increasingly specialized perspectives. Moreover, within the context of tension between the needs for interdisciplinarity and specialization, it is imperative that those involved in Great Lakes governance recognize issues affecting public participation, particularly as the procedural aspects of ecosystem management are increasingly recognized as an essential element of governance in the region. Second, another promising area of inquiry relates to an acknowledged limitation of the present work. More specifically, this work has proceeded on the basis that economic theory is essentially sound. If this premise were removed and mainstream economic theory became the subject of inquiry, it is likely that useful new insights into the limitations and merits of environmental economics would be gained in respect of the ecosystem approach and other core concepts of Great Lakes environmental policy. A third promising direction for further research involves attempting to apply ecosystem management lessons from the Great Lakes to other regions of Canada, the United States, and elsewhere. For example, from a comparative standpoint, one interesting question meriting further analysis relates to elucidating the factors contributing to the influence of particular perspectives and disciplines in the development of environmental policy. More generally, comparative analysis, focusing on environmental management in other large

ecosystems, would likely be useful to the proposed establishment of international watershed boards, using an ecosystem approach, along the entire Canadian-United States boundary.<sup>1</sup>

Ultimately, environmental issues in the Great Lakes and elsewhere will continue to be complex and dynamic. The major challenge facing policy-makers and others seeking to anticipate and respond to emerging issues will be how to foster and implement holistic, flexible, and practicable approaches to sustainable ecological stewardship. The diversity and magnitude of resource usage within the Great Lakes basin and globally suggest that the notion of social efficiency cannot be neglected in environmental management. Economic activity will not cease. Therefore, as proponents of an economic perspective of law and policy recognize, it remains essential to appreciate the relationship between the motivations and consequent impact of this fundamental aspect of social life and the broader ecological system.

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<sup>1</sup> IJC, *The IJC and the 21<sup>st</sup> Century* (Windsor: IJC, 1997), online: International Joint Commission <<http://www.ijc.org/comm/21ste.htm>>.

## BIBLIOGRAPHY

### Primary Sources: Treaties, Agreements, and Legislation

*Agreement Between Canada and the United States of America on Great Lakes Water Quality*, 15 November 1978, 30 U.S.T. 1383, as amended by *Agreement Amending the Agreement of November 15, 1978, as amended, on Great Lakes Water Quality*, United States and Canada, 18 November 1987, T.I.A.S. 11551.

*Agreement Between the United States of America and Canada on Great Lakes Water Quality*, United States and Canada, 15 April 1972, 23 U.S.T. 301.

*Anti-Degradation Policy*, 40 C.F.R. §131.12.

Bill C-32, *An Act respecting pollution prevention and the protection of the environment and human health in order to contribute to sustainable development*, 1<sup>st</sup> Sess., 36<sup>th</sup> Parl., 1999.

*Canada-Ontario Agreement respecting the Great Lakes Basin Ecosystem*, Canada and Ontario, 1 April 1994.

*Canada-United States Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes Basin*, Canada and United States, 7 April 1997, online: USEPA <<http://www.epa.gov/glnpo/p2/bns.html>> (last modified: 6 January 1998).

*Clean Water Act of 1977*, 33 U.S.C. §121 *et seq.* (1977).

*Constitution Act, 1867* (U.K.), 30 & 31 Vict., c. 3, ss. 91, 92, reprinted in R.S.C. 1985, App. II, No. 5.

*Final Water Quality Guidance for the Great Lakes System*, 40 C.F.R. pts. 9, 122, 123, 131 and 132 (1995).

*Great Lakes Critical Programs Act of 1990*, 33 U.S.C. §1268 *et seq.* (1993).

*Minimum Requirements for Water Quality Standards Submission*, 40 C.F.R. §131.6.

*Pollution Prevention Act*, 42 U.S.C. §13101 *et seq.* (1990).

*Proposed Water Quality Guidance for the Great Lakes System*, 40 C.F.R. pts. 9, 122, 123, 131, 132 (1993).

*Regulatory Planning and Review*, Exec. Order No. 12866, 58 Fed. Reg. 51735 (1993).

*Treaty Between the United States and Great Britain Relating to Boundary Waters, and Questions Arising Between the United States and Canada (1909)*, United States and Great Britain, 11 January 1909, 36 U.S. Stat. 2448, U.K.T.S. 1910 No. 548.

### **Secondary Sources: Books and Reports**

Allen, T.F.H., B.L. Bandurski & A.W. King, *The Ecosystem Approach: Theory and Ecosystem Integrity*, Report to the Great Lakes Science Advisory Board (Windsor: IJC, 1994).

Aubert E.J., & T.L. Richards, eds., *IFYGL - The International Field Year for the Great Lakes* (Ann Arbor, MI: Great Lakes Environmental Research Laboratory and National Oceanic and Atmospheric Administration, 1981).

Baumol, W.J. & W.E. Oates, *The Theory of Environmental Policy*, 2d. ed. (New York: Cambridge University Press, 1988).

Bloomfield, L.M., & G.F. Fitzgerald, *Boundary Water Problems of Canada and the United States* (Toronto: Carswell, 1958).

Bohm, P., *Social Efficiency: A Concise Introduction to Welfare Economics*, 2d. ed. (London: MacMillan Education, 1987).

Botts, L., & P. Muldoon, *The Great Lakes Water Quality Agreement: Its Past Successes and Uncertain Future* (Dartmouth College, 1996), online: Canada Centre for Inland Waters <<http://www.cciw.ca/glwqa/GLREPORT.html>> (date accessed: 12 November 1998).

Brofenbrenner, U., *The Ecology of Human Development: Experiments by Nature and Design* (Cambridge, Mass.: Harvard Univ. Press, 1979).

Caldwell, L.K., ed., *Perspectives on Ecosystem Management for the Great Lakes - A Reader* (Albany: State University of New York Press, 1988).

Canada, (Environment Canada, Department of Fisheries and Oceans & Health and Welfare Canada), *Toxic Chemicals in the Great Lakes and Associated Effects: Synopsis* (Ottawa: Ministry of Supply and Services Canada, 1991).

—, (Environment Canada), *Reviewing CEPA - The Issues #3: The Ecosystem Approach* (Ottawa: Supply and Services, 1994).

- , Environment Canada, *Pollution Prevention in the Ontario Great Lakes Basin: 1997*, 1997.
- & Ontario, (Environment Canada & Ministry of the Environment and Energy), *First Progress Report under the 1994 Canada-Ontario Agreement respecting the Great Lakes Basin Ecosystem*, (1995), online: Canada Centre for Inland Waters <<http://www.cciw.ca/glimr/data/coa-first-report/intro.html>> (last modified: 16 February 1996).
- & Ontario, (Environment Canada & Ministry of the Environment and Energy), *Second Report of Progress under the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (1995-1997)* (1997), online: Canada Centre for Inland Waters <<http://www.cciw.ca/glimr/data/coa-second-report/intro.html>> (last modified: 18 December 1997).
- & United States, (Environment Canada & USEPA), *Great Lakes Binational Toxics Strategy Implementation Plan and Structure*, online: USEPA <<http://www.epa.gov/glnpo/bns/implplan.html>> (last modified: 30 December 1997).
- & United States, (Environment Canada & USEPA), *Introduction to the Great Lakes Binational Toxics Strategy*, online: USEPA <<http://www.epa.gov/glnpo/p2/bnsintro.html>> (last modified: 2 April 1998).
- Canadian Environmental Law Association, Great Lakes United & National Wildlife Federation, *Treading Water: A Review of Government Progress Under the Great Lakes Water Quality Agreement* (October, 1997).
- Carroll, J.E., *Environmental Diplomacy - An Examination and a Prospective of Canadian-U.S. Environmental Relations* (Ann Arbor: University of Michigan Press, 1983).
- Costanza, R., J. Cumberland, H. Daly, R. Goodland & R. Norgaard, *An Introduction to Ecological Economics* (Boca Raton: St. Lucie Press, 1997).
- DRI/McGraw-Hill, *The Great Lakes Water Quality Initiative: Cost Effective Measures to Enhance Environmental Quality and Regional Competitiveness* (San Francisco: DRI/McGraw-Hill, 1993).
- EAGLE Project, Indigenous Environmental Network & Great Lakes United, *Environmental Injustice in the Great Lakes Water Quality Agreement* (IJC Great Lakes Water Quality Public Forum, Niagara Falls, 2 November 1997).
- Evans, M.S., ed., *Toxic Contaminants and Ecosystem Health: A Great Lakes Focus* (Toronto: Wiley & Sons, 1988).



- Faber, M., R. Manstetten & J. Proops, *Ecological Economics: Concepts and Methods* (Brookfield, VT: Edward Elgar, 1996).
- Federal Reserve Bank of Chicago & Great Lakes Commission, *The Great Lakes Economy: Looking North and South* (Chicago: Federal Reserve Bank of Chicago, 1991).
- Hanley, N., J. F. Shogren & B. White, *Environmental Economics: In Theory and Practice* (London: MacMillan Press, 1997).
- Hickling Corporation, *Economic Instruments for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes Basin*, Report prepared for International Joint Commission (IJC) (Windsor: IJC, 1994).
- Hirsch, W.Z., *Law and Economics: An Introductory Analysis*, 2d. ed. (Toronto: Academic Press, 1988).
- Hirshleifer, J., & A. Glazer, *Price Theory and Applications*, 5<sup>th</sup> ed. (Toronto: Prentice-Hall, 1992).
- Hjalte, K., K. Lidgren & I. Stahl, *Environmental Policy and Welfare Economics* (New York: Cambridge University Press, 1977).
- Hogg, P.W., *Constitutional Law of Canada*, 4<sup>th</sup> ed. (Toronto: Carswell, 1996).
- Holling, C.S., ed., *Adaptive Environmental Assessment and Management*, International Series on Applied Systems Analysis #3 (Chichester, England: John Wiley & Sons, 1978).
- International Joint Commission (IJC), (Great Lakes Research Advisory Board), *Annual Report to the International Joint Commission* (Windsor: IJC, 1977).
- , (Great Lakes Research Advisory Board), *The Ecosystem Approach: Scope and Implications of an Ecosystem Approach to Transboundary Problems in the Great Lakes Basin*, Special Report to the IJC (Windsor: IJC, 1978).
- , *First Biennial Report under the Great Lakes Water Quality Agreement of 1978* (Windsor: IJC, 1982).
- , *Second Biennial Report Under the Great Lakes Water Quality Agreement of 1978* (Windsor: IJC, 1984).
- , *Cleaning Up the Great Lakes* (Windsor: International Joint Commission, 1991).

- , *Sixth Biennial Report under the Great Lakes Water Quality Agreement of 1978* (Windsor: IJC, 1992).
- , *Indicators to Evaluate Progress under the Great Lakes Water Quality Agreement* (Windsor: IJC, 1996).
- , *1995-97 Priorities and Progress under the Great Lakes Water Quality Agreement* (Windsor: IJC, 1997).
- , Great Lakes Water Quality Agreement Public Forum, November 1, 1997, Transcript.
- , *The IJC and the 21<sup>st</sup> Century* (Windsor: IJC, 1997), online: International Joint Commission <<http://www.ijc.org/comm/21ste.htm>>.
- , *Ninth Biennial Report on Great Lakes Water Quality* (Windsor: IJC, 1998).
- , Water Quality Board, *Review of Government Resources and Changing Program Thrusts as They Relate to Delivery of Programs under the Great Lakes Water Quality Agreement*, online: IJC <<http://www.ijc.org/boards/wqb/govres/review.html>> (date accessed: 5 November 1998).
- Kehoe, T., *Cleaning Up the Great Lakes: From Cooperation to Confrontation*, (DeKalb: Northern Illinois University Press, 1997).
- MacKenzie, S.H., *Integrated Resource Planning and Management: The Ecosystem Approach in the Great Lakes Basin* (Washington: Island Press, 1996).
- Mesarovic, M.D., D. Macko & Y. Takahara, *Theory of Hierarchical Multilevel Systems* (New York: Academic Press, 1970).
- Minda, G., *Postmodern Legal Movements: Law and Jurisprudence at Century's End* (New York: New York University Press, 1995).
- Muldoon, P., & M. Valiante, *Toxic Water Pollution in Canada: Regulatory Principles for Reduction and Elimination* (Calgary: Canadian Institute of Resources Law, 1988).
- Nath, S.K., *A Perspective of Welfare Economics* (London: MacMillan Press, 1973).
- National Research Council of the United States & Royal Society of Canada, *The Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management* (Washington: National Academy Press, 1985).
- Ontario Law Reform Commission, *Report on Damages for Environmental Harm* (Toronto: Ministry of the Attorney-General, 1990).

- Organisation for Economic Co-operation and Development, *Evaluating Economic Instruments for Environmental Policy* (Ottawa: Renouf Publishing, 1997).
- Paolucci, B., O.A. Hall & N.W. Axinn, *Family Decision-Making - An Ecosystem Approach* (New York: Wiley, 1977).
- Polinsky, A.M., *An Introduction to Law and Economics* (Toronto: Little, Brown & Co., 1983).
- Posner, R.A., *Economic Analysis of Law*, 5<sup>th</sup> ed. (New York: Aspen Publishers, 1998).
- Revesz, R.L., *Foundations of Environmental Law and Policy* (New York: Oxford University Press, 1997).
- Royal Commission on the Future of the Toronto Waterfront, *Regeneration - Toronto's Waterfront and the Sustainable City: Final Report* (Toronto: Supply and Services Canada, 1992).
- Santos, M.A., *Limits and Scope of Environmental Law* (Springfield: Charles C. Thomas, 1995).
- Scavia D., & A. Robertson, eds., *Perspectives on Lake Ecosystem Modeling* (Ann Arbor, MI: Ann Arbor Science Publishers, 1979).
- Schrecker, T.F., *Political Economy of Environmental Hazards*, Study Paper prepared for the Law Reform Commission of Canada (Ottawa: Law Reform Commission of Canada, 1984).
- Shuter, B.J., J.F. Koonce & H.A. Regier, *Modeling the Lake Erie Walleye Population: A Feasibility Study*, GLFC Rep. 32 (Ann Arbor, MI: Great Lakes Fishery Commission, 1979).
- Slocombe, D.S., *Ecosystem Approaches: An Annotated Multidisciplinary Bibliography*, Working Paper No. 1 (Waterloo: Wilfred Laurier University & International Union for Conservation of Nature and Natural Resources, 1991).
- United Nations, *Agenda 21: Programme of Action for Sustainable Development, Rio Declaration on Environment and Development, and Statement of Forest Principles - Final Text of Agreements Negotiated by Governments at the United Nations Conference on Environment and Development (UNCED), 3-14 June 1992, Rio de Janeiro, Brazil* (New York: United Nations Department of Publications, 1992).

United States, United States Environmental Protection Agency (USEPA), *Regulatory Impact Analysis of the Great Lakes Water Quality Guidance - Final Report* (March 1995).

—, USEPA, *Water Quality Guidance for the Great Lakes System: Supplementary Information Document*, EPA-820-B-95-001 (March, 1995).

—, USEPA, *Protecting the Great Lakes: The Costs and Benefits of Reducing Toxic Pollution in Three Communities*, EPA-820-F-95-004 (November, 1995).

—, USEPA, *Great Lakes Water Quality Initiative: A Summary* (March 1995), online: USEPA, Office of Water <<http://chagrin.epa.ohio.gov/gli/gli7.html>> (last modified: 5 June 1998).

— & Canada, (USEPA & Environment Canada), *Practical Steps to Implement an Ecosystem Approach in Great Lakes Management*, Workshop Report (Detroit: Wayne State Univ., 1995).

#### **Secondary Sources: Articles, Chapters of Texts, Conference Papers, and Newspaper Articles**

Allardice, D.R., R.H. Mattoon & W.A. Testa, "Industry Approaches to Environmental Policy in the Great Lakes Region" (1994) 25 U. Tol. L. Rev. 357.

Allardice, D.R., & S. Thorp, "A Changing Great Lakes Economy: Economic and Environmental Linkages" (Background Paper presented at State of the Lakes Ecosystem Conference, Dearborn, Michigan, October 26-28, 1994), online: Consortium for International Earth Science Information Network <<http://epawww.ciesin.org/glreis/nonpo/ndata/solec/economic/economic.html>> (date accessed: 3 October 1998).

Bach, C.L., & J. Edstrom, "Achieving Environmental Protection in a High-Performance Economy: A Great Lakes Perspective" (1995) 26 U. Tol. L. Rev. 305.

Bartlett, R.V., "Ecological Rationality: Reason and Environmental Policy" (1986) 8 Environmental Ethics 221.

Beder, S., "Charging the earth: The promotion of price-based measures for pollution control" (1996) 16 Ecological Economics 51.

Booth, D.E., "Ethics and the limits of environmental economics" (1994) 9 Ecological Economics 241.

- Caldwell, L.K., "Problems of Applied Ecology: Perceptions, Institutions, Methods, and Operational Tools" (1966) 16 *BioScience* 524.
- , "Introduction: Implementing an Ecological Systems Approach to Basinwide Management" in L.K. Caldwell, ed., *Perspectives on Ecosystem Management for the Great Lakes - A Reader* (Albany: State University of New York Press, 1988).
- "Canadians Green Up Again" (1998) 8 *Environment Policy & Law* 669.
- Cangelosi, A., "Economic Valuation of Environmental Benefits" (Sept./Oct. 1998) *Northeast Midwest Economic Review* 7.
- Christie, W.J., "The Ecosystem Approach to Managing the Great Lakes: New Ideas and Problems Associated With Implementing Them" (1995) 26 *U. Tol. L. Rev.* 279.
- , M. Becker, J.W. Cowden & J.R. Vallentyne, "Managing the Great Lakes Basin as a Home" (1986) 12 *J. Great Lakes Res.* 2.
- Cinti, T., "The Regulator's Dilemma: Should Best Available Technology or Cost Benefit Analysis Be Used To Determine the Applicable Hazardous Waste Treatment, Storage and Disposal Technology?" (1990) 16 *Rutgers Computer & Tech. L.J.* 145.
- Cleaveland, C.J., "Basic Principles and Evolution of Ecological Economics" in ProEdit Cassette, ed., *Ecological Economics: Emergence of a New Development Paradigm*, Proceedings of a Workshop sponsored by The Institute for Research on Environment and the Economy & The Canadian International Development Agency (Ottawa: Institute for Research on Environment and the Economy, 1993) 25.
- Costanza, R., "What is Ecological Economics?" (1989) 1 *Ecological Economics* 1.
- Cropper, M.L., & W. E. Oates, "Environmental Economics: A Survey" (1992) XXX *J. Econ. Lit.* 675 at 681, reproduced in Oates, *The Economics of Environmental Regulation* (Brookfield, VT: Edward Elgar Publishing, 1996) 381.
- Donahue, M.J., "Institutional Arrangements for Great Lakes Management" in Caldwell, L.K., ed., *Perspectives on Ecosystem Management for the Great Lakes - A Reader* (Albany: State University of New York Press, 1988).
- , "Water Resources and Policy" (Chap. 6) in Federal Reserve Bank of Chicago & Great Lakes Commission, *The Great Lakes Economy: Looking North and South* (Chicago: Federal Reserve Bank of Chicago, 1991).
- Edwards, S., "In Defense of Environmental Economics" (1987) 9 *Environmental Ethics* 73.

- Evans, M.S., "Toxic contaminants and Great Lakes ecosystem health: current understandings and strategies for improved assessments" (1993) 2 J. Aquat. Ecosyst. Health 87.
- Francis, G.R., "Great Lakes Governance and the Ecosystem Approach: Where Next?" in Caldwell, L.K., ed., *Perspectives on Ecosystem Management for the Great Lakes - A Reader* (Albany: State University of New York Press, 1988).
- , "Flexible Governance" in C.J. Edwards & H.A. Regier, eds., *An Ecosystem Approach to the Integrity of the Great Lakes in Turbulent Times*, Great Lakes Fisheries Commission (GLFC) Spec. Pub. 90-4 (Ann Arbor: GLFC, 1988) 195.
- Gallagher, S.P., "Great Lakes Water Quality Initiative: National Standards Governing a Binational Resource" (1995) 2 Indiana J. Global Leg. Stud. 465, online: Indiana University School of Law <<http://www.law.indiana.edu/glsj/glsj.html>> (date accessed: 25 October 1998).
- Gilbertson, M., "Are causes knowable? Some consequences of successional versus toxicological interpretations of the Great Lakes Water Quality Agreement" (1997) 54 Can. J. Fish. Aquat. Sci. 483.
- Gonzalez, O.J., "Formulating an Ecosystem Approach to Environmental Protection" (1996) 20 Environmental Management 597.
- Grey, S., "Environmental Protection Thinning: As Government Funding Dries Up and Public Interest Turns to Indifference, the Watchdogs are Beginning to Fade Away" *The Globe and Mail* (19 August 1997) A1.
- Gurtner-Zimmermann, A., "A Mid-Term Review of Remedial Action Plans: Difficulties With Translating Comprehensive Planning Into Comprehensive Action" (1995) 21 J. Great Lakes Res. 234.
- Hartig, J.H., & J.R. Vallentyne, "Use of an Ecosystem Approach to Restore Degraded Areas of the Great Lakes" (1989) 18 Ambio 423.
- Hartig, J.H., R.L. Thomas & E. Iwachewski, "Lessons from practical application of an ecosystem approach in management of the Laurentian Great Lakes" (1996) 2 Lakes & Reservoirs: Research and Management 137.
- Kelman, S., "Cost-Benefit Analysis: An Ethical Critique" in C. Pierce & D. VanDeVeer, *People, Penguins, and Plastic Trees*, 2d. ed. (Belmont, CA: Wadsworth, 1995) 384.

- Kitchell, J.F., D.J. Stewart & D. Weininger, "Applications of a bioenergetic model to yellow perch (*Perca flavescens*) and Walleye (*Stizostedion vitreum vitreum*)" (1977) 34 J. Fish. Res. Board Can. 1922.
- Knetsch, J.L., "Economics, Losses, Fairness, and Resource-Use Conflicts" in M. Ross & J.O. Saunders, eds., *Growing Demands on a Shrinking Heritage: Managing Resource-Use Conflicts*, Essays from the Fifth Institute Conference on Natural Resources Law (Calgary: Canadian Institute of Resources Law, 1992) 20.
- Kunkle, L.K., "Interstate Water Quality Conflicts and the Great Lakes Initiative: Is it the Solution to Calming the Waters?" (1994) 25 U. Tol. L. Rev. 457.
- Lee, B.J., H.A. Regier & D.J. Rapport, "Ten Ecosystem Approaches to the Planning and Management of the Great Lakes" (1982) 8 J. Great Lakes Res. 505.
- Leonard, H.B., & R. J. Zeckhauser, "Cost-Benefit Analysis Defended" in D. VanDeVeer & C. Pierce, eds., *People, Penguins, and Plastic Trees* (Belmont, CA: Wadsworth, 1986) 249.
- MacKenzie, S.H., "Ecosystem Management in the Great Lakes: Some Observations from Three RAP Sites" (1993) 19 J. Great Lakes Res. 136.
- , "Toward Integrated Resource Management: Lessons About the Ecosystem Approach from the Laurentian Great Lakes" (1997) 21 Environmental Management 173.
- Malloy, R.P., "A New Law and Economics" (Ch. 1) in R. P. Malloy & C. K. Braun, eds., *Law and Economics: New and Critical Perspectives* (New York: Peter Lang Publishing, 1995).
- Manno, J., "Advocacy and Diplomacy in the Great Lakes: A Case History of Non-Governmental-Organization Participation in Negotiating the Great Lakes Water Quality Agreement" (1993) 1 Buff. Env. L.J. 1.
- Mercuro, N., & S. G. Medema, "Schools of Thought in Law and Economics: A Kuhnian Competition" in R. P. Malloy & C. K. Braun, eds., *Law and Economics: New and Critical Perspectives* (New York: Peter Lang Publishing, 1995) 65.
- Milbraith, L.W., "A Governance Structure Designed to Learn Would Better Protect the Great Lakes Ecosystem" in Caldwell, L.K., ed., *Perspectives on Ecosystem Management for the Great Lakes - A Reader* (Albany: State University of New York Press, 1988).

- Mishan, E.J., "Welfare Criteria: Resolution of a Paradox" in E. J. Mishan, *Economic Efficiency and Social Welfare: Selected Essays on Fundamental Aspects of the Economic Theory of Social Welfare* (London: George Allen & Unwin, 1981) 33.
- Muldoon, P., "Bilateral and Multilateral Dimensions of International Environmental Law" (Chap. 15) in E.L. Hughes, A.R. Lucas & W.A. Tilleman, eds., *Environmental Law and Policy*, 2<sup>nd</sup> ed. (Toronto: Emond Montgomery Publications, 1998).
- Munton, D., "Toward a More Accountable Process: The Royal Society - National Research Council Report" in Caldwell, L.K., ed., *Perspectives on Ecosystem Management for the Great Lakes - A Reader* (Albany: State University of New York Press, 1988).
- Odum, E.P., "The Strategy of Ecosystem Development" (1969) 164 *Science*.
- Rescher, N., "Economics Versus Moral Philosophy: The Pareto Principle as a Case Study" in N. Rescher, *Unpopular Essays on Technological Progress* (Pittsburgh: University of Pittsburgh Press, 1980) 69.
- Reynoldson, T.B., "The development of ecosystem objectives for the Laurentian Great Lakes" (1993) 2 *J. Aquat. Ecosyst. Health* 81.
- Schaefer, K.A., & S. Bailey, "Socio-Economic Considerations in Remedial Action Planning in the Great Lakes Basin" in Coastal Zone Canada 1994, ed., *Co-operation in the Coastal Zone*, Conference Proceedings, vol. 2 (Dartmouth: Coastal Zone Canada Association, 1994) 663.
- Schulze, P.C., "Cost-benefit analyses and environmental policy" (1994) 9 *Ecological Economics* 197.
- Siros, S.M., "Transboundary Pollution in the Great Lakes: Do Individual States Have Any Role to Play in its Prevention?" (1996) 20 *S. Ill. U.L.J.* 287.
- Slocombe, D.S., "Environmental Planning, Ecosystem Science, and Ecosystem Approaches for Integrating Environment and Development" (1993) 17 *Environmental Management* 289.
- Smith, V.K., "Preface" in V. K. Smith, ed., *Estimating Economic Values for Nature* (Brookfield, VT: Edward Elgar, 1996) xiii.
- Spurr, S.H., "The Natural Resource Ecosystem" (Ch. 1) in G.M. Van Dyne, ed., *The Ecosystem Concept in Natural Resource Management* (New York: Academic Press, 1969) 3.



- Toope, S.J., & J. Brunnée, "Freshwater Regimes: The Mandate of the International Joint Commission" (1998) 15 Arizona J. Int'l & Comp. L. 273.
- Valiante, M., & P. Muldoon, "Ecosystem Governance: Some Lessons from the Great Lakes Regime" (Dartmouth College Conference on International Governance in the Twenty-first Century, September 14-16, 1995) [unpublished].
- Vallentyne, J.R., "Workshop on 'Implementing an Ecosystem Approach to Management in the Great Lakes Basin', Held at Hiram College, Hiram, Ohio, During 22-24 March, 1983" (1983) 10 Environmental Conservation 273.
- , "The Ecosystems Approach to Pollution in the Great Lakes" (Paper presented at Third Annual International Conference: Lake, River and Coastal Pollution - Can it be Contained?, Cork, Ireland, November 5-6, 1987) vol. 4:9
- , & M. Munawar, "From aquatic science to ecosystem health: a philosophical perspective" (1993) 2 J. Aquat. Ecosyst. Health 231.
- Veeman, T.S., "Benefit-Cost Analysis in Environmental Decision-Making: Procedures, Perils and Promise" in Canadian Society of Environmental Biologists, Alberta Chapter, *Economy and Ecology: The Economics of Environmental Protection* (Symposium, University of Alberta, February 19-20, 1985) 129.
- Wellington, A. & A. Greenbaum, "Social Conflict and Environmental Law: Editors' Note" in A. Greenbaum, A. Wellington & E. Baar, eds., *Social Conflict and Environmental Law: Ethics, Economics and Equity*, vol. 1 (North York: Captus Press, 1995).
- Wever, G., "Alternative Strategies to Reduce Effects of Persistent Toxic Chemicals in the Natural Environment: A Great Lakes Regional Perspective" (1993) 1 Buff. Env. L.J. 317.