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Canada

LEGAL ASPECTS OF GROUNDWATER QUANTITY ALLOCATION AND QUALITY PROTECTION IN CANADA

By

Kenneth Kanu Orie, LL.B., B.L., LL.M.
Graduate Program in Law.
Institute of Comparative Law.
Faculty of Graduate Studies and Research.
McGill University, Montreal.
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ABSTRACT

Groundwater quantity allocation and quality protection in Canada largely proceed in a fragmented fashion. Each jurisdiction pursues the management of its water resources and the aquatic environment separately as well as independently of other jurisdictions. This approach is at odds with the unity of the natural environment and the inter-connectedness of groundwater resources.

The challenge facing Canada is to make the law recognize and be more responsive to the unity of the aquatic environment and water resources. An active federal role in uniting and coordinating the efforts of the provinces in this regard is crucial if this challenge is to be met. However, since the constitutional division of powers in Canada encourages a fragmented approach to managing environment and water resources, the federal government is incapacitated, purely on a legal score, with respect to pulling together the efforts of the provinces. A cooperative approach, based on political rather than legal coordination, is therefore, the most realistic option for the federal government to meet the challenge.

In this work, the writer examines the various areas for federal-provincial cooperation regarding groundwater allocation and protection. Such institutional integration or cooperation cannot be effective unless groundwater is addressed together with the other component of the hydrologic cycle, namely: surface water and the ecosystem they support. At the same time, in adopting an integrated hydrologic cycle approach, specific groundwater management strategies canvassed in this work must be taken into account if groundwater is to be more efficiently allocated and protected. Pursuant to these considerations, this writer is of the opinion that groundwater resources in Canada should be managed in a way that meets both present and future needs of Canadians, thus in a sustainable fashion. This can best be achieved if resource management relies upon a combination of contaminant-focused and resource-focused approaches adopted under unified federal-provincial efforts as well as under an integrated hydrologic cycle management.

RESUME

Au Canada, la compétence pour l'allocation en terme de la quantité et de la protection du point de vue de la qualité des eaux souterraines est fragmentée. Chaque juridiction se dirige, de manière séparée et l'une indépendamment de l'autre, a la gestion de ses propres ressources aquafères et de son environnement aquatique. Cette façon de procéder est difficilement compatible avec, d'une part le caractère unitaire même de l'environnement et d'autre part le fait de l'interconnection des ressources aquafères.

Le défi pour le Canada est de rendre le droit plus sensible et donc de mieux faire prendre compte par celui-ci, de la réalité unitaire de l'environnement aquatique et de celle des ressources en eau. Afin de rélever un tel défi, le gouvernement fédéral se doit de jouer un rôle actif pour l'unification et la coordination des efforts de chacune des provinces sur ce sujet. Toutefois, le partage constitutionnel des compétences - favorisant plutôt une approche parcellaire de la gestion et de l'administration de l'environnement et des ressources en eau - se présente comme un obstacle pour le gouvernement, qui se trouve handicapé au plan purement juridique pour mener à bien une telle concertation. Une approche coopérative fondée sur une coordination politique plutôt que légale, serait l'option la plus réaliste que pourrait choisir le gouvernement fédéral, pour répondre aux exigences de la gestion des ressources aquafères.

Dans son travail, l'auteur examine les différents domaines pour une coopération fédérale provinciale, en matière de l'allocation et de la protèction des eaux souterraines. Une telle intégration ou coopération au plan institutionnel, ne peut être efficace que dans la mesure où la question est abordée en conjonction avec les autres composantes du cycle hydrologique: soit les eaux de surface et l'écosystème que ces eaux (souterraines et de suface) supportent. Par ailleurs afin de mieux allouer et protéger les dites-ressources, l'adoption de l'approche intégrée du cycle hydrologique doit prendre également en compte les stratégies spécifiques exposées dans ce travail. A la lumière de ces considérations, l'auteur croit que, les ressources aquafères canadiennes doivent être gérées de manière à préserver la capacité de satisfaire aux besoins présents et futurs des canadiens. Cet objectif ne peut être atteint que si l'on adopte un cadre de gestion intégrée du cycle hydrologique, de même qu'un cadre où l'emphase est mise sur la règlementation des polluants et sur la gestion des eaux en tant que ressources, le tout adopté grâce aux efforts conjoints des gouvernements fédéral et provinciaux.

PREFACE

The conservation of water resources and the aquatic environment is posing a tremendous challenge to the world. Canada, with its large share of the world's water resources and the aquatic environment must prove to be a good custodian of these natural resources. The challenge it faces is thus more prominent and must be met.

Much of the legal discourse on and research into water resources management has centered on surface water. There is a dearth of legal contributions to the management of Canada's groundwater resources in terms of both quantity and quality. This work sets out to make, from a legal point of view, a comprehensive contribution to a more efficient management of this resource in Canada.

I owe the success of this work to the only living, loving, powerful and wise God, the Lord Jesus Christ in whom is hidden all the treasures of wisdom and knowledge and, by whose grace, I was strengthened and encouraged to the completion of this work. Professor Brunnee, my supervisor brought her legal scholarship to bear upon this work. I thank her for her immense contributions in fashioning the conceptual approach followed in this work and her overall thorough supervision. I also thank my parents, Mr. and Mrs. Stanford Nwamuo Orie, my brothers: Amaefule and Ndubuisi and my sisters: Ihuoma, Ugwuezi and Ogonnaya for their moral support. I acknowledge the financial support of McGill University by way of school fees and funding of the printing of this work. Also, my thanks go to the Law Foundation of British Columbia for their financial support while I was pursuing

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I gladly dedicate this work to the glory of God the father and the Lord Jesus Christ. Amen.

The author can be contacted at the following addresses:

P.O. Box 32
New Westminster, B.C.
CANADA
V3L 4X9
Phone # 604 - 325 4361

Or

G.P.O. Box 3100
Marina, Lagos
NIGERIA

INTRODUCTION

Freshwater is considered the most valuable natural resource endowed to humankind. Water supports human and aquatic life and the environment. How this resource is managed in terms of use and protection is, therefore, crucial to the survival of any society. This work examines the legal aspects of Canadian efforts to allocate groundwater and protect it from contamination. It does not engage in discussion on remediation of groundwater problems after contamination. It, however, refers to federal-provincial agreements in this area as appropriate model for groundwater resources management and protection. Where appropriate, the work draws upon the American experience to canvass approaches Canada could adopt to promote efficient management and protection of groundwater resources. The American case is chosen because the United States face similar water supply, demand and management problems, though of a more urgent nature than Canada is facing as of yet.

The environment, particularly the aquatic environment, is scientifically proven to be a single connected entity. The unity of the environment does not respect political or spatial boundaries. The major problem in dealing with groundwater concerns in Canada is the fragmented legal approach in place at both the federal and provincial levels. Each political unit is saddled with addressing its water resources and environment as if they were unconnected with the water resources and environment of neighbouring political units. This fragmentation stems from the constitutional division of powers between the federal government and the provinces. Furthermore,

groundwater management laws are fragmented within each political unit. There is no law in Canada which would address groundwater problems in a comprehensive fashion.

Unless the efforts of all political entities are harmonized, and the patch-work of laws dealing with groundwater concerns are articulated more comprehensively and inclusively to enhance their administration, the challenge of efficient management of groundwater resources cannot be met. This work explores ways in which the present state of the law regarding groundwater management could be modified to better accommodate the "new" reality of environmental unity which was not and could not have been the original focus of the existing laws and the constitutional division of powers. Sustainable development is raised as a force that could pull together efforts of the different political units.

Thus, conceptually, a case is made for a "holistic" approach to groundwater management. This means that groundwater and related resources such as surface water and the ecosystem they support must be dealt with simultaneously under a unified effort of both the federal and provincial governments. This approach recognizes the interconnected components of the aquatic environment, namely: groundwater, surface water and the ecosystems as a unity. The following is an overview of how this work addresses the issues above raised.

In Chapter One, a case is made for greater government attention to the management of groundwater. It sets out the scientific facts underlying the legal discussion of groundwater problems. Also, factors which threaten Canada's water

supplies, for example, uneven natural distribution of surface water resulting in areas of relative water scarcity, pollution and potential climate change are examined. In addition, factors which increase demand for water, such as increase in population, the expansion of industrial and agricultural activities and water waste due to poor demand- management are addressed. A review of these factors provides strong indications that governments should take water resources management and particularly groundwater management more seriously.

Furthermore, the problems of groundwater management in Canada are identified. The inadequate recognition of the environment as a natural cohesive unity while it should be more efficiently managed by unified rather than fragmented efforts of the federal and provincial governments, is identified as a major challenge. Other problems include integrating or coordinating groundwater quality and quantity, their relationship to surface water quantity and quality and the proper application of land use as a tool for groundwater protection.

The constitutional mandate of both the federal and provincial governments in managing groundwater resources is the focus of Chapter Two. Although there is no express mention of the environment or water resources in the Constitution, judicial interpretations of the traditional heads of power of both levels of government have promoted fragmented efforts of both levels in managing the environment and the water resources of Canada. This development fundamentally contradicts the ecological reality of the environment as a natural unity demanding a unified effort by

those who manage it for a more efficient result.

Efforts to achieve a unified effort to managing the environment including the water resources outside of the Constitution, that is in the political context, by means of cooperative agreements and the limitations of such agreements are also examined. The strengths and weaknesses of these agreements almost invariably determine the effectiveness of management efforts. By comparison, a unified approach to managing the environment in the United States is supported by law. Interestingly, even at the inherently fragmented international level efforts are made to foster rules that transcend national sovereignty to recognize ecological unity.

Since groundwater resources are owned by the provinces under the Constitution, the provinces manage the allocation of groundwater quantity. This is the subject of Chapter Three. Management of groundwater allocation, however, presents enormous challenges which the individual provinces alone cannot meet. The law is reactive and responsive to changing needs of the society. This explains the evolution of the common law water doctrines and the changes they have undergone. Ultimately the changes have culminated into statutory regimes which must be fine-tuned when and where necessary to meet the needs of modern society.

Federal jurisdiction over fisheries and navigation bears upon provincial allocation of surface water frequented by fish or which is navigable and hydrologically connected to groundwater. Arguably, such a hydrological connection makes even the allocation of groundwater an incidental or indirect concern of the federal government.

More important, however, is the emphasis on areas of federal-provincial cooperation in order to achieve efficient management of the resource. Included in these areas are: making water available to areas of scarce supplies, promoting efficient demand-management to discourage waste of water, and providing financial and technical assistance for charting and assessing of aquifers to determine their safe yields so that allocation decisions can be more efficiently guided. The allocation policies and laws of different provinces are examined and criticized. Ways of improvement are suggested where appropriate.

In Chapter Four, the common law is examined and found to be inadequate to protect the quality of the environment. To the extent that environmental protection is a public interest concern, the common law which is premised on private proprietary interest can not provide the desired protection. The law must nonetheless respond to this broader public interest in protecting the environment. For this reason, the federal government policy and legal framework on the environment are examined. Again, owing to the constitutional situation, federal legislation touches groundwater concerns only indirectly or incidentally. In the main, federal laws are sectoral or contaminant-focused rather than comprehensive and inclusive. The Federal Water Policy of 1987 outlines more direct federal measures for groundwater management. In large part, however, these measures are to be taken in cooperation with the provinces. The Department of the Environment's (DOE's) groundwater protection strategy for the implementation of federal policy on groundwater is also examined.

The strategy has the potential of revolutionizing groundwater management in Canada because it combines contaminant-focused and resource-focused elements of groundwater management. It also emphasizes areas of federal-provincial cooperation to manage groundwater concern better. There are, however, constraints facing the implementation of this strategy, a more prominent one being funding. Furthermore, the contaminant-focused and resource-focused elements of the DOE Strategy need to be developed further. Options for achieving this are discussed with reference to the American experience. The American Constitution allows Congress to enact laws with far- reaching protection effect on groundwater quality. States are assigned some roles, but within the umbrella legislation of Congress. The American approach particularly as articulated in the Environmental Protection Agency's (EPA) groundwater protection strategy offers some guidelines on how the DOE strategy could be improved.

As in the case of groundwater quantity allocation, groundwater quality protection falls primarily under provincial jurisdiction. Chapter Five deals with provincial approaches to groundwater protection. One approach commonly taken is contaminant-focused. Under this approach, laws designed to control sources of environmental pollution are examined. These laws directly relate to groundwater only in a technical and practical way. While some jurisdictions have weak laws, others have strong laws. The weaknesses and strengths of these laws and the extent to which they protect groundwater quality in the various provinces are explored. By virtue of their

focus, these laws are inherently fragmented rather than comprehensive. Each deals with a different source of groundwater contamination. A harmonization of these laws through a federal leadership role would produce a better result by taking into account the unity of the environment.

Another common approach is resource-focused. Under this approach, aquifer delineation, assessment, and classification according to yield, quality and vulnerability to contamination are discussed. Protection strategies such as monitoring of groundwater quality and protection areas through land-use practices are addressed. The role of municipal or local governments in undertaking pilot projects and using zoning and subdivision ordinances to protect groundwater quality is also stressed. Some contaminant-focused and resource-focused elements of groundwater protection are articulated and suggested as components of a model comprehensive provincial groundwater protection law.

Largely, owing to lack of financial and technical resources, both the contaminant-focused and resource-focused elements of groundwater protection programs in the provinces are inadequate. Although federal initiatives as indicated in the Federal Water Policy and the DOE strategy are being offered to the provinces, more federal funding and the improvements suggested in this work would enhance efficient management of groundwater resources.

In conclusion, ways of integrating water resources and managerial efforts to achieve the goal of managing Canadian water resources to meet present and future

needs are being canvassed. The hydrological connection of surface and groundwater demands integrated or at least coordinated management of both resources and the ecosystems they support. However, care must be taken to avoid managing too many elements at the same time so as not to blur management goals or misapply managerial efforts. Therefore, a streamlined, integrated approach to water resources management is advocated. This means that both the resources, that is, the management variables, and the institutions involved in managing them must be narrowed down. The fewer the institutions, the easier the integration or coordination of management efforts. Of more importance is the integration of federal and provincial efforts in managing water resources and groundwater in particular.

While groundwater must not be managed separately from surface water hydrologically connected to it, the management elements canvassed in this work must be respected if the resource is to be more efficiently managed. This writer believes that for groundwater resources to be managed to meet the needs of both present and future generations of Canadians, there must be more unified efforts on the part of the federal and provincial governments than there are at present. Such efforts must view the aquatic environment as a single continuum, a natural cohesive unity which does not respect political boundaries and which does not, therefore, lend itself to a fragmented approach. A combination of the contaminant-focused and resource-focused approaches under integrated or unified federal-provincial efforts as well as integrated management of the hydrologic cycle will yield a more efficient management of Canada's water resources.

CHAPTER ONE

CANADA'S WATER SITUATION: A CASE FOR GREATER GOVERNMENT ATTENTION TO GROUNDWATER MANAGEMENT AND PROTECTION FROM CONTAMINATION

Water is a unique resource endowed to man by nature. It can be fresh as in rivers and lakes or salty as in oceans. Whether fresh or salty, water supports life, social and economic activities. While some countries enjoy abundant water supply, others have only scarce supplies. Although a renewable resource, freshwater is finite in many ways. A country of abundant water supply today may suffer scarcity tomorrow because of the way it manages its water. Already there is a threat of global water scarcity.[1] Efficient management of water resources is, therefore, crucial to meet both present and future needs.

A. THE HYDROLOGIC CYCLE

Water naturally exists in a cycle called the hydrologic cycle.[2] The hydrologic cycle is encompassed in the earth's hydrosphere which is defined as "solid, liquid and

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[1] M. Keating, Towards a Common Future A Report on Sustainable Development and its Implications for Canada (Ottawa: Supply and Services Canada, 1989) at 17.

[2] The hydrologic cycle and groundwater process are more complicated than presented in this work. The discussion here offers only a simple appreciation of the subject. It is intended to provide a simple scientific basis to allow a meaningful discussion of the law of groundwater management and protection.

gaseous water layer of variable thickness".[3] Within the hydrologic cycle water changes its form and location. While some water in surface water bodies evaporates under the heat of the sun, some water in the soil is lost to the atmosphere through vegetation transpiration. Over time, atmospheric water condenses in cloud form and results in precipitation (rain or snow). Some of the precipitation deposited on land surface runs off into water bodies, some percolates into the ground to provide soil moisture and ground water[4].

Thus, surface and ground water are components of the hydrological cycle. Both are part of the environment which support wetlands, aquatic life and other ecosystems.[5] Management of water resources, therefore, should ideally consider not only the resources themselves but also the ecological environment they support. As one writer has said, a shift from water management which does not consider the water cycle as part of the ecosystem to an ecologically based approach to water would better serve and sustain increasing human population.[6] According to The Brundtland Report the world environment is a cohesive unity because "ecosystems

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[3] L.E. Mack, Ground Water Management In Development Of A National Policy On Water. Prepared for the United States of America's National Water Commission, (Arlington, Virginia: U.S.A., 1971) at 2-3.

[4] J.J. Sharp and P.G. Sawden, Basic Hydrology (London; Boston: Butterworths & Co. Publishers Ltd., 1984) at 74. See also, L.B. Leopold, Water: A Primer (San Francisco: W.H. Freeman & Co., 1974) at 9-11.

[5] See infra notes 74-76, 78, 79.

[6] M. Falkenmark, "New Ecological Approach to the Ticket to the Future" (1984)13 Ambio No.3 at 156.

do not respect national boundaries".[7] The natural unity of the environment which ecompasses the hydrological cycle demands a unified management approach, that is, a "holistic" approach.

While the various components of the hydrologic cycle are mentioned in appropriate context, the main focus of this work is groundwater.

B. GROUNDWATER PROCESSES

I. Groundwater Occurrence:

The earth's subsurface is divided into two hydrologic zones: the "soil zone" and the "groundwater" zone. While the soil zone lies above the water table, the groundwater zone lies below it.[8] The water table is the interface between the soil zone and the groundwater zone.

The soil zone in turn is subdivided into three zones: (a) the "soil-water zone" which extends from the ground surface downwards with depths being determined by soil type and vegetation; (b) the "intermediate zone" extending from the depth or the base of the soil-water zone to the top of the capillary zone and serving as a conduit for the passage of water from the "near-ground surface region" to the "near-water

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[7] The World Commission on Environment and Development, Our Common Future (Oxford: Oxford University Press, 1987) at 38.

[8] E.A. Keller, Environmental Geology 5th ed.(Columbus, Toronto, London, Melbourne: Merrill Publishing Co., 1988) at 37.

table region"; and (c) the "capillary zone" extending from the "water table to a height determined by the capillary rise which can be generated by the soil."[9]

In the groundwater zone the pores or empty spaces between the soil particles are filled or saturated with water. This is what hydrologists understand to be groundwater and define more specifically as

> that portion of water beneath the surface of the earth that is under pressure greater than atmospheric such that it will flow into open holes dug into the earth or will naturally move to the earth's surface in the form of seepage or springs.[10]

Groundwater occurs in certain geological formations in the subsurface such as sands, gravels, sandstones, clays and silts and bed rocks.[11] Earth materials are classified according to their water bearing, storing and transmission capacities. Saturated, unconsolidated, porous and permeable earth materials such as sands, gravels, limestones and fractured rocks which can bear, store and transmit water at

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[9] D.K. Todd, Groundwater Hydrology (New York: John Wiley Inc., 1959) at 17-26. The soil-water zone is unsaturated except during the period of heavy infiltration. The zone contains three types of water namely: hygroscopic water which is absorbed from the atmosphere; capillary water which is held by surface tension; and gravitational water which drains or seeps through the soil.

[10] L.W. Canter et al, Groundwater Quality Protection (Chelsea, Michigan: Lewis Publishers Inc., 1987) at 21. In other words, according to Canter et al., soil moisture or water in the soil zone which is at a pressure below atmospheric pressure is not considered to be groundwater.

[11] J.A. Cherry, "Contaminant Migration in Groundwater: Process and Problems" in Proceedings of the Second National Water Conference, The State of Toxic In Surface and Ground Waters, January 24-25, 1984 (Philadelphia: The Academy of Natural Science, 1984) at 67.

a rate that it can be beneficially or economically used, are known as aquifers.[12]

There are unconfined and confined aquifers. An unconfined aquifer does not have any impermeable earth material on its surface and sometimes it discharges water in form of springs. A confined aquifer on the other hand lies in between two impermeable earth materials which exert pressure on it resulting in an "artesian condition".[13] Water in confined aquifers is usually extracted by sinking a well. As water is withdrawn from the well, groundwater flows to the direction of the well in response to pressure. Where the flow is resisted or delayed by earth materials, a cone-shaped depression of the ground surface around the well will occur.[14] Not all saturated earth materials are aquifers. For example, an unfractured saturated clay material is not an aquifer because it cannot transmit water at a beneficial rate and quantity. Such earth materials are known as aquitards (aquiclude).[15]

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[12] R.A. Freeze and J.A. Cherry, Groundwater (Englewood Cliffs, New Jersey: Prentice Hall Inc., 1979) at 47. According to Keller, supra, note 8 at 38, porosity refers to the percentage of empty spaces in between earth materials, and permeability refers to the measure of the ability of water to pass through a particular earth material. Keller gives the porosity of certain earth materials in percentage and the permeability in cubic metres per day/Sq. metres. For porosity: clay, 45; sand, 35; gravel, 25; gravel and sand, 20; sandstone, 15; dense limestone or shale, 5; and granite, 1. Their permeabilities are respectively 0.041; 32.8, 205.0; 82.0; 28.7; 0.041 and 0.0041.

[13] Freeze and Cherry, supra, note 12, at 47, 48. "Artesian condition" refers to the rise of water by natural pressure above aquifer level or above ground surface.

[14] W. Viessman and M.J. Hammer, Water Supply and Pollution Control (New York: Harpers and Row Publishers, 1985) at 88. The cone of depression continues until the withdrawn water is replenished and steady flow is maintained.

[15] Freeze and Cherry supra, note 12, at 47,48, 145. According to the authors, the distribution of aquitards and aquifers in a geologic environment is a function of the lithology, stratigraphy and structural features of a particular area. Lithology refers to

II. Groundwater Flow:

Upon precipitation, water percolates downwards first to the soil zone and then passing through the water table belt to the groundwater zone.[16] In the groundwater zone, water flow through the inter-connected pores of subsurface earth materials is governed by Darcy's law of flow of fluid through porous media. Under Darcy's law[17] the flow rate or velocity of fluid (including groundwater) is proportional to the hydraulic gradient (which is generally proportional to topography), the hydraulic conductivity and the porosity of the subsurface materials. Thus, in a down gradient geologic formation, the velocity of groundwater flow would be high if the flow direction from the pressure generating point is downward. The velocity will, however be low if the reverse is the case.

Conductivity of water through the aquifers is dependent upon permeability,

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the "physical make up, including the mineral composition, grain size, grain packing, of sediments or rocks that make up the geological systems". Stratigraphy refers to the "geometrical and age relations between the various lenses, beds, and formations in geologic systems of sedimentary origin." Structural features include "cleavages, fractures, folds, and faults...produced by deformation after deposition or crystallization." Aquitards environment is suitable for waste disposal as it minimizes seepage of leachate into groundwater zone: see infra Chapter Five, notes 18-23.

[16] Todd, supra, note 9, at 44-48, 50-57, 61-71.

[17] Ibid. See also, R. J. M. DeWiest, Geohydrology (New York, London, Sydney: John Wiley & Sons Inc, 1965) 167-176, 199-200. The elevation of the water table is proportional to topography. At the water table belt water rises and falls in the capillary fringe (conduit) in response to surface tension.

acceleration of gravity, density of fluid (water) and viscosity.[18] An increase in permeability, acceleration of gravity and density will increase conductivity and consequently, increase the rate of groundwater flow. But an increase in viscosity will decrease conductivity and the rate of groundwater flow.[19] Hydraulic conductivity is, therefore, directly proportional to permeability, gravity and density, and inversely proportional to viscosity. The amount of groundwater stored in an aquifer at a particular time and place is determined by the rate of recharge (inflow of water) and discharge (outflow of water).[20]

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[18] Freeze and Cherry supra, note 12, 22-29. Also in support of this propostion is a Personal Communication with Professor Paul Toft of Department of Geological Sciences, McGill University, dated November 14, 1991, see Appendix. Conductivity refers to the rate at which water moves through the aquifers. It is measured in metres per second. Permeability is measured in metres squared. Acceleration of gravity is measured in metres per second squared. Density refers to the mass or concentration of fluids. It is measured in kilograms per metres cube. Viscosity refers to the measure of resistance to sheer deformation of fluids. According to the Personal Communication, conductivity of water flow here is limited to confined aquifers but is relevant to fluids flows in general.

[19] Ibid.

[20] P. Meyboom, "Estimates of Groundwater Recharge on the Prairies" in C.E. Dolman, ed., Water Resources of Canada Symposium Presented to the Royal Society of Canada in 1966 (Toronto: University of Toronto Press, 1966) at 128. Groundwater budget is therefore, expressed as Recharge plus Discharge = Change in Storage.

C. CANADA'S WATER SITUATION

I. The Amount of Canada's Water:

Bodies of surface freshwater occupy 8% of Canada's land territory.[21] Canada has 25 recorded river basin regions covering a total of 9,974 kilometres square (Km.Sq.) and 45 lakes with areas covering more than 1000 Km.Sq.[22] Generally, Canada's present climatic conditions favour stable water supply. On average, Canada's annual precipitation is 600mm. In eastern and western Canada total annual precipitation is greater than 2000mm, about 1000mm in the Rocky Mountains region, below 400mm in the Prairies, and less than 100mm in the high Arctic.[23] Canada is the single largest proprietor of freshwater in the world[24], having about 360,000 litres of water per person[25].

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[21] Canada's National Report. United Nations Conference On Environment and Development, Brazil, June, 1992. (hereinafter Canada National Report) (Ottawa, 1991) at 25.

[22] P.H. Pearse, et al., Current Of Change Final Report On Federal Water Policy (Ottawa: 1985) at 25, 35.

[23] E.A. Ripley, "Climatic Change and the Hydrological Regime" (1987) 215-217 Can. Bull of Fisheries & Aquatic Sciences. at 154.

[24] D. Johansen, Water Exports. Current Review 88-9E (Ottawa: Canada Library of Parliament, Oct., 1985 revised April, 1989) at 1.

[25] Pearse et al., supra, note 22, at 29: "On the basis of seasonal flow rates, the North Saskatchewan, the South Saskatchewan, the Assiniobe, the Red and Missouri Basins have less than 2,500 litres of water per capita per day." These are areas which suffer relative water scarcity in Canada.

Although the volume of fresh groundwater in Canada is not yet known, experts believe that it is "certainly much larger than the total volume of water in the Great Lakes".[26] With proper management and protection from contamination of this resource, Canada may afford stable water supply even in a drought situation.

Groundwater is ubiquitous and in Canada aquifers are more evenly distributed than surface water. A study of Hess' hydrologic maps shows that major aquifers (yielding greater than 0.4 litres of water per second (l/s)) are widespread in the Prairies, Ontario, and the Atlantic regions other than in Labrador portion of Newfoundland while major aquifers yielding greater than 0.5 l/s are wide spread in British Columbia, Quebec, Labrador in Newfoundland and the Yukon and the Northwest territories.[27]

II. Factors Affecting Canada's Water Supply:

Unfortunately, Canada's "abundant" surface water supply is **not evenly distributed.** There are regional variations. The bulk of the supply is naturally diverted

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[26] J.A. Cherry, "Groundwater Occurence and Contamination in Canada" (1987) 215-217 Can. Bull. of Fisheries & Aquatic Sciences, at 387.

[27] P.J. Hess, Groundwater Use in Canada 1981 (Ottawa: National Hydrology Research Institute, Inland Water Directorate, 1986) at 19, Maps Nos. 1-4: water quality of these aquifers range from potable (less than 1000mg/L) to 5000mg/L of dissolved solids. But Cherry, supra, note 26, at 390, says most of the major regional aquifers are not within most major cities. The fact remains, however, that these aquifers are in great number in the more populous southern Canada and water supply from them may be more economical than from interbasin transfers.

northward into the ocean, away from the south where the majority of people live and do business. According to Agriculture Canada:

> Approximately 60% of Canada's surface freshwater drains north whereas 90% of Canada's population lives within 300 Kilometers of the nation's southern border.... Southwestern Canada (the Prairies and B.C.) generates 55% of Canada's agricultural receipts, some of it from irrigated land, yet this region possesses less than 4% of the nation's water resources.[28]

In the Great Lakes basin, areas such as southern Ontario suffer periodic and sometimes chronic water shortage.[29] One of the challenges facing water managers is to make water available in areas that are not favoured by the natural distribution of surface water. Projects of interbasin transfer of water take many years to complete and entail enormous economic, social and environmental costs. Socially, natives who have traditionally made their homes by the riversides are dislocated. Environmentally, aquatic life and other ecosystems are destroyed. During the public hearing on federal water policy, the natives stated that

> the salmon fishing in the rivers of our territories has been and will continue to be central to our economy and culture. The diversion of water away from these salmon spawning, rearing and migration rivers

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[28] Hearing About Water: A Synthesis Of Public Hearings of Inquiry On Federal Water Policy. (hereinafter Hearing About Water). (Ottawa, 1985) at 9. See also, Canada West Foundation, Natures Lifeline: Prairies And Northern Water. (Calgary: Canada West Foundation and Devonian Group of Charitable Foundations, 1982) at 20: In western Canada, "over 80% of the natural water supplies are in an area populated by fewer than 10% of the region's people." And at 24: "over 60% of the total annual water flow passes through the Prairies on its way to Hudson bay during a three month period" and from there drains into the ocean.

[29] A Primer On Water (Ottawa: Environment Canada, 1991) at 31: Groundwater mining is reported in this area.

is a fundamental threat to our existence as a people.[30]

Some experts argued that the economic rationale given for water diversion from northern Alberta to supplement the Oldman River supplies and the damming of the Oldman River for purposes of water diversion, for example, was unattractive.[31] Inspite of opposition to river diversions, Canada has executed about 60 major interbasin transfer projects exceeding the combined total of water diversions in the U.S.A. and the former U.S.S.R.[32]. But this has not solved the relative water scarcity in some regions in Canada. Instead of diverting water from water-rich areas to water-short areas or from areas of low population to areas of high population, majority of Canada's interbasin transfers have always been designed for hydroelectric power generation.[33] Some experts have said that a true assessment of Canada's

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[30] Hearing About Water. supra, note 28, at 14: A submission by the Gitksan-Wet' Suwet'en Tribal Council. It was also stated that river diversions have affected social, economic and environmental activities in the George River-Caribou areas.

[31] W. Phillips et al., "Evaluation of the Oldman River Basin Irrigation Proposals: Implications for Interbasin transfers." (1981) 6 (No.2) Canadian Water Resources J. at 59, 60; M. Cooper and L. Allison, "Social and Environmental Impacts: Does Anyone Really Care?" (1981) 6 (No.2) Canadian Water Resources J. at 18, 25, 26: accuse government of neglecting public opinions concerning the social and environmental impacts of the Paddle, Red Deer and the Oldman Rivers dam projects.

[32] F. Quinn, "Water Transfers-Canadian Style" (1981)6 (No.1) Canadian Water Resources J. at 68. This is a 1980 figure. According to Quinn, 95% of these transfers were for purposes of hydroelectric power generation. At 69, Quinn gives the number of transfers according to provinces as follows: Newfoundland, 6; Nova Scotia, 4; New Brunswick, 2; Quebec, 7; Ontario, 9; Manitoba, 6; Alberta, 9; British Columbia, 12; and none in the Northwest Territories and Yukon.

[33] A Primer On Water supra, note 29 at 39, 40. It was also reported here that interbasin transfer from the Nelson River necessitated the relocation of the Southern Indian Lake Community in Manitoba. The pollution resulting from this project cost

water need and a reduction of water waste would reduce the number of interbasin transfers designed for water supplies.[34]

The Final Report of Inquiry On Federal Water Policy did not advise the federal government on minimizing local interbasin transfers in favour of other alternatives. The report only advised the government to take into consideration environmental disruptions among many other factors in making any decision for major water diversion to the U.S.A.[35]. The disruption of the ecological environment by interbasin transfer projects shows the difficulty in accommodating the interests of all components of the water cycle at the same time. These concerns point to alternative sources of water supply. It is submitted that groundwater is a viable alternative. However, as a finite resource, wastage owing to cheap water rates[36] and pollution could diminish the availability of groundwater.

The problem of uneven distribution of Canada's surface water resources is compounded by incessant **pollution.** Areas of good water supply are in danger of having less water because of increasing pollution. Experts say the

> estimates of lakes at risk from acid rain range up to 600,000; already as many as 100,000 lakes have been damaged..., serious damage to lakes and rivers is found in Ontario and Quebec, and part of Atlantic Canada. Hundreds of Ontario lakes have no fish because of acid rain.

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the natives their commercial fishing activities.

[34] M. Gysi, "Measuring the Needs for Interbasin Transfers". (1981) 6 (No.2) Canadian Water Resources J. at 44, 52.

[35] Pearse et al., supra, note 22 at 126, 127.

[36] See infra Chapter Three, notes 233-245 and accompanying text for a discussion on water waste in Canada because of low water rates.

> In Nova Scotia, several rivers no longer have salmon runs, while others have salmon fisheries bordering on extinction.[37]

Trace metals from industrial, agricultural and sewage disposal activities have been found in undesirable concentration levels in the Fraser River in British Columbia.[38] Hazardous substances have been detected in the Fraser, St Lawrence and St Clair rivers and in the waters in Lac-St Louis area.[39] In 1987, seven out of twelve samples from the Sydenham River in Ontario contained metolachlor and six out of twelve drinking water samples were contaminated.[40] Toxic pollution has also been detected in the Great Lakes which supply a considerable amount of freshwater to Ontario and Quebec. In 1987, the Water Quality Board of the International Joint Commission (IJC) reported that

> New persistent toxic substances will continue to be introduced to the Great Lakes ecosystem in even greater quantities, production capacity and consumptive demand greatly exceeding government capacity for

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[37] Water 2020 Sustainable Use For Water In The Twenty First Century. (hereinafter Water 2020) (Science Council of Canada Report 40.) (Ottawa, 1988) at 13.

[38] M.H. Sproule-Jones, The Real World of Pollution Control. (Vancouver: Westwater Research Centre, the University of British Columbia, 1980) 4-5. According to Sproule-Jones, concentration levels in Fraser River of cadium, copper, mercury, nickel, lead and zinc from industrial activities are 1.5, 780, 60, 44, 1,240, and 300 respectively. (All values in parts per million, except mercury which is in parts per billion).

[39] Canadian Water Quality Guidelines Updates (Ottawa: Environment Canada, 1991) at VII-17. An Average of 53% influent PCBs was detected during waste water treatment in British Columbia

[40] Ibid. at VIII-7. It was reported at VIII-6 that metolachlor has been found even in treated water at five locations in Ontario.

regulation and enforcement.[41]

Although there is no inventory on how much water pollution Canada is facing, toxic contamination is at unacceptable level[42] despite measures taken by the government to control it.

Another threat to Canada's water supply is the effect of **climatic change**. Climate change has a potentially negative impact on water resources. Scientists say the world's climate is subject to change over time and has, in fact, changed in the

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[41] Report of the Great Lakes Water Quality Board to the International Joint Commission on Great Lakes water Quality (Windsor, Ontario: I.J.C., 1987) at 206-207. See also, A.F. Duda, "Cross-Media Management of the Toxic Pollutants in the Great lakes Basin Ecosystem" in R.Y. McNeil and J.E. Windsor, ed., Innovations In River Basin Management. Proceedings of the 43rd Annual Conference of the Canadian Water Resources Association (hereinafter Innovations in River Basin Management) (Penticton, British Columbia, 1990) at 322.

[42] P. Muldon and M. Valiante, Toxic Water Pollution in Canada: Regulatory Principles for Reduction and Elimination, with Emphasis on Canadian Federal and Ontario Laws (Calgary: Canadian Institute of Resources Law, 1988) at 23. Canada's National Report supra, note 21, 35-40: states that municipal discharge into fresh water has increased partly because of population growth. According to the report, discharges of phosphorous and biological oxygen demand (BOD) have increased by about 9% and 5% respectively. Pesticides discharges from agricultural activities are high particularly in southern Ontario's Thame River and the Bow River in Calgary. In these rivers the levels of concentration of herbicide atrazine exceed the maximum levels allowed by the Ontario and the Prairies Water Quality Guidelines. The report further cited the "Toxic Chemicals in the Great Lakes and Associated Effects", a report published by the Government of Canada in March, 1991, as saying that the toxic chemicals in the Great Lakes have been found to build up in the tissues of fish, aquatic plants and animals, causing extensive damage to them and consequently endangering human health. The report said clean up of some contaminated lakes like Lake Erie has been remarkable and that some polluting industries have improved their technology to reduce effluent emission while increasing production at the same time. For example, the Pulp and Paper industry and the Oil Refinery industry have respectively reduced discharges of total suspended solids (TSS) and BOD by 67% and 50% between 1970 and 1987.

past. Commenting on Canada's climate, a scientist stated already in 1975 that

> since 1940, there appears to have been a slight decrease in precipitation on the Prairies, little change in the central part of the country, and a slight increase along the east coast and in the high Arctic.[43]

Studies show that increased emission of carbon dioxide into the atmosphere could lead to global warming which would, in turn, increase evaporation.[44] Although precipitation will increase at the same time, it will not match the rate of evaporation.[45] For example, in the Grand River Basin, Ontario, studies indicate that there will be 20% to 25% average increase in annual evaporation, a reduction of 12% to 17% in annual water surplus and an increase in soil moisture deficiency by 40% to 100%.[46] This means there will be less water in the future than at present. Scientists predict that by the year 2085 winter precipitation and runoff across Canada will increase by about 0.5mm in the Arctic and in the southeastern Canada but

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[43] M. K. Thomas, Recent Climatic Fluctuations in Canada (Ottawa: Environment Canada, Cat. No. EN 57-7/28, 1975) at 92.

[44] Parliamentary Forum on Global Climate Change of the House of Commons April 23-24, 1990 (Ottawa, 1990) 33-42. See also, Out of Balance. The Risk of Irreversible Climate Change. Part III of Our Changing Atmosphere Series of the Standing Committee on Environment of the House of Commons, (hereinafter Out Of Balance. The Risk of Irrevesible Climate Change) (Ottawa, 1991) 1 et seq.

[45] M. Sanderson and J. Smith, "Climate Change and Water in the Grand River Basin, Ontario". in Innovations in River Basin Management, supra, note 41, 243 at 257.

[46] Ibid. Predictions are based on the Goddard Institute of Space Studies (GISS) which is one of the General Circulation Models (GCMs) for climatic experiment.

correspondingly decrease in British Columbia and in northern Quebec.[47] Commenting on the implications of climate change on Canada's water resources, Environment Canada suggests that:

> ...droughts would be much more frequent and severe on the southern Great Plains. The Great Lakes region should be drier but without serious drought. Atmospheric warmings should reduce spring runoff from the Rocky Mountains by 25%, and would pose a problem to water supply on the Prairies. This will result in increased demand for irrigation, particularly in the southern Prairies. The Great Lakes region probably will need more irrigation.[48]

It is, however, admitted that there is a high degree of uncertainty as to the precise effect of climate change on Canada's water resources.[49] This uncertainty adds to the many water management problems facing Canada. Canada should, therefore, prepare for the worst case scenario.

Unlike surface water, groundwater is protected from any significant adverse

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[47] Ripley, supra, note 23 at 154. Predictions are based on the United Kingdom Meterological Office (UKMO) model. Ripley says at 154 that "future changes in climate will likely have major impact on the patterns of precipitation and evapotranspiration, affecting water availability for human consumption, irrigation, power generation and direct use by natural and agricultural ecosystems." According to him, this condition will increase sedimentation in rivers and lakes and will reduce dilution effect, and the high temperature causing rapid evaporation will increase biological changes in the aquatic system. All these will degrade surface water quality.

[48] Hearings About Water, supra, note 28 at 20. See also, Out of Balance. The Risks of Irreversible Climate Change. supra, note 44 at 8. For the effect of climate change on Prairies crops, see J.M. Byrne and D. Schaffer, "Water Supply, Demand and Crop Yield Responses to Climate Change Scenarios for the Saskatchewan River basin" in Innovations in River Basin Mangement, supra, note 41, 263.

[49] V. Klemes, "Sensitivity of the Water Resource Systems to Climatic Variability" in Innovations in River Basin Management, supra, note 41, 233 at 241.

effect of climate change. It is protected from evapotranspiration.[50] It is, therefore, important for Canada to start developing, managing and protecting this resource in a greater measure.

Possible **export of freshwater to the United States** is a further potential threat to Canada's water supply. Already water transfer takes place from Coutts, Alberta to Sweetgrass, Montana; from Gretna, Manitoba to Nenche, North Dakota and from St. Stephen, New Brunswick to Calais, Maine. These examples are, however, small scale water transfers.[51] The 1987 Federal Water Policy rejects water export to other countries through interbasin transfers apparently because of the social and environmental impacts associated with such projects.[52] Yet some experts say that freshwater is included in the definition of "good" under the Free Trade Agreement between Canada and the United States and that, there is therefore, the possibility of Canada exporting water to the United States.[53] The Colorado River Basin, the High Plains and the Great Lakes Basin regions of the United States have been identified

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[50] A.H. Laycock, "The Amount of Canadian Water and Its Distribution" (1987) 215-217 Can. Bull. of Fisheries & Aquatic Sciences, at 15.

[51] Johansen, supra, note 24 at 3: The NAWAPA and GRAND proposed interbasin projects for the export of Canadian water to the United States estimated to cost $355 billion (Canadian) and $100 billion (Canadian) respectively have not yet been accepted by the Canadian government.

[52] The Federal Water Policy. (Ottawa: Environment Canada, 1987) at 24.

[53] W. Holm, Water and Free Trade: Mulroney Government's Agenda for Canada's Most Precious Resource. ed. (Toronto: James Lorner & Co., 1988) at xvi, 149. See also, D. Shrubsole, "Book Review" (1990) 15 Canadian Water Resources J. 80-81.

as potential large scale importers of Canada's water.[54]

D. GENERAL WATER USE IN CANADA

While Canada's water supply is threatened by the factors above discussed, population growth and increasing economic activities increase water demand. Therefore, the most current general water use rates in Canada which were as at 1981 and 1986 are presented in this section.[55] Water use is measured by "withdrawal use" and "consumptive use". Withdrawal use means the quantity of water taken from its source some of which returns to the water course eventually. For example, water used by industries for cooling purposes or water used for hydro power generation. "Consumptive use" captures the quantity of water actually consumed and lost with none returning to the water course, for example, water used for agricultural irrigation.[56]

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[54] J. Whalley, Canada's Resource Industries and Water Export Policy (Toronto: University of Toronto Press, 1986) at 177, 194: although the federal and provincial governments oppose international interbasin transfers, they allow export of water by tankers.

[55] This section is based mainly on Canada Water Year Book, Water Use Edition. (hereinafter Canada Water Year Book) (Ottawa: Environment Canada, 1985) which apparently is the most authoritative work on this subject. The section also refers to the 1986 water use rates in A State of the Environment Report: A Report on Canada's Progress Towards A National Set of Environmental Indicators (hereinafter Enviromental Indicators) (Ottawa: Environment Canada, 1991)

[56] D. Tate, "Current and Projected Water Uses in Canada, 1981 to 2011" (1987) 215-217 Can. Bull. of Fisheries & Aquatic Sciences, at 57.

Water use studies show that the quantity of water used in Canada has been on the increase. Nationally, withdrawal increased from 24,057 million cubic metres (mcm) in 1972 to 37,254 mcm in 1981.[57] Ontario withdrew 56% or 21,230 mcm and the Prairies withdrew 5363 mcm of the national total. Quebec withdrew 4252 mcm, British Columbia withdrew 3789 mcm and the Atlantic region was responsible for 2884 mcm of the national total.[58]

Sectorally, in 1981, manufacturing industries withdrew 10,200 mcm, recirculated 11,259 mcm, consumed 507 mcm and discharged 9693 mcm. The consumption rate was lower than withdrawal because of increased recirculation of water.[59] Mineral industries use water for mining, milling and processing operations. In 1981, these industries withdrew 648 mcm, recirculated 2,792 mcm and discharged 1428 mcm of water.[60] Although recirculation is desirable, it will not significantly

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[57] Canada Water Year Book, supra, note 55 at 15. But Tate, supra, note 56: put the 1981 figure at 37,500 mcm.

[58] Tate, supra, note 56 at 55-56: Ontario's high withdrawal was due to its thermal industry which used 70% of Ontario's water supplies. Prairies relative high withdrawal rate was due to irrigation. Quebec's withdrawal was low compared with Ontario's because of its reliance on hydro industry which takes less water than thermal plants.

[59] Canada Water Year Book, supra, note 55, 25-26. Recirculation in Ontario was low apparently because of the abundant water supply from the Great Lakes. Recirculation in British Columbia and Quebec was higher than in Ontario but lower than in the Prairies where higher recirculation was influenced by the relative water shortage in the region. Recirculation in the Atlantic region was low probably due to fewer major industries.

[60] Ibid. 33-37: Subsectors of mineral industry use water in different quantities. For example, metal mines subsector withdrew 449 mcm, recirculated 1247 mcm and discharged 1240 mcm. Mineral fuels subsector was responsible for 140 mcm intake, 1125 mcm recirculation and 108 mcm discharge. Non metal mines accounted for 59 mcm intake, 420 mcm recirculation and 80 mcm discharge. It is noted that discharge

offset the factors threatening the supply of surface freshwater. Water use in the agricultural sector is dominated by irrigation. In 1981, on a per hectare basis, the irrigation subsector consumed 1884 mcm in Alberta, 524 mcm in British Columbia, 262 mcm in Saskatchewan, 60 mcm in Ontario, 21 mcm in Manitoba and 14 mcm in Quebec.[61] Municipal water use rose from 3157 mcm in 1972 to 4263 mcm in 1981.[62]

Water withdrawal by the industrial sector (i.e. the mining, manufacturing and thermal subsectors) and agricultural sector rose by 75% from 1972 to 1986 or from 24 billion cubic metres to over 42.2 billion cubic metres.[63] Water withdrawal for household use increased by approximately 8% from 1983 to 1989, a rate which doubles that of Europe.[64]

The water use trends in Canada show increasing demand for water and there are indications that the rate of increase will be rapid in the near future. For example,

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often exceeds intake because of groundwater seepage. This is particularly the case in tailing ponds located in aquifer discharge areas.

[61] Ibid. 42-44: Livestock watering per category of livestock accounted for 90 mcm in Alberta, 88 mcm in Ontario, 21 mcm in British Columbia, 50 mcm in Saskatchewan and 60 mcm in Quebec. Figures for other provinces were reported to be unreliable.

[62] Ibid. 20-23.

[63] Environmental Indicators. supra, note 55, 82-83, 84: The thermal subsector accounted for large proportion of the withdrawal. Withdrawal by the manufacturing subsector declined by 5%. Of the total withdrawal only 10% was consumed, the remaining was returned to the source. Agricultural sector was responsible for 77% of the total consumption. The rate of water recirculation by industries fell by 30% although there was a relative increase in the Prairies.

[64] Ibid at 85: Water prices are said to be cheaper in Canada than in Europe.

studies suggest that by the year 2011, water withdrawal will rise to 74,331 mcm from about 37,500 mcm in 1981, representing approximately 100% increase. Tate gives figures of water use increase from 1981 to 2011 on sectoral basis in million cubic meters as follows:[65]

	1981		2011	
	water intake	water consump.	water intake	water consump.
Agric.	3125	2412	5897	4567
Mineral Extraction	648	179	1733	433
Manufacturing	10201	507	20274	1034
Power Generat.	19281	168	39558	349
Municipal	4263	640	6869	975
Total	37518	3906	74331	7363

Overall, an annual withdrawal increase of about 2.3% and an annual consumption increase of about 2.1% are forecast to the year 2011.[66]

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[65] Tate, supra, note 56, at 57.

[66] Ibid at 59: Increases in Ontario and the Prairies are about 2.4%. This is higher than the national average which is 2.3% for withdrawal and 2.1% for consumption.

E. GROUNDWATER USE IN CANADA

The water use trends above discussed generally include groundwater but the specific trends of groundwater use at present and in the future are not stated. The trends of groundwater use based on 1981 water use rates, the most current data, are considered in this section.[67]

In 1981, groundwater contributed 450 mcm or 9% of the municipal water supplied through municipal distribution network across Canada.[68] In the same year, out of 2474 communities supplied with water through municipal distribution system, 950 communities of less than 10,000 people each depended entirely on groundwater, while 24 municipalities of more than 10,000 people each depended entirely on groundwater. Cities like Regina in Saskatchewan and Kitchener in Ontario with more than 100,000 people each depended mainly on groundwater.[69]

Four million or 82% of rural users relied on groundwater in 1981 for domestic purposes. Provincially, the distribution is as follows: Prince Edward Island (PEI), 100%; British Columbia, 35-40%; Ontario, Quebec, Newfoundland, New Brunswick, Saskatchewan, Alberta and Manitoba, 90% respectively. Yukon and Northwest

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[67] This section draws upon Groundwater Use in Canada 1981 supra, note 27: This represents the most current authoritative study on this subject.

[68] Ibid 4-5, 20: This figure does not include the volume of groundwater withdrawn from private pumping systems.

[69] Ibid.

territories depended on groundwater to 65% and 1% respectively.[70] In the agricultural and industrial sectors ground water contributed 404 mcm or 13% and 324 mcm or 1% of water supplied to these sectors in 1981.[71]

The total national groundwater use in 1981 was 1.46 billion cubic metres. Regionally, Ontario accounted for 27% followed by the Prairies with 23.4%, British Columbia with 22.5%, Quebec with 15.5%, the Atlantic region with 10.5% and the Yukon and Northwest territories with 0.9%. Sectorally, municipal use accounted for 31% and agricultural use was responsible for 28%. Industrial and rural uses were 22% and 19% respectively.[72] Overall, groundwater use in Canada increased from 10% in the 1960's to 26% in 1981 with 6.2 million Canadians depending on it.[73]

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[70] Ibid 6-7: These rural users are often located in remote places where it may be difficult to extend surface water supplies. Rural users usually draw water from their own private wells and drink it untreated. They do not form part of municipal users for our purpose.

[71] Ibid 9-15: Groundwater contributed 90% of total volume of water used for livestock watering across Canada except in British Columbia where it was only about 40%. Because of the prestine quality of groundwater it is preferred for watering livestock to ensure the health of the animals. Groundwater intake for irrigation was 20% in Ontario, 20% in Quebec, 5-20% in British Columbia, 65% in Manitoba, 0.6% in Saskatchewan, and less than 0.5% in Alberta because of heavy reliance on surface water apparently made available through diversions. Industrially, on a national basis, groundwater intake by the mining subsector was 12%; 1% and less than 1% by the manufacturing and thermal subsectors respectively. For our purpose, industrial users are only those who are not connected to municipal water distribution system but use their own facilities to withdraw water.

[72] Ibid at 20.

[73] Water 2020 , supra, note 37 at 12: "Thirty eight percent of Canadian municipalities rely partly or totally on groundwater." Although "the total number of recorded wells in Canada is about 900,000", it is believed that the real number is about 2 million.

This represents 16% increase in goundwater use in 20 years. These water use trends suggest that, at the minimum, this rate of increase will be maintained in the next 20 years from 1981. This means that untill the year 2001 groundwater use in Canada will increase to at least 42%.

It can be concluded from the preceding discussion that although the volume of groundwater consumption is less than that of surface water, it is more important to the livestock subsector, small municipalities and the rural users (including small farms) which are located in places where it might be too expensive to extend surface water supply. In other words, the consumptive importance of groundwater is not to be measured by how much of it is consumed compared with surface water but rather by the kinds of needs it meets and the geographical locations in which it meets those needs. All regions should, therefore, give greater attention to the management and protection of groundwater from contamination.

There are also other reasons why groundwater should be given greater attention. Hydrologists have said that groundwater constitutes the base flow of surface water (i.e. the minimal quantity of water required to keep surface water from going dry).[74] Groundwater discharges into and recharges rivers, lakes and wetlands. Surface water, in turn, recharges groundwater.[75] Wetlands, that is, marshes, swamps, bogs and sloughs, sustain aquatic plants, animals and fish and retain water during

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[74] E. de Jong and R.G. Kachanoski, "The Role of Grassland in Hydrology" (1987) 215-217 Can. Bull. of Fisheries & Aquatic Sciences, at 228, 229.

[75] T.H. Whillans, "Wetlands and Aquatic Resources" (1987) 215-217 Can. Bull. of Fisheries & Aquatic Sciences, 225-235.

periods of plenty and release it to nourish the environment during dry seasons.[76]

It is, therefore, misguided to address surface water problems in isolation from groundwater problems or to give one greater attention than the other. The inter-connection of both is so intimate that "today's contaminated groundwater is tomorrow's contaminated surface water"[77] and vice versa. In reference to government neglect of conjunctive management of groundwater, surface water and wetlands, the Department of Environment concluded:

> Practically nothing has been done in Canada to investigate, let alone implement any of these "conjunctive use" kinds of approach (sic) from either a quality or quantity-oriented perspective. Indeed there is no incentive to investigate such methods designed to improve efficiency of groundwater and surface water use, as long as the resource itself (groundwater) is considered to have little or no intrinsic value.[78]

One must also bear in mind that groundwater gives special support to fish both in their natural habitat and in enhancement facilities. Fishery studies show that in regions of extreme cold like northern Yukon and McKenzie River regions, several fish species survive due to continuous groundwater discharge which keeps their

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[76] Ibid.

[77] Department of Environment, Background on the DOE Ground Water Strategy. A Management Approach to the Ground Water Issue: Conservation and Protection (hereinafter DOE Ground Water Strategy) (Ottawa: Environment Canada, 1990) at 7-8: The contamination of the Great Lakes is partly as a result cf contaminated groundwater discharging into the lakes.

[78] Ibid at 6. At 9, it was stated that Canada's share of the Great Lakes clean up since 1972 is $2.8 billion and that the country spent $2 billion for structural flood control from 1940 to 1990, and has spent $50 million for non structural flood control since 1976. These are examples of government attention to surface water related problems. Unfortunately, nothing of a comparative attention has been given to groundwater problems despite the intimate connetion between groundwater and surface water.

habitat from freezing.[79] In British Columbia's coastal area, research shows that

> anadronomous fish return to spawning grounds in creeks where groundwater with inherent constant temperature discharges. The groundwater with temperatures close to 10 degrees Centigrade provides a controlled temperature medium for incubation".[80]

Groundwater is important to all regions of Canada whether humid, semi-arid or arid. No region should manage and protect groundwater any less than surface water. However, drier regions like the Prairies or regions that have high consumptive use of groundwater like Prince Edward Island should have greatest sense of urgency when addressing groundwater concerns. Yet all regions would be well advised to address groundwater concerns more forcefully.

F. GROUNDWATER CONTAMINATION IN CANADA

I. Instances of Groundwater Contamination:

The federal government recognizes that groundwater is being polluted in many parts of the country and plans to introduce guidelines to help local authorities to deal

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[79] R.O. Van Everdingen, "The Importance of Permafrost in the Hydrological Regime" (1987) 215-217 Can. Bull. of Fisheries & Aquatic Sciences, at 262.

[80] E.C. Halstead, Ground Water Supply-Fraser Lowland, British Columbia. (Saskatoon, Saskatchewan: National Hydrology Research Institute, Inland Water Directorate, 1986) at 57.

with the problem.[81] For example, it is estimated that clean up of known groundwater contamination sites will cost about $2.5 billion and for the groundwater contamination in the Fraser River area alone the clean up cost is estimated to be between $220 million and $530 million.[82] Chemical and petrochemical contamination of groundwater between the towns of Mercier and Ste-Martin, Quebec forced thousands of residents to abandon their drinking water wells.[83] In 1978, at Penticton, British Columbia, some chemicals leaked in a sawmill and contaminated an unconfined aquifer which discharged water into the Okanagan River and consequently contaminated the river.[84] Three aquifers respectively supplying drinking water to the inhabitants of Alliston, Kitchener-Waterloo and North Bay, all in Ontario, have been reported contaminated by landfill sites in these towns.[85]

Clean up of contaminated groundwater is difficult although this depends on the type of contaminants, their mobility and the geological complexity of the

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[81] Canada Government, Canada Green Plan (Ottawa: Printing Service, Canada Communication Group, 1990) at 35. Contaminations from landfill wastes disposal, pesticides and USTs are particularly emphasized.

[82] DOE Ground Water Strategy supra note 77 at 5-6.

[83] Water 2020, supra 37 at 13. By 1986, the direct cost of cleaning the contamination was $10 million. And experts say additional expenditure of several millions of dollars may not guarantee the restoration of the aquifer to its natural quality.

[84] "Groundwater Occurrence and Contamination in Canada", supra note 26 at 407-408. Despite remedial action which lasted six years, contaminants were still found in the groundwater.

[85] Ibid. at 402-403. In the case of North Bay, the groundwater contamination subsequently contributed to the pollution of the Chippewa Creek and Lake Nipissing.

subsurface. A brief description of groundwater contamination processes gives a fuller appreciation of why contamination should be prevented rather than remedied.

II. Contaminants Transport in Groundwater:

The main issue here is whether contaminants will move with groundwater (flow) through the subsurface at a velocity equivalent to that of groundwater (advection), will be "adsorbed onto subsurface materials or be subjected to chemical reactions or biological degradation", or will be dispersed.[86] Adsorption retards the movement of reactive contaminants such as Polybrominated biphenyls (PBBs) Chlorophenol and Hexa-chlorobenzene (HCB).[87] The higher the interaction of reactive contaminants with the aquifer solids, the more the transportation of the contaminant is retarded.[88] Chemicals which are less dense than water float on water

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[86] Canter et al, supra, note 10 at 125-126. Dispersion refers to the "spreading of a solute on the subsurface materials owing to variation in aquifer permeability, fluid mixing and molecular diffusion."

[87] Ibid: Adsorption refers to a chemical process wherein contaminants or solutes react with subsurface materials. See also, D.M. MacKay and J.A. Cherry, "Groundwater Contamination: Pump and Treat Remediation" (1989) (No.6) 23 Environ. Science Technol. 631 at 633.

[88] D.M. MacKay et al, "Transport of Organic Contaminants in Groundwater Distribution and Fate of Chemicals in Sand and Gravel Aquifers" (1985)(No.5) 19 Environ. Science Technol. 384 at 385. MacKay et al say the interaction of contaminants with aquifer solids depends on the "concentration and characteristics of the contaminant, the characteristics of the aquifer solids, the pH of the groundwater, and the presence of other dissolved contituents. It is possible for the degree of interaction, and therefore, retardation, to vary in space and in time due to variations in one or more of these factors in the natural groundwater environment."

and may be transported at groundwater flow velocity. But chemicals more dense than water sink to the bottom of the aquifer or water depth and may be transported at a speed and in a direction totally unrelated to the groundwater flow.[89]

Contaminants transport is also influenced by molecular diffusion, a process whereby contaminants facing low velocity, diffuse from zones of high contaminants concentration to zones of lower concentration.[90] For example, at the Confederation Road landfill in Sarnia, Ontario, heavy metals were found to have migrated by diffusion to a depth of 10cm to 20cm below the clayey deposit with the potential of reaching the groundwater.[91]

The complexity of contaminants transport in groundwater has been described as follows:

> The fact that chemicals are attenuated in the soil through adsorption and chemical interaction with other organic constituents of the aquifer

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[89] D.W. Miller "Chemical Contamination of Groundwater" in C.H. Ward et al., Groundwater Quality (New York: John Wiley & Sons Inc., 1985) at 45-47. Gasoline is less dense than water. Dense Non Aqueous Phase Liquid Sources (DNAPLS) such as Trichloroethene are more dense than water. According to Miller, "because groundwater flows in a laminar fashion, dissolved chemicals will follow groundwater flow lines and form distinct plumes. Plumes of contaminated groundwater have been traced from a few feet to several miles downstreams of pollution sources."

[90] Cherry, supra, note 11 at 75. Thus even where there is rich impermeable clay deposit underlying a waste disposal site, contaminants from the site would migrate to the groundwater zone by means of molecular diffusion. But Cherry submits that the "very low groundwater velocity, the slow rate at which contaminant diffusion occurs, and the lack of large variability of diffusion coefficients for non reactive contaminants make unweathered clayey deposits a desirable hydrologic environment for isolation of many types of solid hazardous wastes."

[91] E.K. Yanful et al, "Heavy Metal Migration At A Landfill Site, Sarnia, Ontario, Canada-2: Metal Partitioning And Geotechnical Implications" (1983) 3 Applied Geochemistry 623-629.

> makes it difficult to predict the movement and fate of chemicals in groundwater. Volatile organic chemicals in groundwater are extremely mobile while other chemicals are not so mobile. There are differences in attenuation through sorption and some chemicals are less changed in the groundwater environment than others.[92]

Studies indicate that the

> extreme time lags that characterize contaminant transport suggest that groundwater contamination by hazardous chemicals is a long-term problem that can reach large proportions before being recognized. It is a problem that is likely to persist long after serious mitigation efforts have begun.[93]

Contaminant complications in groundwater make it desirable to prevent groundwater contamination as much as possible. Remediation is difficult and expensive and in some cases the desired water quality cannot even be restored.[94] The strength, detail and scope of groundwater protection law should be informed by scientific knowlege of groundwater process. While scientific knowledge in this area may be limited, the law should afford protection to groundwater on the basis of present scientific knowledge of groundwater process.

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[92] Miller supra, note 89 at 44.

[93] MacKay et al, supra, note 88 at 392.

[94] "Groundwater Contamination: Pump-and-Treat Remediation" supra, note 87, at 631-635; S.I. Gutter, "SDWA Standards: A Framework for Groundwater Clean-Up" (1989) 4 No.1 Natrural Res. & Environment at 5; R.A. Brown et al, "Aquifer Restoration with Enhanced Bioreclamation" (Nov. 1985) Pollution Engineering at 25-26; L.W. Canter and R.C. Knox, Groundwater Pollution Control (Michigan: Lewis Publishers Inc., 1986) at 131-149.

G. CONCLUDING REMARK ON CANADA'S WATER SITUATION

Canada might have enjoyed abundant water supply in the past. At present, abundant water supply in Canada is more of an illusion than a reality.[95] The threat of a global water crisis; continuous, increasing and widespread surface and groundwater pollution; natural factors such as climate change and population growth impacting on water supplies call for a greater government attention to the management and protection of this resource. Furthermore, the dependence of rural communities and livestock on groundwater supply and groundwater support of surface water, wetlands, fish and the overall ecosystems warrant such attention. To be meaningful, however, groundwater management must be geared towards the goals of sustainable development. This means that there must be a balance between economic development and conservation of the environment as well as managing natural resources in a way that meets present and future needs.[96] Economic development entails the utilization of natural resources as well as their environment.

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[95] H.D. Foster and W.R. Derrick Sewell, Water: The Emerging Crisis in Canada (Toronto: James Lorimer & Co. Publishers, 1981) at 12-19.

[96] The term "sustainable development" is capable of different definitions, broad and narrow. But it essentially means recognizing the interdependence of economic, social and natural (environmental) systems and balancing them in such a way that accommodates present needs and the needs of future generations. See E. Smith, Sustainable Development through Northern Conservation Strategies (Calgary: The University of Calgary Press, 1990) at x-xiv; Economic development must respect environmental integrity: see M. Keating supra note 1 at 1, 31: discusses The Brandtland Report, Our Common Future.

To carry on economic activities without compromising the ability of natural resources to meet present and future needs is a basic tenet of the concept of sustainable development. Water resources, in terms of both quantity and quality, must, therefore, be managed to attain this goal. As this reality must be taken into account in management decisions, the challenge thus presented is so serious and threatening that it will be unwise to fragment or leave groundwater management and protection to the individual provincial governments. A unified approach coordinated by the federal government should yield the most effective and satisfying result. Already, Canada is divided into river basin regions. Each region has its own watershed in line with natural locations of rivers rather than political boundaries of the provinces.[97] This recognizes the unity of the aquatic environment which includes groundwater. This makes a unified management approach more appropriate.

It is not that the federal and provincial governments are not taking measures to manage and protect groundwater from contamination. Rather, the problem lies in the measures not being unified enough, and being grossly inadequate in view of the importance of groundwater resources. The question therefore, arises as to what measures will be adequate and how Canada should apply them? An examination of American experience may offer some insight. It will identify measures that are appropriate in dealing with groundwater problems. The following is an outline of how America's water experience parallels Canada's. American water problems are similar

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[97] Pearse et al supra, note 22 at 34-36, 96-97: watersheds are appropriate geographical units for water management because they recognize the unity of natural processes and their interdependence.

to the Canadian experience in substance, but are far more urgent because the U.S.A. are more populated and more industrialized than Canada and have a history of bad water management.[98] An American water expert has said that

> the problem of assuring an adequate supply of water for Canada's future differs from the problem in the United States more in degree than in substance.[99]

H. UNITED STATES' WATER SITUATION

Surface fresh water occupies 4% of the USA's land territory[100] and like Canada, United States are "endowed with a bountiful supply of water. However, the water is not always in the right place at the right time, or in the right quality".[101] While the eastern USA are well watered with major and minor rivers, the western

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[98] F.E. Moss, "Towards A North American Water Policy" in Water Resources of Canada Symposia Presented to the Royal Society of Canada in 1966, supra, note 20 at 4.

[99] Ibid.

[100] Viessman and Hammer, supra, note 14 at 61.

[101] Environmental Protection Agency, The Potential Effect of Global Climate Change on the United States. United States Environmental Protection Agency Policy Planning and Evaluation (Washington, D.C., 1989) at 166. At 167, it was reported that "on a national scale water supplies are adequate and water availability exceeds withdrawals and consumption. However, in some regions, the gap between demand for water and available supply is narrow, or the variability in water supply is high, or both. For example, average surface water supply exceeds average streamflow in the Great Basin, Rio Grande and Colorado River Basins".

USA are generally a mix of semi arid and arid areas.[102]

Although the eastern United States are humid, there are localized water shortages primarily due to the occurrence of drought from time to time.[103] For example, in the 1960's, a major drought which lasted for six years struck the Delaware River Basin and seriously affected water supplies to about 22 million people in the states of New York, New Jersey, Pennsylvania, Philadelphia and Delaware.[104] There is also uneven distribution of surface water within some eastern states. For example, in Long Island in New York State, there is enough surface freshwater but much of it is not located where it is needed.[105]

Within some western states surface water is unevenly distributed. In California, for example, the

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[102] E.A. Ackerman and G.O.G. Lof, Technology in American Water Development (Baltimore, U.S.A.: John Hopkins Press, 1959) 19-20: Some major surface water bodies in eastern U.S.A. are the Mississippi, the Ohio and the St. Lawrence Rivers and the Great Lakes. The Hudson, the Connecticut and the Alabama Rivers also have substantial flows.

[103] H.E. Schwarz, "Climate Change and Water Supply: How Sensitive is the Northeast" in Climate, Climatic Change and Water Supply. (Washington D.C.: The National Research Council, National Academy of Science, 1977) at 112: The States of New York, New Jersey and Maryland and District of Columbia face localized water supply problems.

[104] W.L. Meier, "Identification of Economic and Social Impacts of Water Shortages" in Climate, Climatic Change, and Water Supply, supra, note 103 at 89, 90, 93.

[105] E.G. Tanebaum, "Hydrologic Zoning On Long Island" in Proceedings of the Sixth National Groundwater Quality Symposium. State, County, Regional and Municipal Jurisdiction of Groundwater Protection September 22-24, 1982. (hereinafter Groundwater Quality Symposium) (Atlanta, Georgia, U.S.A., 1982) at 57.

> water resources are poorly distributed, relative to human settlement patterns in the State. Over two-thirds of the State's surface water supply originate north of Sacramento, 70% of its population and 80% of its total demand for water lie to the south.[106]

In Texas, while the majority of the ten major rivers are in the eastern part of the state, a region of high precipitation, western Texas including the High Plain region is deficient in water supply.[107]

Interbasin water transfer is one way of correcting the uneven natural distribution of surface water in the U.S.A.. Water has been diverted from the water-rich northern California and the Colorado River to southern California.[108] Completed major interbasin transfer projects in California include the more recent Federal Central Valley Project (CVP) and the California State Water Project which are said to be the world's largest interbasin transfers.[109] There are also completed major interbasin transfer projects in New York State and Colorado.[110]

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[106] California State Water Project. (Sacramento, C.A.: California Department of Water Resources, 1985) 1. It was also reported that about 85% of total annual precipitation in California's Central Valley Basins occurs between November and April, and not in summer when water demand is highest.

[107] W.P. Webb, More Water for Texas (Austin, Texas: University of Texas Press, 1954) 4, 17-20.

[108] E.S. Helfman, Rivers and Watersheds in America's Future. (New York: David McKay Co., 1967) 80-83.

[109] J.B. Smith and D.A. Tirpak, The Potential Effect of Global Climate Change on the United States (New York: Hemisphere Publishing Corp., 1990) at 67.

[110] C.W. Howe and K.W. Easter, Interbasin Transfers of Water (Baltimore, Maryland, U.S.A.: John Hopkins Press, 1971) 6-7.: Major interbasin transfers in New York State include Croton System delivering 364,000 acre feet of water a year, the Catskill System transfering 622,000 acre feet of water and the Delaware System delivering about 1.03 million acre feet of water a year. In the State of Colorado,

The transfer of water from one basin to another in the United States, however, seems to be poorly planned. An American water expert has commented:

> With the exception of the deserts of the Great Basin, the Colorado River Basin has the greatest water deficiency of any basin in the conterminous United States. Yet more water is exported from the Colorado River basin than from any other river basin in the United States.[111]

Given the apportionment of the Colorado River to seven states, studies show that states on the upper Colorado River basin will exhaust their allocations by the year 2000.[112] The social and environmental impacts associated with interbasin transfers discussed in respect to Canada also apply to the United States. Public opposition to interbasin transfers in the United States has reduced the number of projects executed in recent years. For example, in 1982, the people of California voted against funds for a proposed project designed to increase water diversion from

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major transfers include the Big Thompson Project delivering an average of 230,000 acre feet of water a year and the Denver System delivering about 335,000 acre feet of water annually.

[111] J.A. Dracup, "Impact on the Colorado River Basin and Southwest Water Supply" in Climate, Climatic Change and Water Supply, supra, note 103 at 123. It was stated here that by agreements and judicial decisions seven states and Mexico share the Colorado River. The basin is divided into lower and upper Colorado River Basin for administrative purposes. Areas of the states of Utah, Colorado, Arizona, New Mexico and Wyoming draining into the Colorado River belong to the upper basin while the lower basin encompasses parts of Arizona, southeastern Nevada, southeastern Utah, southeastern California and western New Mexico.

[112] A.V. Kneese and G. Brown, "Hypothetical Shocks to Water Allocation Institutions in the Colorado River Basin." in New Courses for the Colorado River: Major Issues for the Next Century (Albuquerque: University of New Mexico, 1986) 87-108.

northern to southern California.[113] California's rejection of this project in the face of its water supply problems is an indication of a growing public support for environmental protection. Groundwater supply is a good alternative to interbasin transfers. As we shall see, both the humid eastern and the arid and semi-arid western United States significantly depend on groundwater particularly for potable and irrigation supplies.

In addition to water distribution problem, the United States face a worse situation than Canada as regards water pollution. It has been said that between 1972 and 1985, public and private sectors spent a total of $336 billion (US) to abate and control water pollution.[114]

Climate change threatens to compound the water supply problems of the United States. According to the United States Environmental Protection Agency (EPA), global warming will exacerbate the water shortage and water quality problems of the western United States particularly, the arid Rio Grande, Colorado, Missouri and California River Basins.[115] Even the more humid eastern United States will

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[113] Smith and Tirpak, supra, note 109, 303-304: "Only the Central Utah Project and the Central Arizona Project have gone forward in recent years. Largely because of public opposition to new dams, only one major project in the northeast has been completed in past 20 years." The Animas La Planta and Narrows Project in Colorado, the Garrison Diversion Project in North Dakota and a similar project to divert water from northern New England to southeastern Massachussetts have not yet been executed.

[114] K.D. Farber and G.L. Rutledge, "Pollution Abatement and Control Expenditure" (May, 1987) Survey of Current Business, 21-26. For instances of major water pollution, see F. Powledge, Water (New York: Farrar Straus Giroux, 1982) at 57-58, 88.

[115] The Potential Effects of Global Climate Change. supra, note 101 at 176.

experience a mix of drought and flood. And because of generally reduced river flow affecting groundwater recharge, water supply will hardly meet increasing demand.[116] As already discussed, there is a potential for Canada to export water to the United States. The effect of climate change in the United States may intensify American demand of Canadian water.

Waste of water also threatens American water supply. For example, farmers in the Grand Valley Colorado are said to use six times as much water as is needed to grow their crops, and improper canals divert 60% of irrigation water away from the intended crops.[117]

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[116] Ibid 169, 177. See also, Smith and Tirpak, supra, note 109 at 83, 125, 174-175, 186, 257: Predictions based on GCMs are that climate change would diminish water supplies from the California State Water Project by between 7% and 20%. Southeastern states such as Florida, North Carolina, South Carolina, Georgia, Alabama, Tennessee, Mississippi and Louisiana which already have high temperature will get hotter and this will affect the quantity and quality of water supplies. The aridity of the Great Plain states such as Texas, Oklahoma, Kansas, Nebraska and New Mexico will increase and the region will be vulnerable to serious droughts. This region depends heavily on groundwater supplies particularly from the Ogallala aquifer for irrigation. About 61-86% of the total water used in Oklahoma, Nebraska and Kansas is groundwater. The Great Lakes supply about 95% of the U.S. freshwater. Climate change will diminish the supply and will particularly affect Great Lakes states such as New York, Michigan and Wisconsin.

[117] P. Rogers "The Future of Water" (July, 1983) The Atlantic Monthly, at 91; C. Szechenyi, "Thirty Plains Rapidly Drain Ogallala Aquifer (May, 1981) Kansas City Times, both cited in R.C. Bocking, "Canadian Water: A Commodity for Export?" (1987) 215-217 Can. Bull of Fisheries & Aquatic Sciences, at 110. See also D.A. Dreyfus and B.S. Cooper, Water and Energy Self-Sufficiency. U.S. Committee on Interior and Insular Affairs, U.S. Senate, S. Res.45, (submission by D.A. Dreyfus and B.S. Cooper of the National Fuels and Energy Policy Study) (Washington D.C., 1974) 1.

I. GENERAL WATER USE AND GROUNDWATER USE TRENDS IN THE UNITED STATES

Overall national water use trends by sectors in 21 water resources regions in the United States based on a 1980 study and projected to the year 2000[118] show a slight decrease in withdrawal apparently due to reuse of water. Consumption is, however, on the increase.[119]

In specific terms, more than 50% of American population depends on groundwater as a source of drinking water supply.[120] Groundwater use is on the increase across all regions of the United States.[121] Although the arid and semi-arid Western and Great Plains states depend heavily on groundwater, the humid Eastern states particularly the southeastern states depend on groundwater to a significant extent. Overall national groundwater withdrawal rose from 85,270 million gallons per

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[118] The discussion in this section draws heavily upon the State and National Water Use Trends to the Year 2000. A Report Prepared by the Congressional Research Service of the Library of Congress for the Committee on Environment and Public Works of the U.S Senate. (Washington D.C.: U.S. Government Printing Office, 1980) at 245.

[119] Ibid: Sectors include, municipal, rural, commercial, manufacturing, irrigation, livestock, steam electric generation, mineral industries and public lands.

[120] R.C. Heath "Introduction to States Summaries of Ground Water Resources" in National Water Summary 1984 Water Supply Paper 2275 (Washington D.C.; U.S.Geological Survey, 1985) 118-121.

[121] R. Patrick et al., Groundwater Contamination in the United States 2ed. (Philadelphia: University of Pennsylvania, 1987) 28, 47.

day (mgd) in 1975 to 89,030 mgd in 1980.[122]

J. GROUNDWATER CONTAMINATION IN THE UNITED STATES

Groundwater contamination in the United States is a pervasive problem. A 1977 survey showed that there were 17 million waste disposal sites in the United States discharging about 6.5 billion cubic metres of liquid waste into the ground each year and causing extensive groundwater contamination.[123] More than one-half of the hazardous wastes produced in the United States is buried underground by means of deep well injection mechanism. In one year, Dow Chemical Corporation alone, for example, injected 2.5 billion gallons of waste into the ground in Midland, Michigan.[124] Consequently, there are many instances of groundwater contamination in the U.S.A.[125]

In sum, uneven natural distribution of surface water, pollution, effect of

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[122] Ibid 29, 31.

[123] U.S. E.P.A., Waste Disposal Practices and their Effects on Groundwater - Report to Congress (Washington D.C.: U.S. Environmental Protection Agency, 1977) 81-107.

[124] A. Culver and R.M. Avdette, "Dangers in the Well" (March-April,1985) Environmental Action, 15-17.

[125] L.W. Canter and R.C. Knox, Groundwater Pollution Control. (Chelsea, Michigan: Lewis Publishers Inc., 1986) 350-351, 358-361, 371-385. Canter and Knox at 388 to 394 lists 15 other cases of groundwater contamination in the United States. See also, J.J. Westrick et al, "The Groundwater Supply Survey" (1984) 76 No.5 J. American Water Works Assoc., 52; L.G. Wolfson, Rural Groundwater Contamination (Chelsea, Michigan: Lewis Publishers, 1987) at 77.

potential climate change and waste threaten water supply in the United States.

K. CANADA AND THE UNITED STATES: A COMPARATIVE PERSPECTIVE ON WATER SUPPLY PROBLEMS

Like Canada, water supply in the United States is uneven across the country. As we have seen, in broad classification, eastern Canada and eastern United States are humid while western Canada (paricularly the Prairies) and western United States are a mix of arid and semi-arid regions. Furthermore, Canadian and American water supplies are threatened by pollution, effect of climate change and water waste. However, because of large population, large industrial and agricultural activities and a more wide-spread water shortages, the American water supply problem is more serious and demands a more urgent attention. Consequently, the United States federal and state governments have stepped up groundwater management and protection from contamination.[126]

Given the similarity of water supply problems shared by Canada and the United States, more than any other country, the United States are a good example for Canada to consider in planning its water management strategy. Canada should not wait until it has water problems to the same degree as the United States before it steps up measures for groundwater management and protection. Canada has learned from United States experience in the past. For example, in the comprehensive studies

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[126] See generally infra, Chapters Three and Four.

for Canada's river basins, particularly the Okanagan River Basin in British Columbia, Canada adopted the American Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources, 1973" which established national economic development and environmental quality objectives for the United States, and this has been useful to Canada.[127]

Some of the measures taken by the United States to manage their water resources may suit Canada. But where necessary they should be modified to suit local circumstances. These measures are discussed in chapter four.

L. GROUNDWATER QUANTITY AND QUALITY PROBLEMS DEFINED

The problems identified here are common to the United States and Canada. But unlike Canada, the United States address these problems to a greater degree through legislation, policies, programs and strategies.

Legislation and policies should provide for the integration or coordination of groundwater and surface water management in terms of quantity and quality because of the intimate connection between the two. A serious draw-down of the water table or contamination of groundwater might affect the quantity or quality of nearby surface water recharged by it. Integration of surface and groundwater in this way would be more efficient if the management of groundwater quantity and quality is

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[127] A.H.J. Dorcey, "Research for Water Resources Management: The Rise and Fall of Great Expectations." (1987) 215-217 Can. Bull. of Fisheries & Aquatic Sciences, at 487.

first integrated. As discussed in Chapters Three and Four, in Canada, the coordination of the management of these components of the hydrologic cycle is inadequate.

Secondly, water resources management efforts are fragmented in Canada. Each level of government and each province appears to be concerned only with its own resources and environment with little regard for the interests of others. Harmonizing or unifying these efforts at the provincial level as well as unifiying the efforts of the federal and provincial governments is a major challenge facing water managers. Harmonization of laws or efforts in the sense used in this work does not mean having a strict uniform law across Canada. Rather, it means that every jurisdiction should, while respecting local circumstances, have in its law the basic elements of good groundwater management and protection for example, managing surface water quantity and quality in a way that does not adversely affect groundwater quantity and quality and vice versa.[128] This is important in both areas where groundwater is interconnected and where it is not. Federal role in guiding the provinces to do this by providing regulatory framework, financial and technical assistance is advocated.

Thirdly, there is the challenge of developing laws, policies, programs and strategies specifically directed at dealing with groundwater problems. The particularity of groundwater occurrence and contamination is such that a law designed for general

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[128] For other basic elements of good groundwater management and protection, see infra Chapter Five, subtitle "Proposed Elements of A Model Provincial Comprehensive Groundwater Protection Legislation".

environmental protection will not adequately deal with groundwater problems. Scientists have distinguished groundwater contamination from air or surface water contamination as follows:

> The long time periods for contamination to become extensive, the difficulty in monitoring and predicting the pathways of contaminant migration and great variations in the nature of contaminant behaviour from site to site, which depend greatly on the local geologic conditions, are general features of groundwater contamination problem that distinguish it from the problems of air contamination or of lake or river contamination.[129]

This distinction should be recognized in the laws, policies, programs and strategies for water resources management.

The fourth problem is the recognition of land use planning and practice as a crucial element in the management and protection of groundwater from contamination. Existing land use laws and practices do not adequately protect groundwater. They need to be replaced. But in order for the new laws and policies to be well informed and efficient, there has to be hydrogeologic identification of aquifers, their depths, their yields and quality, their recharge and discharge areas. Such information would help decision makers to know aquifers that may be classified as being in "critical protection zone". Aquifers that yield potable water are usually in such zones. There should also be the identification of potential contamination sources to ensure that they are not zoned together with important aquifers or that they are cleaned up before such zonings. Basically, protection of groundwater based on zoning laws has either not been done in Canada or has not been properly done. For

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[129] Cherry supra, note 11 at 10.

example, Cherry[130] reported that in 1976, some liquid hazardous substances spilled in a transformer manufacturing plant in Regina. Although the factory was located on a thick layer of clay soil which naturally can hold back chemicals from seeping into the ground, the factory location was naturally connected by a layer of vertical fractures to a major aquifer which supplies more than one-third of Regina's population with potable water. Although the aquifer was not contaminated, the possibility of its contamination was not remote. A proper zoning plan designed for groundwater protection should not have permitted the construction of the factory in that location.

In conclusion, given the importance of groundwater, Canada needs to evaluate and design its water laws, policies, programs and strategies to deal with these problems more effectively.[131] These are canvassed in the following chapters.

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[130] "Groundwater Occurrence and Contamination in Canada". supra, note 26 at 409.

[131] There is also the question of scientific research into groundwater problems which is beyond the scope of this work.

CHAPTER TWO

ECONOMIC AND LEGAL APPROACHES TO CANADIAN ENVIRONMENTAL PROTECTION

During the second half of this century, pollution, in particular, industrial pollution, has become much more evident and urgent thus intensifying the call for the protection of the environment. While there is general agreement about the importance of environmental protection, opinions diverge as to ways of achieving this goal. This Chapter is concerned with approaches to environmental protection. There are ethical,[1] economic and regulatory approaches. Only the last two appoaches are considered herein. While the economic approach is briefly examined, the regulatory approach, as the dominant and practically more important approach, is the focus of this work.

A. ECONOMIC APPROACH TO ENVIRONMENTAL PROTECTION

Economists insist that the appropriate method of achieving public policy objectives in environmental or other matters is the employment of market forces as a tool for efficient allocation of scarce resources. Efficient allocation of resources is

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[1] The ethical approach demands a change in the consumption pattern of the society in order to discourage pollution and promote conservation. This is one of the tenets of sustainable development as conceptualized by the Brundtland Report, supra Chapter One, note 7 at 44.

represented by the concept of "Pareto Optimum", a state where one is made better off without another being made worse off.[2] The interaction of demand and supply is expected to achieve optimal allocation of resources.[3] However, in the environmental context, market forces have more often than not been unable to allocate resources in the most efficient way. Polluters often end up better, and their victims worse off. The basic reason for this "market failure" is that the cost of pollution is not borne by the polluter but by the public (thus, social cost).[4] The prices of the polluters' goods are cheaper than they would be if the social costs were incorporated into them. Consequently, demand for the polluters' goods is high, causing them to expand production and thus generate more pollution.

Looking at the society at large, one economic argument is that efficiency is sustained even where polluters are made better off and their victims made worse off,

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[2] N. Rescher, "Economic Verses Moral Philosophy: The Pareto Principle As A Case Study" in N. Rescher, Unpopular Essays In Technological Progress (Pittsbugh: University of Pittsbugh Press, 1980) at 60: Summarizes "Pareto Optimum" as follows: "Definition: One distribution of utility to the members of a society is a 'Pareto Improvement' upon another if it is such that some better and none fare worse. Definition: A Distribution is 'Pareto Optimal' within a range of alternatives if it represents Pareto Improvement over every other member of this set. Thesis: Whenever one alternative represents an overall distribution of utilities to members of a society that is Pareto Optimal within a set of its rivals, then the 'socially rational' thing to do is to prefer this alternative over the rest."

[3] See J. Brunnee, Acid Rain And Ozone Layer Depletion - International Law And Regulation (Dobbs/Ferry: Transnational Publishers, 1988) at 52.

[4] Ibid 53, 54: argues that market failure is aggravated by the fact that clean environment is regarded as "public good". This means that when the market fails to control pollution, no one is willing to challenge the polluters as a successful challenge will benefit others who did not contribute to the challenge (free riders). Consequently, the pollution continues unabated or uncontrolled.

provided the polluters can compensate their victims for the differential damage.[5] This is premised on Kaldo Hicks' doctrine of aggregate gains outweighing aggregate losses which has been criticized as being inequitable.[6] Efficiency premised on this doctrine erroneously assumes that all losses are compensable. It is assumed that the gain from the activity causing the pollution outweighs the loss incurred. Therefore, there is no compelling reason for stopping the activity since the resulting loss can always be compensated. In other words, the doctine, would allow the use of cost-benefit analysis as a tool for determining policy objectives in environmental and other matters.[7]

Cost-benefit analysis operates only where the market value of things is known or capable of being known. It cannot, therefore, be employed in the environmental context where there is no determinable market value of such things as aesthetics or the intrinsic value of the natural environment or the future value of an environmental resource or the future impact of a damage to it.[8] For groundwater, it has been suggested that cost-benefit analysis cannot take into account the value of groundwater

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[5] Law Reform Commission of Canada, Political Economy of Environmental Hazards Protection of Life Series. Study Paper (Ottawa: Law Reform Commission of Canada, 1984) at 43-45.

[6] Ibid.

[7] Ibid.

[8] L.H. Tribe, "Ways Not To Think About Plastic Trees: New Foundations For Environmental Law" (1974) 83 Yale L.J. 1315, M. Sagoff, "On Preserving The Natural Environment" (1974) 84 Yale L.J. 205, M.R. Gelpe and A.D. Tarlock, "The Uses Of Scientific Information In Environmental Decision Making" (1974) 48 South Calif. L. Rev. 371 at n.118.

as a natural resource "stored in the ground capable of future use, or kept in reserve for use in possible periods of droughts".[9] Cost-benefit analysis would also discount groundwater support of surface water bodies, wetlands and the ecosystems. It would also not take into account death, sicknesses and diseases posed to human, plants and animals by groundwater contamination.[10]

Compensation, an element of economic efficiency can hardly be adequate for groundwater contamination. It is not environmentally sound or acceptable to permit, for example, the contamination of pristine groundwater (drinkable without treatment) serving 3,000 people just because a polluter can pay them monetary compensation, or because the cost of avoiding the contamination could be used to create jobs for 5,000 people, or because the polluter can afford an alternative water supply to the community at a cost cheaper than avoiding the contamination. The value of the groundwater is not only in the drinking but also in its nourishing support of the environment at large and the intrinsic natural value the community attaches to it. Admittedly, the cost of protecting groundwater is high. However, because good

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[9] A.S. Gonzalez, "Basic Economic Concepts Applied To Groundwater Management" in E. Custodio and A Gurgui, Groundwater Economics: Selected Papers from A United Nations Symposium Held in Bacelona, Spain (hereinafter Groundwater Economics) (Amsterdam; Oxford; New York; Tokyo: Elsevier, 1989) 3 at 10, 13: Generally the value of water is indeterminate or at best based on subjective criteria.

[10] J. Vrba, "Economic Aspects of Groundwater Protection" in Groundwater Economics supra, note 9, 153 at 177-178, S.S.D. Foster and V. Foster, "The Economic Dimension of Aquifer Protection: Putting A Price On Groundwater Protection" in Groundwater Economics, supra, note 9, 201 at 210: cost of aquifer pollution is difficult to quantify.

quality groundwater is crucial to the quality of life, health and the natural environment it should be protected for social reasons[11] and also, for economic reasons because the cost generated by health problems caused by groundwater contamination can be avoided.

In canvassing groundwater protection through economic mechanisms, it should be understood that as long as polluters find it cheaper to pollute than to treat their waste or apply other mitigating measures, they will not stop or minimize pollution. As we have seen, market forces tend to encourage this approach. Pollution is further encouraged by the traditional concept of private ownership. The polluter sees air and water as resources not owned by any one so that no price is attached to their use or misuse.[12]

Consequently, increased pollution has necessitated the putting of a price on the environment. Rather than externalize the costs of pollution, the polluter is made to internalize them according to the "polluter pays principle".[13] Theoretically then,

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[11] R.A. Downing, "Some Aspects of the Economics of Groundwater Conservation and Protection" in Groundwater Economics supra, note 9, 181 at 198.

[12] W. Block, Economics and the Environment: A Reconciliation (Vancouver: The Fraser Institute, 1990) at 62.

[13] Ibid at 48: "The pricing mechanism should reflect not just the private cost but as much as possible the total cost to society, including energy and materials used , ecological impact and social considerations. This will permit the market system to allocate resources in a manner that more closely reflects societal needs, both immediate and long term"; G. Hardin, "The Tragedy of the Commons" (1968) 162 Science 1241 at 1245: "... the tragedy of the commons as a cesspool must be prevented by different means, by coercive laws or taxing devices that make it cheaper for the polluter to treat his pollutants than to discharge them untreated."

it will be cheaper for the polluter to control pollution.[14]

The polluter pays principle can be achieved through the imposition of taxes, charges and regulations.[15] Usually, the severity of taxes is determined by the seriousness of pollution and the same is true of charges[16]. Another technique is to set a standard of environmental quality which polluters must maintain. The government may issue emission permits to polluters in such proportions that the aggregate emission does not derogate from the environmental quality set. Polluters who do not exhaust their emission allocations may be allowed to trade them.[17] Some polluters may reduce emissions in order to trade the surplus for profit. In one sense, this does not really reduce pollution as the buyers of unused emission rights will use them. However, it can reduce pollution if the overall ceiling is gradually lowered. Critics say the emission permit system legitimizes pollution and should not be allowed.[18]

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[14] K.W. Kapp, "Environmental Disruption: Challenge to Social Science" in Kapp, Environmental Policies and Development Planning in Contemporary China and Other Essays, Environment and Social Sciences 4 (Paris; The Hague: Mouton, 1972) at 60.

[15] As regulations are part of the legal approach, they will be discussed infra Chapters Three, Four and Five.

[16] J. P. Barde, " The Economic Approach to the Environment" (1989) O.E.C.D. Observer 12 at 13-14: There are different kinds of charges. Effluent charges are imposed where a polluter exceeds the amount of emission he is permitted. Product charges are imposed on goods the manufacture of which generates pollution. This would increase the price of the goods, decrease demand and supply and consequently reduce pollution. User charges are paid by polluters for the treatment of their wastes by government authorities.

[17] Ibid at 14.

[18] D. Thompson, "Giving Greed A Chance" Time (Feb. 12, 1990).

The economic approach to pollution control has some merit, particularly, the internalization of pollution costs through the mechanisms of taxation and charges. Taxes and charges may not only be imposed to deter pollution, the revenue raised by them could also be used to enhance groundwater quality. Charges in the form of realistic water prices can be imposed to minimize water waste and thus promote conservation.[19]

While in absolute terms cost-benefit analysis may not be a proper tool for determining and setting groundwater protection policy, it can be used for determining priority areas. Where, for example, groundwater is already so seriously contaminated that remedial action might be very expensive, cost-benefit analysis could suggest the use of an alternative water supply.

The economic approach alone, however, is not enough to achieve the desired level of environmental protection. Taxes and charges need to be animated and enforced by the force of law in order to secure compliance by the polluter. The law, where effectively enforced has the advantage of directly controlling the behaviour of the polluter. Thus, the economic approach combined with the legal approach would produce a better result.

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[19] For more detail on this point, see Chapter Three infra, notes 236-248 and the accompanying text.

B. LEGAL APPROACH TO ENVIRONMENTAL PROTECTION

The Constitution is the supreme law from which other laws in Canada derive their validity. The nature, strength and scope of regulations directed towards groundwater management and protection are determined by the constitutional mandate of legislative authority, the federal or the provincial government. Therefore, the Canadian constitutional order is considered first in this discussion of the legal approach. A key issue in this context is whether, in the light of the natural unity of the environment, the Constitution of Canada[20] allows for a unified management approach to the environment in general and water resources in particular. The constitutional discussion also identifies who is responsible for groundwater management and protection and the extent to which the authorities concerned are helped or constrained in discharging their responsibilities.

Canada is a federation. This means that a central government (federal) and component (provincial) governments share legislative and administrative powers provided for in the Constitution. One scholar is of the view that there are three categories of federalism, namely: coordinate, cooperative and organic. According to him, there is no practical distinction between coordinate and cooperative federalism because the expression "cooperative" implies that the system has, to a considerable

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[20] The Constitution Acts 1867 to 1982 as Amended in 1982 and consolidated as of October 1st, 1989 (Ottawa: Department of Justice, Canada, 1989).

degree, the quality of coordination. Both "coordination" and "cooperative" imply that the component governments which make up a federal state enjoy some degree of autonomy.[21] In a system of coordinate federalism, there are both the capacity for autonomous activity as well as the absence of a combined action by the governments. This would then necessitate cooperation between the governments and none of them, not even the central government would play a dominant role because each government is autonomous and can decline cooperation if it is "pushed" too far. This is different in a system of "organic" federalism. Here, the central government plays a dominant role in policy formulation and spending choices and in supervising the component governments which are assigned mere administrative role over the issues determined by the central government.[22]

Obviously, "organic" federalism will promote a unified approach to protecting the environment because of the dominant role of the central government. "Coordinate" or "cooperative" federalism on the other hand, is fraught with the risk of a component government declining coordination or cooperation since it has autonomous power. Whether Canadian federalism promotes a unified approach to environmental protection depends on which form of federalism it falls into, and

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[21] M. Commelin, "Federal-State Cooperation On Natural Resources: The Australian Experience" in J. Owen Saunders, Managing Natural Resources In A Federal State Essays from the Second Banff Conference on Natural Resources Law (Toronto, Calgary, Vancouver: Carswell, 1986) 295 at 321: citing Professor Sawer's Federalism Under Strain (1977) at 6: coordinate federalism does not really exist in pure form.

[22] Ibid: the administrative discretions of the component governments might also contibute in moulding policies.

whether there is anything in the Constitution which gives a legal force to that form. Otherwise, a political solution to fashioning anyone of these forms of federalism will have to be employed. Where this is the case, the absence of a legal obligation would not encourage governments to take appropriate actions. Again, a government can always change its mind concerning a deal where it no longer finds the terms acceptable.

In Canada, each level of government has plenary legislative powers over matters assigned to it under the Constitution.[23] Section 91 of the Canadian Constitution enumerates the heads of legislative powers of the federal parliament and section 92 enumerates those of the provincial legislative assemblies.

I. Federal Legislative Powers Relevant to Water Management and Protection:

Section 91 of the Constitution empowers the federal government to make laws for the peace, order and good government of Canada (hereinafter POGG power) in respect of all matters not exclusively assigned to the provinces but not in a way to restrict "the generality of the foregoing terms of this section". This power is discussed more extensively because it seems to be the most appropriate basis upon which a unified approach to environmental management, if constitutionally possible, may be

[23] The discussion focuses only on those heads of legislative powers relevant to environmental aspects of water management and protection.

allowed. In addition, other relevant heads of powers are briefly discussed.

The scope of each head of power has been the subject of a great number of judicial decisions and much scholarly debate. The words "environment" or "water" is not mentioned in the Constitution. Therefore, jurisdiction over water resources, their management and their protection has to be deduced from the enumerated heads of powers. This is a fundamental problem rooted in the Constitution and largely responsible for the controversies which characterize the determination of federal and provincial jurisdictions over the environment in general and water in particular.

Environmental problems were not an issue in the 19th century when the Constitution was enacted, hence no provision was made for them. The sensitivity of the federal-provincial power balance and the need to avoid political tensions between both levels of government explain the failure of the 1982 amendment to clarify jurisdiction over the environment or water. Section 92A which resulted from the amendment provides for federal and provincial legislation over non-renewable natural resources, forestry and electrical energy. This amendment did not explicitly change the existing uncertainty surrounding jurisdiction over water or the environment. One scholar has argued that this amendment enhances provincial powers over the environment and diminishes chances of federal government adopting a national environmental standard. According to him, by giving the provinces jurisdiction over the development, conservation and management of their non-renewable resources including forestry resources and the siting of hydro electricity projects, the amendment has given the provinces legislative power over related or associated

environmental matters.[24] This amendment does not, therefore, help the case for a unified approach to the environment.

In the absence of a constitutional clarification of jurisdiction over the environment, almost every piece of legislation on water or the environment enacted by either level of government is filled with the apprehension of invalidity until it is upheld by the courts upon a constitutional challenge. The fear of enacting ultra vires legislation often diminishes the will and drive of particularly the federal government to pursue certain environmental goals more decisively. For this reason, some environmental legislation such as, for example, the Canada Water Act[25] is loosely worded, and not forceful enough to achieve desired results.

Part I of this Act contemplates a comprehensive water management role for the federal government and emphasizes federal-provincial cooperation. It limits federal role to federal waters[26]. Federal power in terms of water quantity and quality under the Act can only be exercized in the context of agreements with provincial governments. Under s.5 of the Act the Minister is permitted to enter into an agreement with provinces concerned in respect of waters of "significant national interest" for the management of such waters. The management would include: a)

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[24] A.R. Lucas, "Harmonization of Federal and Provincial Environmental Policies: The Changing Legal and Policy Framework" in Managing Natural Resources in a Federal State supra note 21 at 36.

[25] R.S.C. 1985, c.11.

[26] Section 2(1) of the Act defines federal waters as "waters under the exclusive jurisdiction of the Parliament of Canada". It does not mention whether groundwater is included in "waters".

establishing and maintaining an inventory of such waters; b) collecting, processing and providing data on the quality, quantity, distribution and use of such waters; c) conducting research for any aspects of such waters; and d) formulating comprehensive water resource management plans and implementation strategies for such waters. Other management aspects relate to e) designing projects for the efficient conservation, development and utilization of such waters and f) implementing any projects referred to in d) and e)[27].

Yet, as Saunders submits,

> despite its description as comprising 'comprehensive water management', there is very little that is comprehensive about Part I of the Act, in the sense of asserting a wider federal role.[28]

In Part II of the Act, section 11 authorizes the federal minister in charge to enter into arrangements with the provinces for the implementation of water quality management programs in respect to water issues that are of "urgent national

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[27] Ibid. By s.6(1)(a) the Minister can unilaterally undertake in respect to federal waters, projects referred to in s.5(a) to (e). He can also, under s.6(1)(b)(c), unilaterally undertake projects referred to in s.5(d) and (e) in respect to any interjurisdictional and international boundary waters of significant national interest. However, by s.6(2) the minister can only undertake unilateral projects as stated in s.6(1)(b)(c) only with the approval of the Governor in Council who will only give such approval where he is "satisfied that all reasonable efforts have been made by the minister to reach an agreement under s.5 with one or more provincial governemnts having an interest in the water resource management of the waters in question and that those efforts have failed".

Section 2(1) defines interjurisdictional waters as "any waters whether international, boundary or otherwise, that whether wholly situated in a province or not, significantly affect the quantity and quality of waters out side the province."

[28] J.O. Saunders, Interjurisdictional Issues in Canadian Water Management (Calgary: Canadian Institute of Resources Law, 1988) at 28.

concern". Section 13 allows for unilateral federal action where "all reasonable efforts" to reach an agreement have been made but no agreement is reached due to the fault of the province(s). Under s. 13(1) the federal government, in pursuit of a unilateral action in this regard, can designate affected waters as water quality management area, and can under s. 13(2) set up an agency to implement a federal water quality management plan for that area. But the details of the mandate given to federal agency under the Act[29] represent a potential encroachment to provincial powers and may be held unconstitutional.[30] The Act also suggests that the federal government cannot take any preventive measures until water quality has deteriorated to a level of "urgent national concern" in which case damage might have been done.

The federal government has not exercised its unilateral power under the Act because of perceived provincial challenges.[31] The overall weakness of the Canada Water Act is summed up as follows:

> ... in the main, merely... a framework for actions; it does not in and of itself direct such action. It is permissive rather than imperative. Despite somewhat bold profile taken by the federal government in Part II, no water quality management areas have, in fact, been designated-whether in cooperation with the provinces or unilaterally by the federal government despite some research programs carried out for certain

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[29] See generally s.15(2). The mandate of federal agency under the Act includes building and operating waste treatment facilities, s.15(4)(a); collecting charges for such treatment, s.15(4)(b) and collecting prescribed effluent fees, s.15(4)(c).

[30] S.B. Stein, "An Opinion on the Constitutional Validity of the Proposed Canada Water Act" (1970) 28 Univ. Toronto Fac. Law Rev. 74 at 79. See also, Pearse et al., Current of Change supra, Chapter One, note 22.

[31] A.R. Thompson, Environmental Regulation in Canada (Vancouver: Westwater Research Centre, 1980) at 19-21, 33ff.

basins.[32]

While federal unilateral actions have never been taken, federal-provincial agreements are difficult and time-consuming to negotiate. And, when negotiated, they may be challenged in court by citizens where they are reached at the expense of the legislative powers of either level of government.[33] Until the Constitution is amended to clarify federal and provincial jurisdictions over the environment or water, the courts and scholars will continue to be saddled with the difficult task of determining this issue from the existing enumerated heads of legislative powers.

The determination of the validity of a legislation involves, first, determining the essence of the legislation; second, the head of power under which it can be properly made and third, its relevance to carrying into effect the objective of the appropriate head of power.[34] According to Hogg[35], the controlling factor is whether or not the "pith and substance" of the legislation falls under the enumerated federal or provincial heads of powers. The "pith and substance" test also guides the exercise of the federal residuary or general (POGG) power in respect of matters not assigned to the provinces.

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[32] Saunders, supra, note 28 at 30.

[33] A.R. Lucas, "Natural Resource and Environmental Management: A Jurisdictional Primer" in D. Tingley, Environmental Protection and the Canadian Constitution Proceedings of the Canadian Symposium on Jurisdiction and Responsibility for the Environment (hereinafter Environmental Protection and the Canadian Constitution) (Edmonton: Environmental Law Centre, 1987) at 32.

[34] Ibid at 33-35.

[35] P.W. Hogg, Constitutional Law of Canada 2nd ed. (Toronto: Carswell, 1985) at 314.

Guided by the "pith and substance" test, constitutional interpretations in Canada allow each level of government to exercise, to the exclusion of the other, legislative powers in respect of subject matters assigned to it under the Constitution. In matters, such as the environment, which are not specifically assigned to either level of government, the exercise of concurrent jurisdictions may be allowed. But the question will arise as to whether the subject of the legislation is something better handled at the federal or provincial level[36]. The relative importance of the legislation to the federal and provincial concerns becomes an important consideration and this will determine whether or not the federal government can exercise its POGG power.

a) POGG Power:

The scope of this power and when it can be exercised by the federal government have been subject to judicial interpretation. Originally, the exercise of this power was confined to matters of national emergency, for example, war, which

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[36] J.D. Whyte and W.R. Lederman, 2nd ed. Canadian Constitutional Law (Toronto: Butterworths & Co. Canada Ltd., 1977) at 4 paragraphs 16 and 19: The question is: " (1) Does the challenged law have any feature of meaning that might reasonably cause it to fall within one of the provincial classes of laws in s.92? If not, the power to pass the law is exclusively federal. If the answer is yes, question (2) should be asked. (2) Does the challenged law also have features of meaning that might reasonably cause it to fall within one of the federal classes of laws in s. 91? If not, then the power to pass that law is exclusively provincial. If the answer is yes", then the relative importance of the legislation has to be determined: whether it is something that can be done on the basis of provincial or national autonomy.

no one province can deal with.[37] But in A.G. Ontario v. Canada Temperance Federation[38] the "national concern or dimension test" was applied apparently in rejection of the national emergency test. Lord Viscount Simon stated:

> the true test must be found in the real subject matter of the legislation: if it is such that it goes beyond local or provincial concern or interest and must from its inherent nature be the concern of the Dominion as a whole... then it will fall within the competence of the Dominion Parliament as a matter affecting the peace, order and good government of Canada though it may in another aspect touch on matters specifically reserved to the provincial legislature.[39]

Consequently, the exercise of the POGG power has been upheld in non-national emergency cases.[40] Yet in the matter of A Reference of the Anti Inflation Act[41], the Supreme Court of Canada upheld the exercise of POGG power based on national emergency test without overruling the cases approving the national concern test. Thus, both the national concern test and national emergency test would appear to support the exercise of POGG power. Some scholars dispute the combined application of these two tests. They argue that the acceptable test should be that for

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[37] In Re the Board of Commerce Act 1919 and the Combines and Fair Prices Act 1919 (1922) 1 A.C. 191; B. Laskin, "Peace, Order and Good Government Re-examined" (1947) 25 Can. Bar Rev. 1054.

[38] (1946) A.C. 193.

[39] Ibid at 205.

[40] Johannesson v. West St. Paul (1952) 1 S.C.R. 292 (hereinafter Johannesson case); Pronto Uranium Mines v. Ontario Labour Board (1956) 5 D.L.R. (2d) 342; Porter v. The Queen (1965) 1 Ex. C.R. 200; Munro v. National Capital Commission (1966) 57 D.L.R. (2d.) 753 (hereinafter Munro case); The Reference Re Ownership of Offshore Mineral Rights (1968) 65 D.L.R. (2d.) 353 at 375.

[41] (1976) 2 S.C.R. 373

matters not specifically assigned to the provinces under the Constitution, the exercise of POGG power should meet the national concern test while for all other matters the exercise of the power should meet the national emergency test.[42] This seems to be a check on the potential use of this power to erode provincial powers.

A clear case of a national concern matters are interprovincial waters (surface and groundwater). The courts have not hesitated to allow the exercise of the POGG power in this area. In Interprovincial Cooperatives v. Manitoba[43] Pigeon J. held for the majority of the Supreme Court of Canada that while the provinces can regulate rivers within their boundaries pursuant to sections 92(5) and 109 of the Constitution, interprovincial waters and their pollution are a matter of national concern. Accordingly, they fall under the federal POGG power. According to the Judge, "the basic rule is that general legislative authority in respect of all that is not within the provincial field is federal."[44] This case suggests that pollution within a province, no

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[42] P.W. Hogg, Constitutional Law of Canada (Toronto: Carswell, 1977) at 264. See also D. Chesman, "Constitutional Aspects of Water Law" in H.I. Rueggeberg and A.R. Thompson, Water Law and Policy Issues in Canada (Vancouver: Westwater Research Centre, University of British Columbia, 1984) at 75-76.

[43] (1976) 1 S.C.R. 477, 53 D.L.R. (3d) 321 (hereinafter cited to D.L.R.).

[44] Ibid at 357; Saunders, supra, note 28, at 18: submits that the opinion of Ritchie J. which formed part of the majority judgment casts doubt as to the scope of federal jurisdiction over interprovincial waters as the Judge referred to the federal fisheries jurisdiction as a basis for its interprovincial jurisdiction. In the Interprovincial Cooperative case, corporations in Saskatchewan and Ontario duly permitted in these provinces to discharge chemicals into the river, discharged mercury which killed fish in Manitoba, a downstream province. By Manitoba law the corporations were liable in tort to the fishermen. It was held that the Manitoba law could not operate extra provincially to hold the corporations liable. Whyte and Lederman, supra, note 36, at 13 paragraph 24-25 submit that the effect of Pigeon J's decision was that federal legislative jurisdiction covers interprovincial delicts or torts in Canada to the exclusion

matter how serious, remains a provincial matter unless it has extra provincial effect. It has been argued, however, that this case is of little "precedential authority"[45] because of the different grounds upon which the majority based their decisions. However, it seems clear from the case that interprovincial water pollution falls under federal jurisdiction. Whether this is as a result of the federal POGG power as Pigeon J. held or the fisheries power[46] as Ritchie J. suggested is a different question. If interprovincial water quality is under federal jurisdiction, so is interprovincial water quantity. Accordingly, groundwater movement, for example, from "Alberta through Saskatchewan to Manitoba"[47] falls under federal jurisdiction.

In the absence of a clear guide in the Interprovincial Cooperative case as to when the POGG power can apply based on the national concern doctrine, the Supreme Court of Canada in The Queen v. Crown Zellerbach Canada Ltd. et al.

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of provincial statutory law and rules of private international law. According to the learned authors, the received common law rules of private international law which have not been abrogated by the Constitution allows the provinces to make extra provincial laws in respect to matters specifically assigned to them under section 92 of the Constitution where the person affected by that law has substantial connection with the province. The only exception is the imposition of direct taxation on property and persons outside the province even when the same have substantial connection with the province. Thus, the Manitoba law should have been upheld on this ground. (Laskin J. for the minority upheld the Manitoba law on this ground). The authors are of the view that received federal common law tort which Pigeon J's decision suggested, should have been applied concurrently with the Manitoba law.

[45] M.T. Hertz, "Interprovincial, The Constitution and the Conflict of Laws" (1976) 26 U.T.L.J. 84 at 90.

[46] The Constitution Acts supra note 20, s.91(12).

[47] D. Gibson, "The Constitutional Context of Canadian Water Planning" (1969) 7 Alta. L. Rev. at 76.

dealt with this issue extensively. In this case the first respondent was charged with dumping of substances in the Beaver Cove water (salt water) within the province of British Columbia contrary to s.4(1) of the now repealed Ocean Dumping Control Act. Both the trial court and the British Columbia Court of Appeal held that the water of Beaver Cove was within the province of British Columbia and that the federal legislation did not apply to activities undertaken in that water. Alternatively, it was held that the federal legislation was unconstitutional and ultra vires in so far as it applied to that water.[48] On appeal to the Supreme Court of Canada, one of the questions was whether federal jurisdiction to regulate dumping of substances at sea extended to the regulation of dumping in provincial marine waters.

The appellant argued that the control of dumping in provincial marine waters was an integral part of a single matter of national concern, justifying the application of s.4(1) of the challenged law.[49] Justice Le Dain for the majority of the Supreme Court of Canada, after reviewing relevant authorities, stated the law on the application of national concern as a basis for the exercise of POGG power as follows:

> 1) The national concern doctrine is separate and distinct from the national emergency doctrine of the peace, order and good government power, which is chiefly distinguishable by the fact that it provides a constitutional basis for what is necessarily legislation of a temporary nature;
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> 2) The national concern doctrine applies to both new matters which did not exist at Confederation and to matters which, although originally

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[48] (1988) 1 S.C.R. 400 at 415-417.

[49] Ibid at 418-419. (the Ocean Dumping Control Act is now Part VI of CEPA infra note 63.

> matters of a local or private nature in a province, have since, in the absence of national emergency, become matters of national concern:
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> 3) For a matter to qualify as a matter of national concern in either sense it must have a singleness, distinctiveness and indivisibility that distinguishes it from matters of provincial concern and a scale of impact on provincial jurisdiction that is reconcilable with the fundamental distribution of legislative power under the Constitution;
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> 4) In determining whether a matter has attained the required degree of singleness, distinctiveness and indivisibility that clearly distinguishes it from matters of provincial concern it is relevant to consider what would be the effect on extra provincial interests of a provincial failure to deal effectively with the control or regulation of the intra provincial aspects of the matter (i.e. provincial inability test).[50] (emphasis added).

According to the Court, the "provincial inability" test is one of the indicia for determining "whether a matter has that character of singleness or indivisibility required to bring it within the national concern doctrine".[51] But this, in the view of the Court, does not mean that any one level of government has the plenary jurisdiction to deal with such matters. Rather, it means that the interrelationship of intra provincial and extra provincial aspects of the matter might better be dealt with under a single legislative approach.[52]

The learned Judge found that the challenged law was enacted pursuant to the implementation of Canada's international obligation under the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter though the legislation is wider in scope than the Convention in that it applied to internal waters.

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[50] Ibid at 431-432.

[51] Ibid at 434.

[52] Ibid.

He also found that marine pollution which the challenged law sought to regulate met the criteria of singleness, distinctiveness and indivisibility required for a matter to qualify as a matter of national concern. According to the Judge, the challenged law regulated dumping only in salt (marine) water even where such is located within a province as opposed to freshwater. And the ocean being salt water, provincial salt water was only an integral part of the water in the ocean and both were a single matter. As to the distinctiveness of this matter, he found that the pollution of marine or salt water is distinct and separate from freshwater pollution, having its own characteristics and scientific consideration. As to the indivisibility of the matter, he was satisfied that there is no visually observable difference between the internal waters where the international Convention implemented by the challenged law did not apply and the territorial sea where it applied. In addition, the movement of pollutants did not respect the boundaries between the internal waters and the territorial sea. He found marine pollution as a whole to be predominantly of extra provincial and international nature.[53]

Le Dain also found that the distinction between freshwater to which the challenged law did not apply and salt water to which it applied, put a reasonable and ascertainable limit on the impact of federal legislation on the provinces, a consideration which was necessary to guide against the erosion of provincial powers. Based on these condierations, he allowed the appeal holding that the matter was a national concern justifying the enactment and application of s.4(1) of the challenged

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[53] Ibid at 436-437.

law based on the POGG power.[54] This conclusion is not affected by the fact that the matter was local, namely: the management of forestry resources in British Columbia which discharged some substances into the marine water of that province. Furthermore, there was no evidence that the substances dumped in British Columbia's water was deleterious to fish or fish habitat as to trigger federal jurisdiction under s.33 of the Fisheries Act[55] or had extra provincial effect as to trigger the application of the Interprovincial Cooperative case.[56] Although, provincial inability test could, in a proper case, deny federal jurisdiction where a province has the ability to deal with a matter, the overriding consideration in Le Dain's judgment seems to be the unity of the marine environment, necessitating a single legislative approach. Because of this unity the failure of a province to deal with pollution in its marine water would inevitably cause the pollution of the rest of the marine environment.

Dissenting, Justice LaForest for the minority of the Court, stated:

> In legislating under its general power for the control of pollution in areas of the ocean falling outside provincial jurisdiction, the federal Parliament is not confined to regulating activities taking place within those areas. It may take steps to prevent activities in a province, such as dumping substances in provincial waters that pollute or that have the potential to pollute the sea outside the province. Indeed, the exercise of such jurisdiction, it would seem to me, is not limited to coastal or internal waters but extends to the control of deposits in

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[54] Ibid at 437.

[55] R.S.C. 1985, c.F-14.

[56] Supra note 43.

freshwater that have the effect of polluting outside a province.[57]

Had this been the conclusion of LaForest, perhaps a formidable case for enhanced federal powers for groundwater protection could easily be made as this statement is in agreement with and even goes beyond the view of the majority. But the learned Judge invoked a simple, yet profound qualification to his statement when he said:

> In fact, as I see it, the potential breadth of federal power to control pollution by use of its general power is so great... the constitutional challenge in the end may be the development of judicial strategies to confine its ambit....This has profound implications for the federal-provincial balance mandated by the Constitution. The challenge for the courts, as in the past, will be to allow the federal Parliament sufficient scope to acquit itself of its duties to deal with national and international problems while respecting the scheme of federalism provided by the Constitution.[58]

Based on the need to maintain the constitutionally mandated balance of power between the federal and provincial governments, and the absence of evidence of actual or potential extra provincial effect of the activity in question, LaForest declined to approve the challenged law. According to him, to hold otherwise would erode provincial legislative powers over the subject matters constitutionally under their jurisdiction.[59]

However, both the majority and the minority agree that the federal government can legislate over matters such as water pollution which although within

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[57] Crown Zellerbach case supra note 48 at 445.

[58] Ibid at 447-448.

[59] Ibid at 457, 459.

one province, have proven actual or potential extra-provincial effects.[60] Where there is no evidence of such effect, but the matter meets the requirements of singleness, indivisibility and distinctiveness, the implication of LeDain's judgment is that a single legislative (federal) approach is desirable where the province concerned is unable to deal with the matter. But LaForest's view does not consider the unity of the marine environment and arguably, environment as a whole, as a compelling reason to allow federal jurisdiction. His view would support a fragmented approach to managing the environment in line with the traditional heads of power under the Constitution. Obviously, a province will not always have the ability to deal with a matter such as the environment which does not respect political boundaries. One scholar sees water issues generally as a subject which cannot be adequately dealt with by a provincial government. According to him, leaving this matter to

> the individual provinces there would be a substantial risk that fear of losing industry to less demanding provinces might cause some provinces to set lower standards than satisfactory. Since uniform federal standards would therefore provide an approach to pollution control that provincial legislation could not duplicate, the problem has ... a "national dimension" justifying federal action under peace, order and good government Power.[61]

In other words, water management in a province necessarily involves different

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[60] Ibid at 417-418, 445.

[61] D. Gibson, "Constitutional Jurisdiction Over Environmental Management in Canada" (1973) 23 U.T.L.J. 54 at 85, Chesman, supra, note 42 at 74, Stein, supra, note 30 at 80: sees POGG as the strong basis for federal unilateral action under the Canada Water Act (then as Bill c - 144). However, in the event of a constitutional challenge, the onus is on the federal government to prove that water quality problems have become a national concern justifying the exercise of POGG power.

aspects some of which may be outside the jurisdiction of the province. Only the federal government has the power to ensure a comprehensive water management and to establish a multi-jurisdictional agency to handle the project.[62]

Following the decision in Crown Zellerbach case, it can be argued that where groundwater pollution within a province has actual or potential effects outside the province, the federal government can intervene by regulation. For example, nation-wide public health and safety concerns presented by actual or potential groundwater pollution in a province may trigger the exercise of the POGG power. The problem with the POGG power, however, is that the exercise of it might wait for too long for pollution to be of national concern thereby permitting the occurrence of pollution damage. If, however, it is to be exercised in preventing pollution, the burden of proving that the potential pollution is of national concern may be difficult to discharge. Groundwater is, therefore, in danger of not being adequately protected under this power.

The difficulty of justifying the exercise of the POGG power would appear to have led the federal government to believe that the exercise of powers based on the national concern doctrine would, if at all, affect provincial matters peripherially, even in environmental matters which are not specifically assigned to the provinces under

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[62] D. Gibson, "The Constitutional Context of Canadian Water Planning" supra, note 47, 71 at 86: A provincial river basin management authority would not, because of jurisdictional constraint, have power to deal with fishing seasons, navigation or even pollution from federally owned or incorporated companies, and so, cannot ensure the desired comprehensive water management.

the Constitution. For example, the enactment of CEPA[63] which regulates "toxic substances that may endanger life and health ..." may be supported by the POGG power.[64] However, neither CEPA nor any other federal legislation regulates water pollution in the provinces directly. Indeed no federal legislation is designed to address actual or potential water pollution within a province which may have extra provincial effect.[65]

Beside the issue of federal power extending to water pollution cases within a province which have actual or potential extra- provincial effects, is the question whether there are other grounds based on Le Dain's judgment in Crown Zellerbach case for a broader application of the POGG power in groundwater concerns. For example, LeDain found the marine environment as a unity which necessitates a single (unified) legislative approach because it meets the singleness, indivisibility and distinctiveness criteria. Here, the scientific conception of marine environment as a unity fits into legal conception of "unity".

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[63] Canadian Environmental Protection Act (CEPA) R.S.C. 1985, c.16 (4th Supp.).

[64] Lucas in Environmental Protection and the Canadian Constitution, supra, note 33 at 39: submits that CEPA (then a Bill) dealt with international air pollution and not domestic air pollution in order to avoid encroaching upon provincial jurisdiction over property and commercial activities. CEPA controls domestic air pollution only to the extent that it controls toxic substances. See Re Canada Metal and the Queen (1983) 2 W.W.R. 302.

[65] The exception is s.2(1) of the Canada Water Act supra note 25, which defines "interjurisdictional waters" as including water situated wholly in a province the management of which has extra jurisdictional effect. As stated earlier, this provinsion has never been unilaterally exercised by the federal government for fear of provoking political tension with the provinces.

Groundwater is ubiquitous and often interconnected[66] so that the withdrawal of the resource may affect the supplies of a neighbour. This may be said to make groundwater concerns (including pollution) into a single and indivisible matter. Ecologically speaking groundwater is certainly one connected resource since it is part of the general environment which the Brundtland Report describes as a unity.[67] The problem, however, is to have the law recognize the unity of the environment. Le Dain's judgement which suggests a single legislative approach is arguably, limited to the marine environment. Even where there is a legal recognition of the unity of the environment, it does not entitle the federal government to exclusive jurisdiction over the environment. In the Queen in Right of Alberta et al v. Friends of the Oldman River Society (hereinafter the Oldman River case)[68], LaForest seemed to deny that the environment is a subject which requires unity of legal efforts to deal with, when he said:

> I earlier referred to the environment as a diffuse subject, echoing what I said in R v. Crown Zellerbach Canada Ltd. to the effect that environmental control, as a subject matter, does not have the requisite distinctiveness to meet the test under the "national concern" doctrine as articulated by Beetz J. in Reference re Anti-Inflation Act. Although I was writing for the minority in Crown Zellerbach, this opinion was not contested by the majority...[69] (emphasis added).

Therefore, groundwater concerns as part of the environment, fail the

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[66] Supra, Chapter One, note 27; Infra Chapter Three, notes ~~29~~ 31, ~~30~~ 32 and the accompanying text.

[67] See supra Chapter One, note 7.

[68] (Jan. 23, 1992) Unreported, S.C.C. No.21890.

[69] Ibid at 62-63.

distinctiveness test. With the exception of interprovincial groundwater, there is nothing that makes groundwater under federal geographical jurisdiction distinct from groundwater under provincial jurisdiction so as to meet the requirement of distinctiveness.[70] This requirement is important if the impact of federal legislation on groundwater is to have a reasonable and ascertainable limit in so far as its effect on provincial groundwater is concerned.[71] The national concern test is not met[72]. Therefore, other than interprovincial groundwater and its pollution, the POGG power cannot afford a basis for a unified action to dealing with groundwater concern in a broader scope. Although groundwater as a resource is not a national concern, its contamination could be of such concern if, for example, it leads to a widespread health hazard.

An attempt to fit groundwater quantity and quality management into the singleness, indivisibility and distinctiveness test will essentially remove the management of groundwater as a resource from provincial jurisdiction. Unlike marine water which falls under federal jurisdiction notwithstanding that a part of it may be

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[70] It is unrealistic to categorize groundwater into marine and fresh groundwater so as to achieve the distictiveness. This work, as earlier stated, is focusing only on fresh water.

[71] Crown Zellerbach case supra, note 48, at 437: per Le Dain.

[72] Hogg supra, note 35, at 372-373, 379-380: submits that where a matter requires the uniformity of actions in such a way that the failure of a province to cooperate would affect other provinces then it is a national concern requiring the exercise of POGG power. See Johannesson case supra, note 40; and Munro case, supra, note 40. National emergency and gap situations are the other instances for the application of the POGG power, see: Hogg, supra note 35, at 372-373, 370-380: admits that there are limited gaps.

situated within a province, groundwater is by virtue of s.109 of the Constitution, a provincial resource and the environmental aspect of the resource falls under provincial jurisdiction. To hold otherwise, would deprive the provinces jurisdiction over the resource.[73] Thus, the provinces would manage their resources as well as the environmental problems associated with them.

Furthermore, the hope of using the POGG power to secure a federal or a unified jurisdiction over the environment or groundwater pollution is dashed because there is a strong indication that this power may not be expanded beyond the scope determined by the "pith and substance" test. In the Oldman River case, one of the issues was the constitutionality of the Environmental Assessment and Review Process Guidelines Order (hereinafter Guidelines Order). The respondent succeeded in obtaining an certiorari order to quash the approval of the Minister of Transport given to Alberta government to construct the Oldman River dam. The Minister did not conduct an environmental screening of the impact of the project in accordance with the Guidelines Order before giving the approval. The respondent also obtained an order of mandamus to compel both the Minister of Transport and the Minister of Fisheries and Ocean to comply with the Guidelines Order.[74]

Alberta argued, inter alia, that the Guidelines Order was either ultra vires the federal government or was not applicable to the project as it gave the federal

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[73] Arguably, there will not be such a result in the case of marine environment which is part of the ocean over which the federal government has jurisdiction, thus a justification for the decision of Le Dain on this score.

[74] Supra, note 68, at 17-18.

government power to regulate environmental effect of provincial works (in this case, the Oldman River dam), which are exclusively under provincial jurisdiction. It maintained that environmental matters were not under the plenary jurisdiction of any one level of government and that the Guidelines Order purported to give the federal government such jurisdiction.[75]

Speaking for the majority in the Supreme Court of Canada, Justice LaForest held that even if the Oldman River project fell under provincial powers over local works, it did not preclude the federal government from making laws which pertain to the same project as it concerns federal responsibility. According to him,

> In legislating regarding a subject, it is sufficient that the legislative body legislate on that subject. The practical purpose that inspires the legislation and the implications that body must consider in making its decision are another thing. Absent a colourable purpose or a lack of bona fides, these considerations will not detract from the fundamental nature of the legislation.[76] (emphasis added).

The reference to "colourable purpose" emphasizes the "pith and substance" test. He held that the Guidelines Order was intra vires the federal government but could not be used as a colourable device to invade provincial powers in respect of matters which are unconnected to the relevant federal heads of power. He also added that the Guidelines Order fell under federal POGG power and that any intrusion to provincial powers was merely incidental.[77]

Again, he maintained that the environment is a diffuse subject which comes

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[75] Ibid at 61.

[76] Ibid at 69.

[77] Ibid at 72-76.

under the different federal and provincial heads of power under the Constitution in different degrees depending on the nature of each head of power.[78] Diffuse, not in the sense that the environment is compartmenalized into independent segments, but in the sense that the exercise of each of the different traditional heads of power under the Constitution may touch on the environment. Referring to an Australian case, Laforest held that:

> The case points out the danger of falling into the conceptual trap of thinking of the environment as an extraneous matter in making legislative choices or administrative decisions. Clearly this cannot be the case. Quite simply, the environment is comprised of all that is around us and as such must be a part of what actuates many decisions of any moment.[79]

LaForest's conception of the environment as a diffuse subject emphasizes not only the powers of both levels of government to enact environmental laws within the confines of their respective traditional heads of power, but also the possibility of such legislation overlapping. In Alberta Government Telephones v. Canada (Canada Radio-Television and Telecommunication Commission) Dickson C.J speaking for the Supreme Court of Canada stated:

> It should be remembered that one aspect of the pith and substance doctrine is that a law in relation to a matter within the competence of one level of government may validly affect a matter within the competence of the other. Canadian federalism has evolved in such a way which tolerates overlapping federal and provincial legislation in many respects, and in my view, constitutional immunity doctrine is

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[78] Ibid at 62-67.: the environment does not have the requisite distinctiveness characteristic required under the "national concern doctrine."

[79] Ibid at 71.

> neither desirable nor necessary to accommodate valid provincial objectives.[80] (emphasis added).

While this is not an environmental case, LaForest relied on it in the relevant part of his decision in the Oldman River case.[81] Thus, in environmental matters, overlapping legislation is allowed and constitutional immunity cannot be pleaded by one level of government against validly enacted legislation by the other level of government subject to the "pith and substance" test. It is not clear, however, whether the "pith and substance" test will allow a federal legislation to serve to supplement, strengthen or fill the gaps in provincial legislation. This is unlikely because such a legislation, though supplemental, is nevertheless directed to regulate matters within provincial jurisdiction.

The possibility of overlapping legislation, however, can be a springboard for a unified legislative effort. This does not necessarily warrant having a single legislative document, but rather harmonizing purposes, programs, policies and strategies contained in the different federal and provincial legislation in keeping with the natural unity of the environment.

Unfortunately, merely overlapping legislation does not offer much help because it cannot overcome constitutional barriers to a unified approach to environmental protection. Even if one assumes that the POGG gives the federal government jurisdiction over groundwater environment, groundwater resources belong

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[80] (1989) 2 S.C.R. 225 at 275.

[81] Supra, note 68, at 68.

to the provinces. Potential conflict is built into a system where the provinces manage groundwater resources but the environmental aspect falls under the dominant control of the federal government. The Brundtland Report acknowleges the interrelationship between the economy and the environment and recommends that those who manage resources should also manage environmental matters associated with them (institutional principle).[82] As the argument goes, since groundwater is owned and managed by the provinces, its pollution should be managed by them. This is consistent with the traditional heads of power approach under the Constitution which LaForest maintained in the Crown Zellerbach case.[83] Federal and provincial governments are, therefore, to pursue individual interests (fragmented approach) in respect of the environment. The POGG power is to be exercised only where there is proven actual or potential extra-provincial effect.

While it is desirable to have those who manage resources to also manage environmental problems associated with them, in a federal state like Canada, the environmental problems may not always be confined within the spatial unit within which a particular resource manager (a province) has jurisdiction. Environmental problems extend beyond political boundaries because of the unity of the natural environment. Therefore, within the Canadian constitutional context, two important ideals of sustainable development, namely: the institutional principle on the one hand, and a unified management approach based on the unity of the environment on the

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[82] Supra Chapter One, note 7 at 313.

[83] Supra note 48 at 448, 459.

other hand contradict each other.[84]

If the federal government manages the environment as a unity without managing the resources associated with it, such a management will not be effective. On the other hand, where the provinces manage the environment individually, they may ignore the natural unity of the environment and risk being inefficient. Therefore, there must be a compromise where both levels of government can manage the environment and the resources in a cooperative fashion. Such compromise must be found outside the Constitution, and according to one scholar, in "cooperative federalism".[85]

While "cooperative" federalism is to be found outside of the Constitution, it would only be valid if it does not fundamentally offset the constitutional balance of power. Given the Canadian constitutional context, cooperative federalism is the most appropriate form of federalism that is likely to be achieved because the provinces have autonomous powers over the subject matters assigned to them and they cannot be stripped of these powers. Clearly, "organic" federalism is not possible in Canada as it purports to take away legislative powers of the provinces and leaves them with only administrative roles. This will be unconstitutional.

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[84] M. Walters, "Ecological Unity and Political Fragmentation: The Implications of the Brundtland Report for the Canadian Constitutional Order" (1991) XXIX No.2 Alberta L. Rev. 420 at 446: the more POGG power is exercised in favour of the environment as a unity, the more the provinces are denied powers to manage environmental problems associated with management of their resources.

[85] W.R. Lederman, "Unity and Diversity in Canadian Federalism: Ideals and Methods of Moderation" (1975) 53 Can. Bar Rev. 597 at 615.

In sum, the POGG power based on national concern test cannot be constitutionally applied to centralize groundwater protection. And to achieve the same goal through the exercise of the federal spending power is not free from controversy.

b) Federal Spending Power:

There is no explicit enumeration of this power under s.91 of the Constitution. Commentators[86], however, agree that this power is deducable from public debt and property power under s. 91(1A) and taxation power under s.91(3). Also, the common law doctrine of Royal prerogative which is said to be inherent in the Constitution enables the federal government to spend its property and money in whatever manner it wishes.[87]

The federal government can use its spending power to influence and determine environmental protection programs at the provincial and municipal levels

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[86] K. Hanssen, "Constitutional Aspect of Federal Spending Power" in D. Gibson, Constitutional Aspect of Water Management (Winnipeg: The Agassiz Centre, University of Manitoba, 1968) vol. 1. Chapter V. (page numbering is omitted but on a plain count of the pages, the reference is pages 1-12); Franson and Lucas, Environmental Law and Case Digest vol. 1 (Toronto: Butterworth, 1978) 260-261, 263; W.J. Andrews, "Public Interest Perspective" in Environmental Protection and the Canadian Constitution supra, note 33 at 22.

[87] F. Scott, "The Constitutional Background of Taxation Agreements" (1955) 13 (No.1) McGill L.J. at 6: argues that the "Crown is a person capable of making gifts or contracts like any other person, to whomsoever it chooses to benefit."

by linking aids and grants to the conditions that such programs be pursued.[88] It is submitted that through this power the federal government can encourage groundwater management and protection programs at the provincial and municipal levels. A province like British Columbia which still relies on the common law to manage groundwater quantity[89] can be encouraged through federal funding to adopt up to date laws and policies. Provinces which rely on general environmental laws and programs to protect groundwater can also be encouraged to develop laws and programs specifically directed to groundwater protection. As will be suggested further, the U.S. federal government has used its spending power to encourage several groundwater protection programs at the state level.

The federal spending power, however, appears to have constitutional limitations. In A.G. for Canada v. A.G. for Ontario[90] the federal government had raised a fund from contributions by employers across Canada for purposes of compensating the unemployed. A legislation enacted by the federal government for the distribution of this fund was found to be ultra vires the government as it was in "pith and substance" an insurance legislation which fell under provincial jurisdiction. Lord Atkin said:

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[88] Hanssen, supra, note 86, at 7-12; Franson and Lucas, supra, note 86; Andrews in Environmental Protection and the Canadian Constitution supra, note 33.

[89] Infra Chapter Three, note 171 and accompanying text.

[90] (1937) A.C. 355: This was prior to the constitutional Amendment which brought unemployment and social welfare under exclusive federal jurisdiction.

> ... Dominion legislation, even though it deals with Dominion property, may yet be so framed as to invade civil rights within the province, or encroach upon the classes of subjects which are reserved to provincial competence. It is not necessary that it should be a colourable devise or a pretense. If on the true view of the legislation it is found that in reality in pith and substance, the legislature invades civil rights within the province, or in respect of other classes of subjects otherwise encroaches upon the provincial field, the legislation will be invalid. To hold otherwise would afford the Dominion easy passage into the provincial domain.[91]

The validity of any federal legislation authorizing spending depends on the pith and substance of that legislation. This does not mean that federal spending must be confined to matters concerning the enumerated heads of powers under s.91. Federal spending legislation can touch on provincial matters without in pith and substance encroaching on provincial domain. Lord Atkin took this position when he said:

> That the Dominion may impose taxation for the purpose of creating a fund for special purposes, and may apply that fund for making contributions in the public interest to individuals, corporations or public authorities could not as a general proposition be denied[92].

It is submitted that federal spending legislation granting funds to provinces or municipalities on the condition that they pursue environmental programs within their locality is not in pith and substance invasive of provincial domain. As Hanssen stated:

> It would seem to me that conditional grant legislation does not generally "affect" the classes of subjects reserved exclusively to the province. It is essentially an exercise of federal government's discretionary right to dispose of its property as it sees fit.[93]

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[91] Ibid at 367.

[92] Ibid at 366.

[93] Hanssen, supra, note 86, at 7-8, 9-15: several federal-provincial shared cost programs in water resources management has been undertaken under this power.

The pith and substance of such federal spending legislation is spending and its effect on provincial environmental matters is only incidental and that cannot be a ground to invalidate it.[94] In sum, the extent of the federal spending power is uncertain but most commentators say it can be used in relation to matters under provincial jurisdictions.[95] The federal tax power from which the spending power derives can be used to tax polluters in order to minimize pollution.

c) Other Federal Powers Relevant to Water:

Other federal powers relevant to water protection include the sea coast and fisheries power[96] and the navigation and shipping power.[97] While these are primarily concerned with surface water, they have incidental effect on groundwater protection. Also, the federal agricultural power[98] can be used to control pesticides and fertilizers from contaminanting groundwater.[99]

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[94] Ibid; A.G. for Canada v. Canadian Pacific Railway Co. and Canadian National Railways (1958) S.C.R. 285; Reference Re Waters and Water Powers (1929) S.C.R. 200; Re Ogal (1940) 1 W.W.R. 665. These cases say that a legislation is not invalid merely because it incidentally touches on matters outside the jurisdiction of the legislature which enacted it.

[95] For a detailed discussion on this, see A. Petter, "Federalism and the Myth of Federal Spending Power" (1989) 68 Can. Bar Rev. 448, at 450-454, 461, 464-465, 478.

[96] The Constitution Acts supra, note 20, s.91(12).

[97] Ibid s.91(10).

[98] Ibid s.95.

[99] These are further discussed in Chapter Four Infra.

II. Provincial Legislative Powers:

Provincial legislative powers relevant to environmental protection include: taxation, s.92(2); the management and sale of provincial public lands, s.92(5); local works and undertakings that are not assigned to the federal government, s.92(10); property and civil rights, s.92(13); and "generally all matters of a merely local or private nature in the province," s. 92(16). By virtue of s.109 ownership of all lands, mines and minerals in any province is vested in the Crown of that province.

Power to legislate over water and other environmental matters is an incident to the ownership of land and natural resources[100] vested in the provincial Crown under s.109 of the Constitution. This means that the provinces can legislate on the management and protection of groundwater resources within their boundaries.

There are matters in respect to which provincial legislative powers do not apply. For example, although the provinces can regulate federally incorporated companies whose activities fall under provincial jurisdiction,[101] they cannot regulate the activities of such companies which fall under the exclusive jurisdiction of the

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[100] Burrard Power Company v. R (1911) A.C. 87 at 94; D. Gibson, "The Constitutional Context of Canadian Water Planning" supra, note 47, at 73-74: At common law water in its natural state cannot be owned until it is reduced to absolute possession for example, withdrawn or diverted. However, right to water otherwise known as "usufructory" right can be acquired. See also, Embrey v. Owen (1851) 6 Ex. 369.

[101] P.W. Hogg, Constitutional Law of Canada 3rd ed. (Toronto: Carswell, 1992) at 610-611.

federal government.[102]

It is difficult to conceive that given health hazards associated with groundwater contamination, the courts would absolve such corporations from the application of the provincial law especially where there is no validly enacted federal law applicable. To hold otherwise, would encourage pollution of the environment. This also emphasizes the need for federal and provincial cooperation especially where federal laws cannot be far reaching because of constitutional barriers. Another limitation of provincial law is that where it conflicts with a validly made federal law, it is invalid to the extent of its inconsistencies.[103]

Inspite of these and other limitations, by virtue of provincial ownership of land and natural resources, jurisdictions over matters of a mere local nature, civil and property rights, the provinces arguably, have a stronger power than the federal government under the Constitution to protect the environment. As McLeod submits,

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[102] Queen v. Breton (1968) 65 D.L.R. (2d) 76, 79; Commission du Salaire Minimum v. Bell Telephone (1967) 59 D.L.R. (2d) 145; British Columbia Power Corporation v. A.G. of British Columbia (1963) 44 W.W.R. 65. In Johannesson supra, note 40, it was held that a provincial zoning regulations could not affect the construction or operation of a federal air field. Also in R v. Canada Steamship Lines (1960) O.W.N. 277 it was held that a municipal anti smoke by-law was not applicable to a ship in a harbour within the municipality as shipping is a federal matter. But in C.P.R. v. Notre Dame de Bonsecours (1899) A.C. 367 (P.C.) a federal railway authority was ordered to clean ditches on its property in compliance with a municipal by-law. See D. Gibson, "Interjurisdictional Immunity in Canadian Federalism" (1969) 47 Can. Bar Rev. 271.

[103] Multiple Access v. McCutcheon (1982) 2 S.C.R. 161; W. Lederman, "Concurrent Operation of Federal and Provincial Laws" (1963) 9 McGill L.J. 185. See also, B. Laskin "Occupying the Field: Paramountcy in Penal Legislation" (1963) 41 Can. Bar Rev. 234.

constitutionally, the provinces have "primary responsibility for the protection and enhancement of the quality of air, land and water"[104]

III. Defects in the Canadian Constitution Affecting Water Management and Protection:

As we have seen, there is no specific mention of "environment" or "water" in the Constitution. This means that legislative jurisdiction over the environment or water has to be deduced from the enumerated heads of powers. This has been and continues to be difficult and controversial. Consequently, to avoid court challenges by the provinces, federal environmental legislation is often not forceful and comprehensive enough.[105] Uncertainty riddles the validity of both federal and provincial legislation until they are declared valid by the courts. According to some scholars,

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[104] R. McLeod, "The Provincial Perspective" in Environmental Protection and the Canadian Constitution supra, note 33 at 13; P.M. Bird and D.J. Rapport, State of the Environment Report for Canada (Ottawa: Environment Canada, 1986) at 229: submit that "Given provincial powers in environmental legislation and management, federal government responsibilities are limited to: 1) administering the environment laws that fall within its legislative mandate; 2) establishing national standards for adoption and enforcement by the provincial governments; 3) providing scientific and statistical support and information to federal departments and agencies, provincial governments, private sector and general public; 4) encouraging uniformity in resource management by provinces and the private sector; and 5) providing financial assistance to provincial programs through various cost-sharing arrangements and to private sector programs through grants and contributions."

[105] CEPA supra, note 63 is, arguably, an exception.

> "the combination of indirect reference in the Constitution and limited guidance from the courts makes it impossible to define precisely the respective roles of the federal and provincial governments in water management".[106]

The Constitution also fails to clarify interjurisdictional immunity issues. The consequence of this in the environmental context is that federally incorporated companies undertaking activities which fall under the exclusive jurisdictions of the federal government might be held not subject to provincial pollution control laws. The Constitution has been further criticized as impeding cooperation between the federal and provincial governments. As Simeon argues:

> In Canada ... major consequence of traditional institutional structures (for example, the Constitution) has been not to serve as a channel for federal-provincial interaction but rather as block to such interaction and an incentive to the creation of new institutions.[107]

New institutions such as intergovernmental agreements and cross-government delegation of powers to agencies are intended to obviate constitutional jurisdictional problems. Intergovernmental agreements spell out clearly the environmental responsibilities of both levels of government and their agencies and ways of greater coordination of activities to ensure more effective results.[108] However, the

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[106] Pearse et al, supra, Chapter One, note 22, at 63.

[107] R. Simeon, Provincial Diplomacy-The Making of Recent Policy in Canada (Toronto; Buffalo: University of Toronto, 1972) at 307.

[108] R.W. Slater, "The Federal Perspective" in Environmental Protection and the Canadian Constitution supra, note 33, at 8-12: states that there are more than 350 such agreements and that the role of the federal government in this is leadership. See also Saunders supra, note 28 at 47-80 for details of some of the agreements and their legal implications.

conclusion of such agreements is time and resource consuming and "the parties are interested less in the value of the overall project than they are in getting the largest share of benefits for themselves."[109]

To make up for the constitutional deficiencies, federal environmental legislation such as CEPA and Canada Water Act promote "diplomatic" solutions to jurisdictional problems. They provide for federal-provincial consultations, negotiations and agreements. CEPA goes further to provide for compromises by way of the equivalency provision under section 34. By virtue of this provision, where certain aspect(s) of a provincial environmental legislation is considered to be equivalent to the appropriate part of CEPA, CEPA provisions would not apply to the matter in question.

Given the absence of legal obligations to follow "diplomatic" processes, the delay and potential failures associated with such processes, and the tendency for one party to take advantage of the other, "diplomacy" can hardly be a substitute for a clear constitutional mandate given to the federal government to both unify and coordinate environmental protection efforts. To the extent that this affects enviromental protection actions, groundwater management and protection is affected.

As unified environmental protection efforts must proceed on political negotiations and agreements, one is reminded of the issue of inter-provincial water

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[109] K.C. Mackenzie, "Interprovincial Rivers in Canada: A Constitutional Challenge" (1961) 1 U.B.C. L. Rev. 499 at 509.

which continues to be the center of much political discourse. Successes and failures in dealing with this issue should, perhaps, be suggestive of what will happen in the broader issue of federal-provincial unified efforts in managing environmental protection.

IV. Interprovincial Water Issues:

The Canadian constitutional setting and the fear of provoking political tensions between the federal and provincial governments have prompted the federal government to opt for the least offensive approach to dealing with interprovincial water issues. The federal government is neither keen in judicial settlement of interprovincial disputes nor in legislating on the matter. Instead, the government prefers agreements and other extra-judicial and extra-legislative means.[110] In its Water Policy, the federal government stated:

> that interjurisdictional water resources problems arising from pollution or regulation of waterways be resolved, where possible by agreements between the jurisdictions concerned; that steps be taken to develop appropriate procedures so that in cases where the jurisdictions involved have tried but failed to reach agreement, and where the issue has become a major concern to one of the jurisdictions, those disputes can be referred to mediation or arbitration; and to negotiate with the provinces the development of a mechanism which would allow for the

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[110] Lucas, in Managing Natural Resources in a Federal State supra note 21, at 39, 46-51: enumerates the various instruments of federal-provincial cooperation such as agreements and accords, interministerial coordination, advisory board. Federal leadership role has resulted in the Environmental Quality Policy of 1982 among others, which sets emission and ambient standards and objectives for contaminants, and encourages environmental impact assessment. See also Slater supra note 107.

> ultimate resolution of interjurisdictional disputes in cases where all other means of reaching agreement have failed."[111]

The Federal Interdepartmental Committee on Water has reported progress in the implementation of this policy[112]. The Prairie Provinces Master Agreement signed by the federal government which provides for equitable apportionment of eastward flowing streams among the prairie provinces is a typical example of interjurisdictional agreements[113] which the policy advocates. Negotiations are going on for a similar agreement between the federal government and the provinces of British Columbia, Alberta and Saskatchewan in respect of the Mackenzie River.[114] More important, the Water Advisory Committee of the Canadian Council of Ministers of the Environment (CCME) is drafting general principles for water management which

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[111] Federal Water Policy 1987 supra, Chapter One, note 52 at 33: an apparent response to the recommendation of Pearse et al, supra, Chapter One, note 22 at 73-74: Pearse et al argue that judicial resolution of interprovincial disputes would lead to the development of case law which might not be acceptable to all the provinces. They also maintain that a legislative response by the federal government to such disputes might encroach upon provincial constitutional powers. They, therefore, recommended settlement by agreement and ultimately by arbitration composed of representatives of disputing provinces and the federal government.

[112] Interdepartmental Committee on Water, Federal Water Policy: A Progress Report (Ottawa: Government of Canada, 1990) at 56-57. See L. Giroux "Memorandum on Interprovincial Issues Between Quebec and Newfoundland" in Water Law and Policy Issues in Canada supra, note 42 at 95-103: discusses the sad experience of litigation between Quebec and Newfoundland over the Churhill Falls hydroelectric power plant. He submits that an agreement or a negotiated settlement would have produced a better result.

[113] D. Percy, "New Approaches to Inter-Jurisdictional Problems" in Sadler ed. Water Policy for Western Canada: The Legal Issues of the Eighties Proceedings of the Banff Centre School of Management, Second Annual National Resource Conference, 1982 (Calgary: University of Calgary Press, 1983) at 133.

[114] Federal Water Policy: A Progress Report supra note 112 at 56-57.

would contribute to a more coordinated water management approach.[115]

A review of interjurisdictional agreements indicates encouraging success despite the constitutional uncertainty and doubt about the legal effects of such agreements.[116] It is, however, admitted that the interjurisdictional dispute resolution issue is yet to be settled.[117] As one writer observes, "it is true that some issues have not been dealt with successfully (transboundary pollution in particular), and it is plain that negotiated solutions will not always be found."[118] Until a generally acceptable mechanism for resolving interjurisdictional disputes is developed and successfully implemented, "the prevailing uncertainty surrounding interjurisdictional water is (will remain) the most fundamental deficiency in Canada Water Policy."[119]

V. American Constitutional Order:

Since this work draws upon American experience, it is important to briefly consider the extent the American constitutional order promotes or constrains a unified management of the environment.

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[115] Ibid.

[116] B. Barton, "Cooperative Management of Interprovincial Water Resources" in Managing National Resources in a Federal State supra, note 21 at 248.

[117] Federal Water Policy: A Progress Report supra, note 112 at 56-57.

[118] Barton supra note 116 at 248.

[119] Pearse et al, supra, Chapter One, note 22 at 73.

Although residuary power belongs to the states under the American Constitution, the United States Congress' spending power, unlike that of Canada's Parliament is practically unlimited. There is no "pith and substance" restraint or its equivalent. Congress' spending power is derived from Article I, section 8, clause 1 of the Constitution of the United States of America[120] which gives Congress the "power to lay and collect taxes, duties, imports and excises, to pay debts and provide for the common defence and general welfare of the United States..." (hereinafter general welfare power). Essentially, this power enables Congress to spend money on environmental protection or on any other matter which it considers to be in the "general welfare" of the people, and the court will not interfere with Congress' judgment except where it is manifestly arbitrary.[121] The general welfare power is not restricted to the enumerated heads of powers but extends to all matters.[122] Tribe submits that the spending power is also the power to regulate, and is only constrained by the Bill of Rights and the protection of states as individual political entities.[123]

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[120] Constitution of the United States of America with Amendments reprinted in L.H. Tribe, American Constitutional Law 2nd ed. (Mineola, New York: The Foundation Press, 1988) at xxxi-xlvii.

[121] Helvering v. Davis (1936) 301 U.S. 619, 640. See also Buckley v. Valeo (1975) 424 U.S. 1 at 90 which says the general welfare power expands Congress spending power.

[122] R. Berger, Federalism- The Founders Design (Norman; London: University of Oklahoma Press, 1987) at 100-119. See also, E.S. Corwin, "The Passing of Dual Federalism" (1950) 36 Va L. Rev. 1 at 1, 11.

[123] Tribe supra, note 120 at 321, 323.

Congress can spend money in respect of any matter whether within its legislative competence or not and can impose on the recipients any condition it pleases even if the condition does not have any relation to matters within Congress' legislative competence.[124] The spending power is also supported by Article IV section 3, Clause 2 which gives Congress power to dispose of the property of the United States.

The general welfare and spending powers are strengthened by Article I, sec. 8, clause 18 which gives Congress power to

> make all laws necessary which shall be necessary and proper for carrying into execution the foregoing (enumerated heads of powers) powers vested by this Constitution in the government of the United States, or in any department or officer thereof. (hereinafter the necessary and proper power).

A broad judicial interpretation has been given to this power thus enabling Congress to enact a wide range of laws. In McCulloch v. Maryland in which Congress power to enact a banking law was challenged, Chief Justice Marshall stated the scope of this power as follows:

> Let the end be legitimate, let it be within the scope of the Constitution, and all means which are appropriate, which are plainly adapted to that

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[124] D.E. Engdahl, Constitutional Federalism (St. Paul, Minnesota: West Publishing Co., 1987) at 174-176: "The practical dependence upon federal funding has put Congress in the position of being able to influence, and often practically control, the policies of recipient states and local governments and institutions, as well as private recipients of federal funds, with respect to all activities extraneous to legitimate federal concerns; for having absolute discretion over the expenditure of federal monies, Congress may extend its largesse however, it chooses, to whomsoever and under whatsoever conditions it might wish... unless there is offense to some other constitutional limitation (such as the Bill of Rights-type limitations)...there is no constitutional restraint."

> end, which are not prohibited, but consistent with the letter and spirit of the Constitution are constitutional.[125]

Congress has used the necessary and proper power to regulate matters within the jurisdiction of states through the instrumentality of the cumulative effect and protective effect principles. By virtue of these principles, Congress can intervene where it finds that local matters or their cumulative effect might, if not regulated, affect matters within the jurisdiction of Congress,[126] for example, interstate commerce. Where Congress so acts, the courts do not inquire into the purpose of congressional action even where the action is ultra vires Congress provided, however, that the ultimate object achieved is legitimately within the legislative jurisdiction of Congress.[127] Also, where Congress uses its taxation power under Art. I, Sec. 8, Cl.

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[125] (1819) 17 U.S. (4 Wheaton) 316 at 421; NLRB v. Jones and Laughlin Steel Corp. (1937) 301 U.S. 1

[126] Perez v. United States (1970) 402 U.S. 146.

[127] United States v. Darby (1940) 312 U.S. 100, at 115: The court stated: "the motive and purpose of a regulation of interstate commerce are matters for the legislative judgment upon the exercise of which the Constitution places no restriction and over which the courts are given no control". See also, United States v. O'Brien (1968) 391 U.S. 367. In Wichward v. Filburn (1942) 317 U.S. 111 a congressional legislation on grain production, a matter under the jurisdiction of states, was upheld as it was directed to stabilizing interstate commerce, a matter within the jurisdiction of Congress. In Maryland v. Wirtz (1967) 392 U.S. 183 the court upheld the Fair Labour Standards Act (F.L.S.A.), a federal law which applied to states and municipal employees. This case was overruled in National League of Cities v. Usery (1975) 426 U.S. 833 as being an invasion of the jurisdiction of the states. In this case a congressional amendment to the F.L.S.A. extending federal minimum wage and maximum hour pensions to nearly all states and municipal employees was held ultra vires. But this case was subsequently overruled by the Supreme Court of the United States in Garcia v. San Antonio Metropolitan Transit Authority (1984) 469 U.S. 528 and the decision in Wirtz case supra was restored.

1 to regulate a matter rather than raise money, the court would not inquire into congressional motive and purpose.[128] This means that Congress can use its tax power to control pollution even at the state and municipal levels. Thus,

> in this way, federal policies for extraneous matters are very effectively accomplished. Farmers are induced to reduce productive acreage to qualify for financial assistance; states are induced to observe federal rules...[129] (emphasis added).

Congress' power over interstate commerce can also be used to control the transportation of pollutants from one state to another[130]. This power has been interpreted to include the power over navigation.[131] While this does not directly relate to pollution control, it shows a broad judicial interpretation given to congressional power.

As we shall see, the general welfare, spending and necessary and proper powers have been used by the United States federal government to initiate many groundwater protection programs at the federal and state levels. The United States

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[128] Sonzinsky v. United States (1936) 300 U.S. 506, 514. Tribe supra, note 120, at 320 submits: "moreover, the court's expansive modern interpretation of the commerce clause substantially reduces the likelihood that a tax, even if found to be regulatory, would be held to be beyond congressional power." See Minor v. United States (1969) 396 U.S. 87.

[129] Engdahl, supra, note 124 at 60.

[130] United States v. Darby supra, note 127 at 114: the court stated that "Congress, following its own conception of public policy concerning the restrictions which may appropriately be imposed on interstate commerce, is free to exclude from the commerce articles whose use in the states for which they are destined it may conceive to be injurious to public health, morals or welfare, even though the state has not sought to regulate their use."

[131] Gibbons v. Ogden (1824) 22 U.S. (9 Wheaton) 1; Gilman v. Philadelphia (1866) 70 U.S. (3 Wallace) 713, 724, 725.

federal spending is unrestricted and the court would not even inquire into the purpose for passing any legislation authorizing spending. The only restrictions to congressional powers are that they are incapable of invading the Bills of Rights and the existence of the states as separate, individual political entities.

In comparison, Congress has greater power under the American Constitution than Parliament under the Canadian Constitution. For example, while Parliament's POGG power is restricted to matters of national concern, and the "pith and substance" test serves as a check on it, the powers of Congress are practically unrestricted particularly, the general welfare, the spending and the necessary and proper powers. Yet both the Canadian Constitution and the American Contitution do not specifically mention or assign jurisdiction over the environment or water to either level of government.

Like Canadian provinces, American states have stronger power than Congress under the Constitution to protect the environment. According to commentators,

> To the states belong... the control of municipal and local governments, factory and labour legislation ... statutory development and judicial administration of civil and criminal law ... the control of education, and the general "police power" over the health, safety and welfare of the people.[132]

These powers of the states flow from the residual power assigned to them

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[132] S.E. Morison and H.S. Commager, The Growth of the American Republic 4th ed. (place of publication and publisher omitted), 1952 at 287 quoted in Berger, supra note 120 at 74-75. See also New Orleans Gas Co. v. Louisiana Light Co. (1885) 115 U.S. 650 at 661; Barrier v. Connolly (1885) 113 U.S. 27 at 31.

under the Tenth Amendment to the Constitution. However, as we have seen, Congress' general welfare, necessary and proper, and spending powers are far reaching and there is practically almost no restraint in the exercise of these powers. Therefore, it can be concluded that while Canadian provinces and American states have strong power to protect the environment, Congress has greater power to protect the environment than the Parliament of Canada.

With a broader interpretation of the powers of Congress, Congress, unlike Canada's Parliament, has a legal backing to coerce state governments to comply with federal environmental laws and policies. As some scholars have observed,

> In the American Constitutional system, the federal role is preeminent but not exclusive. The Congress has constitutional power to regulate pollution, land use, and resource exploitation as it sees fit....., states have an important... role under the terms of the federal legislation.[133] (emphasis added).

Thus, unlike in Canada, centralization or federal leadership role in environmental protection matters has a legal backing in the United States. Although American federalism is regarded as cooperative[134], to the extent that states cannot decline compliance with umbrella federal environmental laws and policies validly enacted and applicable within their jurisdictions, it is, arguably, "organic" federalism.

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[133] J.L. Huffman and G.C. Coggins, "The Federal Role in Natural Resources Management in the United States" in Managing Natural Resources in a Federal State supra, note 21 at 58-59.

[134] Ibid at 55-59.

VI. Concluding Remarks:

The unity of water resources and the environment has been established. Only a unified management approach in response to this unity would prove most effective. Purely on a legal score, this is not possible in Canada because of the constitutional barriers. Again, for practical reasons, it could be argued that it is more reasonable for those (the provinces) closer to the environment to manage it. Yet, active federal involvement is important as demonstrated in subsequent chapters.

The Canadian position contrasts sharply not only with the American position but also with the international regime. The international order is more decentralized because of the sovereign status of States, yet in response to the natural unity of the environment, it is increasingly shifting from a fragmented approach to a unified approach in managing environmental concerns.[135]

There are emerging rules among States for a unified effort to managing the aquatic environment. The Helsinki Rules on the Uses of the Waters of International Rivers, for example, recognize the interrelationship between surface and groundwater in a natural unit such as a watershed[136]. Article 2, paragraph 3 of the International

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[135] P. McKeague, "Water and the Environment: Development Issues for the Twenty First Century" (1992) 22 No.1 Environt'l Policy & Law at 17-20; S. McCaffrey, "International Organizations and the Holistic Approach to Water Problems" (1991) 31 No.1 Natural Res. J. at 140-149.

[136] The Helsinki Rules on the Uses of the Waters of International Rivers reproduced in the International Law Association (ILA) Report of the 52 Conference Helsinki, 1966 at 485-532 (hereinafter Helsinki Rules) Article II.

Law Association (ILA) Groundwater Rules provides that

> Basin States, in exercising their duties under international law, shall take into account any interdependence of the groundwater and other waters, including any interconnections between aquifers, and any leaching into aquifers caused by activities in areas under their jurisdiction.[137]

Other rules reflect a "holistic" approach to managing water, the environment and other natural resources so that the management of one does not endanger the other.[138] The International Law Commission (ILC) has also recognized the unity of the aquatic environment and the ecosystems and encouraged States to promote unified management of the resources.[139] The International Conference on Water and the Environment (ICWE) has recommended a holistic approach to water "in its proper context, that is, in the integrated spectrum of human and environmental uses and needs as opposed to particular sectoral needs."[140] Furthermore, a set of articles has been completed by the ILC which though provides a framework which States could adapt and apply to specific agreements to suit the nature of individual

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[137] ILA Report of the 62nd Conference, Seoul 1986 at 21, 231-285.

[138] See for example, Articles on the Relationship between Water, Other Natural Resources and the Environment. ILA Report of the 59th Conference, Belgrade, 1980, Article I.

[139] (1980) (vol. 2, Part 2) Y.B. Int'l Law Commission at 110: a commentary to Art. I of a set of articles contained in the Report of the General Assembly on the Workshop of Its 32nd Session; ILC Draft Articles (1988) 3 U.N. GAOR Supp. (No.10) at 75-139, U.N. Doc. A/43/10: articles 5 and 10; Report of the ILC on the Work of 42nd Session (1990) 3 U.N. GAOR Supp. (No.10), U.N. Doc. A/45/10, Chapter IV at 145-146, 148.

[140] P. McKeague, supra, note 135, at 17-20: canvasses for some groundwater protection programs similar to those discussed in this dissertation. For a detail report of the Conference, see ibid at 54.

watercourses, generally encourages States to adopt joint management of international watercourses.[141]

Thus the international legal regime is not only leaning towards uniting management efforts but also uniting water related resources. As McCaffrey observes, there is a trend at the international level of adopting a "holistic" rather than a fragmented approach to managing and protecting water resources.[142] The international legal regime is being strengthened in this direction.[143] This is a challenge to Canadian federalism.

The natural unity of the environment demands a unity of legal efforts to deal with the environment and the ecosystems it supports. While the interdependence of the various segments of the hydrologic cycle calls for a unified or "holistic" approach, the same makes it difficult to effectively address all the segments simultaneously. For example, in areas of scarce supplies, water needs not be conserved to nourish the ecosystems when there is not enough to satisfy drinking demand. While a coordinated or integrated management of all the segments of the water cycle will produce the most effective result, this does not derogate from the need for expert management of each segment. Expert management of each segment will identify not only areas

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[141] 46 U.N GAOR Supp.(No.10), U.N. Doc.A/46/10, 1991 Chapter 3, at 152, 161-172; See (1991) 21 Environ'tal Policy & Law at 247. See also, S. McCaffrey, "The Law of the International Watercourses- The ILC completes Its Draft Articles" (1992) 22 No.2 Environ'tal Policy & Law at 66.

[142] McCaffrey supra, note 135 at 164.

[143] Ibid at 147.

where integration or coordination with other segments (resource integration/ coordination) is important but also areas where the efforts of the managers - federal and provincial governments - need to to be coordinated (institutional coordination). Furthermore, in terms of resource integration/ coordination, a "holistic" approach, unless streamlined, may be too comprehensive to be practicable. For these reasons, this writer is focusing on groundwater, and will where appropriate, identify areas where a unified approach is required.

Ideally, in a federal state, "organic" federalism as in the United States is most appropriate for dealing with groundwater concerns, particularly when such federalism derives from the Constitution and not from political negotiations. We have seen that this is not available under the Canadian Constitution. Even outside the Constitution, this form of federalism cannot be achieved because the Constitution remains a watchdog to ensure that each level of government does not by political means defeat the constitutional balance of power by, for example, signing away its legislative authority. This leaves Canada with a non-binding "cooperative" federalism which allows the provinces to decline cooperation when they think the federal government is overbearing. This is the risk at which a unified effort to managing and protecting the water resources of Canada must proceed.

Although not completely satisfactory, non-binding "cooperative" federalism promises a better result than insistence on the legal or constitutional rights of each level of government to manage water resources as well their pollution. Such a fragmented approach will not serve groundwater management well. Therefore, in the

following chapters, groundwater management under "cooperative" federalism is examined.

CHAPTER THREE

THE LAW OF GROUNDWATER USE RIGHTS

An aspect of managing groundwater resources is the allocation of groundwater to users. One justification for groundwater protection is the value of the resource which is expressed in its beneficial uses, that is, uses for economic, social and environmental purposes. Groundwater allocation management, therefore, is supposed to ensure and enhance the beneficial uses of the resource. A beneficial use of groundwater calls for a management approach that recognizes the interrelationship of surface and groundwater. It should also promote groundwater quality protection by avoiding the intrusion of contaminants into groundwater system through overdraft. These are some of the modern needs of the society to which the law must respond.

The value of any law lies in its ability to react or respond to the needs of the society. Modern needs of water for beneficial uses are subject to the legal regime which defines water rights and uses in the society.[1] The law is mostly statutory but common law still applies where the statutory regime does not cover. The common law is part of the problem of managing groundwater resources because it is premised on private interest rather than the interest of the public at large. Therefore, this law is examined in detail. Such an examination will also expose the need for a statutory

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[1] Where appropriate the discussion draws upon American experience to canvass for a more efficient Canadian approach to groundwater allocation regime.

regime which, in turn, is important for a clearer understanding of the regime. The underlying assumptions and the concept of the common law (including civil law) and statutory law are exposed. The evolution of the common law water doctrines, and the introduction of statutory regimes have been a response to the changing needs of the society. Yet in most cases, existing laws do not meet modern needs. It is misguided and inefficient to apply old laws to new problems. This Chapter is devoted to how this problem can best be tackled. It does this by identifying the deficiencies of the common law, Quebec civil law, and statutes and by suggesting ways of improvement.

A. COMMON LAW WATER DOCTRINES

The development of English common law water doctrines was influenced by the abundant water supplies in ancient England relative to water demand by the population and economic activities. American jurisdictions which received the English common law water doctrines but which had water supply problems modified these doctrines to suit their local circumstances[2], hence the birth of the American common law water doctrines. American doctrines represent an improvement upon English doctrines. Both are discussed because, as we shall see, while English doctrines have been received into Canada's common law, American doctrines have influenced

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[2] Z.A. Smith, "Centralized Decision Making in the Administation of Groundwater Rights: The Experience of Arizona, California and New Mexico and Suggestions for the Future" (1984) 24 Nat. Res. J. at 641, n.2: discusses the influence of abundant water supplies in England on the common law water doctrines and how arid common law jurisdictions in the United States modified these doctrines.

statutory water regimes in some Canadian jurisdictions.

I. English Common Law Water Doctrines:

English common law does not recognize the hydrological relationship between surface and groundwater but deals with them under separate regimes namely: riparian rights and absolute ownership doctrines[3].

a) The Riparian Rights Doctrine:[4]

A riparian right arises as an incident of ownership of a land abutting a natural watercourse[5]. According to Halsbury's Laws of England,

> A riparian owner has, as incident to his property in the riparian land a natural and proprietary right not dependent on prescription, grant or

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[3] Where American cases are cited in this subtitle it is because they endorse or reflect the English common law water doctrines as originally received into American law.

[4] E. Jowitt, The Dictionary of English Law 2 (London: Sweet and Maxwell Ltd., 1959) at 1564: "riparian" is derived from the Latin word "riparia" which means "water running between two banks." Although this applies to surface water, a discussion of it is important since this work canvasses the integration or coordination of surface and groundwater. Also, as we shall see, some jurisdictions distinguish groundwater in terms of "percolating water" and "underground stream" and apply riparian rights doctrine to the latter.

[5] H.J.W. Coulson and U.A. Forbes, The Law Relating to Waters 3rd edition (London: Sweet and Maxwell Ltd., 1910) at 130: riparian right is based on the ownership of the bank of a watercourse and not of the easement or any other holding. See also, Stokes v. Singers (1857) 120 E.R. 12 at 14; Watts v. Robson (1873) 33 U.C.Q.B. 570 at 579.

> acquiescence of the riparian owner above, but arising jure naturae, to have the water in any natural channel, which is known and defined on which his land abuts- or which passes through or under his land, flow to him in its natural state both as regards quantity and quality, whether he has made use of it or not.[6]

Although the riparian rights doctrine applies to surface water, not all surface water bodies are subject to the doctrine. It applies only to surface water bodies in a defined permanent natural watercourse.[7]

i) Rights of A Riparian Owner:

Riparian owners do not own the water in the stream their land abuts but have a usufructuary right to use the water. This is because water in its natural state is a public juris.[8] Riparian rights include: 1) the right of access to the water; 2) the right

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[6] (1962) 39 Halsbury's Law of England 3d. at 516-517, 518-529: discusses other aspects of riparian rights. In Orr Ewing v. Coloquhoun (1877) 2 A.C. 839 at 854 : Lord Blackburn stated, inter alia, that since a riparian right is not contingent upon the use of water, a riparian who is not using the water can maintain an action against another who diminishes the flow or impairs the quality of the water. Also in Fall River Valley Irrigation District v. Mt. Shasta Power Corp. (1927) 202 Cal. 56 at 65, 259 P. 444: it was stated that a riparian right is "not gained by use or lost by disuse" of water.

[7] R v. The Inhabitants of Oxfordshire 109 E.R. 794 at 799; Makowecki v. Yachimyc (1917) 34 D.L.R. 130. Admittedly, what constitutes a natural watercourse depends on the circumstances of each particular case: see Oliver v. Francis (1919) 14 Alta L.R. 509; Parr v. Troop (1922) 55 N.S.R. 252. In Geall v. Richmond TP (1932) 4 D.L.R. 796 at 797 it was held that a canal , about 100 years old built to become a permanent waterway is subject to the riparian doctrine.

[8] E. Jowitt, supra, note 4, at 1443; Embrey v. Owen (1851) 155 E.R. 579; McLean v. Crosson (1873) 33 U.C.Q.B. 448 at 455-456; A.S. Wisdom, The Law of Rivers and Watercourses (London: Shaw and Sons Ltd., 1962) at 11: states "generally speaking,

of draining the riparian land; 3) the right to the flow of the water; 4) the right to the quality of the water; 5) the right to the use of the water; 7) the right of accretion;[9] and 8) the right to fish[10].

A riparian is also entitled to the natural state of water in terms of quantity and quality subject only to ordinary or domestic use by other riparians. According to Lord McNaughten,

> a riparian owner is entitled to have the water of the stream on the banks of which his property lies, flow down as it has been accustomed to flow down to his property, subject to the ordinary use of the flowing water by upper propriators, and to such further use, if any, on their part in connection with property as may be reasonable under the circumstances. Every riparian owner is thus entitled to the flow of his stream, in its natural flow, and without sensible dimunition or increase and without sensible alteration in its character or quality[11].

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there can be no ownership or right of property in the running water of a stream, except that by the general law applicable to running streams each riparian owner is entitled to the ordinary use of the water flowing past his land." Also in Omerod v. Todmorden Joint Stock Mill Co. (1883) 11 Q.B.D. 155 at 171: Bowden L.J. stated "It has long been established that running water is not the subject of property, and that the first occupant cannot acquire an exclusive right to it." See also, Mason v. Hill (1835) 110 E.R. 692.

[9] G.V. La Forest, "Riparian Rights" in La Forest, Water Law In Canada: The Atlantic Provinces (Ottawa: Information Canada, 1973) at 201-233; R. Megarry and H.W.R. Wade, The Law of Real Property 5th edition (London: Sweet and Maxwell, 1984) at 65-66.

[10] Megarry and Wade supra, note 9.

[11] John Young & Co. v. Bankier Distillery Co. (1893) A.C. 691 at 698; Lord Denman stated the same principle in Mason v. Hill (1835) 110 E.R. 692; D.H. Getches, Water Law In A Nutshell (Minnesota: West Publishing Co., 1990) at 16-17: Originally, riparian rights were based on the doctrine of ancient use whereby one who from time immemorial had made use of water continued to use it even if it affected others. In the 18th Century, this was replaced with the doctrine of prior use which protected prior users from injuries by subsequent users (per: Bealey v. Shaw (1805) 6 East 208, 102 E.R. 1266). The Prior use doctrine was however, replaced in the 19th

The provision of art. 503 of the (Lower Canada) Civil Code is similar to common law riparian rights doctrine.[12]

ii) Limitations of Riparian Rights:

Some legal limitations bear upon the exercise and enjoyment of riparian rights. In addition to the limitation of use for ordinary purposes, a riparian owner can only use water on the riparian land[13]. However, where water is used in this way and injury results, the riparian is absolved from any liability[14].

A riparian right is a real right because it is part of the land abutting a natural

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Century by the natural flow doctrine. Under the natural flow doctrine all riparians whether senior or junior have equal rights to receive natural flow of water undiminished in quantity (per: Wright v. Howard (1823) 57 E.R. 76). Getches further states that in most American jurisdictions, the natural flow doctrine has been replaced by the reasonable use doctrine which as we shall see, allows each riparian to make a reasonable use of water subject to the reasonable uses of other riparians. See also, Stratton v.Mt. Hermon Boys School (1913) 216 Mass. 83, 103 N.E. 87.

[12] Similar provisions can be found in arts. 979ff of the upcoming (Quebec) Civil Code.

[13] McCartney v. Londonderry and Lough Swilly Railway Co.(1904) A.C. 301; Miner v. Gilmour 9 Moo P.C. at 156; James v. Town of Bridgewater (1915) 49 N.S.R. 188 at 195. In Attorney General v. The Great Eastern Railway Co. (1871) 23 L.T. 344 at 345 it was stated that domestic purposes include such uses as drinking, cleansing, washing, culinary, feeding and watering of livestock. This does not however, include water for irrigation purposes. The use of water out side riparian lands constitutes trespass to the rights of riparians downstreams: See Anaheim Union Water Co. v. Fuller (1907) 150 Cal. 327, at 334-335, 88 Pac. 978 at 981-982; Moore v. California Oregon Power Co. (1943) 22 Cal. (2d) 725 at 734, 140 Pac. (2d) 798.

[14] Keith v. Corry (1877) 17 N.B.R. 400; McCartney v. Londonderry and Lough Swilly Railway Co. Ltd. (1904) A.C. 301 at 306; James v. Town of Bridgewater (1915) 49 N.S.R. 188 at 195; Kensit v. Great Eastern Railway (1884) 27 Ch.D. 122; Miner v. Gilmour 9 Moo P.C. at 156.

watercourse[15]. Thus a conveyance of the riparian land includes the riparian rights[16] except for those rights that are expressly reserved[17]. There can be no transfer of a riparian right separately from the riparian land[18]. Article 502 of the (Quebec) Civil Code seems to permit unrestricted transfer of water rights. It provides that "He who has a spring on his land may use it or dispose of it as he pleases".

b) The Absolute Ownership Doctrine:

Under this rule, the owners of overlying land have the unfettered right to extract and use the groundwater underneath their land regardless of any injury this

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[15] Palmer v. Railroad Commission of California (1914) 167 Cal. 163 at 173, 138 Pac. 997.

[16] D. Getches supra, note 11, at 29-31: identifies two rules of transfer of riparian rights, namely: source of title rule and the unity of title rule. Under the source of title rule, if "A" conveys the north portion of his land abutting a stream to "B" but retains the south portion, "A" has lost his riparian rights to "B". This is so even if "B" reconveys the land to "A". But this rule does not apply to the partition of land among tenants in common. Under the unity of title rule, a tract of land though divided into several parcels, regardless of when or from whom conveyance of each parcel was made retains riparian rights if the entire land or part of it abuts a water course. Thus if "A" conveys the north portion of his land fronting a watercourse to "B" and retains the south portion, "A" has lost his riparian rights to "B". But if "B" reconveys the land to "A", "A" has regained riparian rights in respect of both the north and the south portions of the land, all in one.

[17] Borough of Portsmouth Water Works Co v. London Brighton & South Coast Railway (1909) 26 T.L.R. 173 at 175; Keewatin Power Co. v. Lake of the Woods Mllg. Co. (1930) A.C. 640, (1930) 4 D.L.R. 961 (P.C.).

[18] A.R. Thompson, "Basic Water Law" in H.I. Rueggeberg and A.R. Thompson, Water Law and Policy Issues in Canada (Vancouver: Westwater Research Centre, The U.B.C., 1984) at 56: A riparian fishing right can, however, be alienated separately from the riparian land.

may cause to their neighbours[19] as the latter does not have proprietary right in the groundwater.[20] For percolating groundwater, this is a dramatic departure from the riparian rights doctrine which applies to surface water.[21] Tindale C.J. provides the following justification:

> The ground and origin of the law which governs streams running in their natural course would seem to be this, that the right enjoyed by several proprietors of lands over which they flow is, and always has been, public and notorious: that the enjoyment has been long continued-in ordinary cases, indeed, time out of mind-and uninterrupted; each man knowing what he receives and what has been received from the higher lands, and what he transmits and what has

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[19] See infra notes 183, 184, 185-188 and accompanying text, where one who caused such damage was held liable in a nuisance or negligence action.

[20] Acton v. Blundell (1843) 152 E.R. 1223 at 1233: enunciated the doctrine. Admittedly, the case was decided with poor hydrological knowledge of groundwater occurrence and flow. In this case, the defendant drew water from a well in his land which diminished the quantity of water available in the plaintiff's well on the plaintiff's land. Tindale C.J. at 1235 stated that this case "... is not to be governed by the law which applies to rivers and flowing streams, but that it falls within that principle, which gives to the owner of the soil all that lies beneath his surface... that the person who owns the surface may dig therein, and apply all that is there found to his own purpose at his free will and pleasure; and that if, in the exercise of such right, he intercepts or drains off the water collected from underground springs in his neighbour's well, this inconvenience to his neighbour falls within the description of damnum abs que injuria, which cannot become the ground of an action." See also, Chasemore v. Richards 11 E.R. 140 where a similar decision was reached by the House of Lords. The doctrine is essentially a rule of capture. F.J. Trelease, "Climatic Change and Water Law" in Climate, Climatic Change and Water Supply supra, Chapter One, note 103 at 70: states "... man must shape his law to the environment as he perceives it. If his picture of the physical universe is false, he is not likely to get good results from a law based on the misconception. A century ago, when judges thought that groundwaters were 'vigrant, meandering drops' moving in 'unknown and unknowable courses', according to 'secret, changeable and uncontrollable forces', they developed rules of law that would not be suitable for a modern hydrologist trying to manage withdrawals from a large groundwater basin with the help of a data bank and a computer model."

[21] See infra notes 27 and 28 and accompanying text.

> always been transmitted to the lower. The rule, therefore, either assumes for its foundation the implied assent and agreement of the proprietors of the different lands from all ages, or perhaps it may be considered as a rule of positive law... But in the case of a well sunk by a proprietor in his own (land), the water which feeds it from a neighbouring soil, does not flow openly in the sight of the neighbouring proprietor, but through the hidden veins of the earth beneath its surface; no man can tell what changes these underground sources have undergone in the progress of time: It may well be that it is only yesterday's date, that they first took the course and direction which enabled them to supply the well: again no proprietor knows what portion of water is taken from beneath his own soil: how much he gives originally or how much he transmits only, or how much he receives: on the contrary until the well is sunk, and the water collected by draining into it, there cannot properly be said, with reference to the well, to be any flow of water at all. In the case, therefore, of the well, there can be no ground for implying any mutual consent or agreement, for ages past, between the owners of the several lands beneath which the underground springs may exist, which is one of the foundations on which the law as to running stream is supposed to be built; nor, for the same reason, can any trace of a positive law be inferred from long-continued acquiescence and submission, whilst the very existence of the underground springs or of the well may be unknown to the proprietor of the soil[22].

This rule was sustained in Bradford v. Pickles where an overlying land owner maliciously extracted and used water in order to affect the availability of water in his neighbour's well[23]. A groundwater user can also use it outside of the overlying land. He can sell or even waste the water[24]. However, recent Anglo Canadian

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[22] Acton v. Blundell supra note 19 at 1233-1234.

[23] (1895) A.C. 587.

[24] City of Corpus Christi v. City of Pleasanton (1955) 154 Tex. 289, 276 S.W. (2d) 798.

jurisprudence has departed from this rule.[25]

There is nothing in the (Lower Canada) Civil Code regulating the withdrawal of groundwater. However, the application of Article 502 to groundwater would produce a result similar to the absolute ownership doctrine of the common law because it means that a groundwater proprietor can use and dispose of it as he pleases regardless of the effect on other users. This can, however, be checked by art.406 which provides:

> "Ownership is the right of enjoying and of disposing of things in the most absolute manner, provided that no use be made of them which is prohibited by law or by regulation.

This provision has been used to check actions to neighbours in respect of both surface and groundwater. In Katz v. Reitz the defendant was held liable for excavating his land beneath the water table in a way that drained the water beneath the plaintiff's land causing plaintiff's house to subside[26].

There are two classes of groundwater, namely: underground streams and percolating water. Underground streams are defined as waters flowing underground

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[25] See Sedleigh-Denfield v. O'Callaghan (1940) A.C. 880; Penno v. Government of Manitoba (1975) 64 D.L.R. (3d) 256; Re National Capital Commission and Pugliese (1977) 79 D.L.R. (3d) 592 affirmed by the Supreme Court of Canada at (1980) 97 D.L.R. (3d) 631. These cases are discussed later.

[26] (1973) C.A. 230: Lajoie J.A. relied on arts. 406 and 1053 to find liability. See also, Carey Canadian Mines Ltd. v. Plante (1975) C.A. 893. at 899: Bernier J.A. relied on art 406 to find the defendant liable for polluting the river which ran through the defendant's land rendering it unfit for drinking and for bathing. P. Girard, "An Expedition to the Frontiers of Nuisance" (1979-80) 25 McGill L.J. at 593: submits that art.1053 is not a basis of liability for a breach of obligation de voisinage as it requires the proof of fault by the plaintiff, but rather art.406 or the combination of arts.406 and 1057 is.

within "reasonably ascertainable boundaries" or as a "constant stream in a known and well defined natural channel."[27] Percolating water does not have the characteristics of an underground stream. It is water which seeps down through the soil and collects underground. It is neither flowing nor remains within reasonably ascertainable boundaries. This distinction is important because the absolute ownership doctrine applies to percolating waters, whereas the riparian rights doctrine applies to underground streams with a definite and known channel. According to Lord Chief Baron Pollock,

> ... if the course of a subterranean stream were well known, as is the case with many which sink underground, pursue for a short space a subterraneous course, and then emerge again, it never could be contended that the owner of the soil under which the stream flowed could not maintain an action for the diversion of it, if it took place under such circumstances as would have enabled him to recover had the stream been wholly above ground"[28].

The court was, therefore, ready to apply the riparian rights doctrine to underground streams flowing in a definite and known course. As underground streams would almost invariably have a definite and known or ascertainable course, they are generally governed by the riparian rights doctrine. Thus in the case of underground streams, except for ordinary use of water, one cannot draw water in a way that adversely affects one's neighbour's ordinary use of the water. Also, as we

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[27] Hayes v. Adams (1923) 109 Oreg. 51, 218 P. 933 at 935.

[28] Dickinson v. The Grand Junction Canal Company 7 Exch. Rep. 300, 301; Chasemore v. Richards supra, note 20 at 150: per Lord Chelmsford stated that the riparian rights doctrine was applicable to "all water flowing in a certain and defined course, whether in an open visible stream or in a known subterranean channel." See also, Herriman Irrigation Co. v. Keel (1902) 25 Utah 96, 69 P. 719.

shall see, in jurisdictions where reasonable use of water is permitted, one is allowed to make reasonable use of the water only in such a way that the reasonable use of the water by one's neighbours is not affected.

While the law distinguishes between underground streams and percolating waters, hydrologists say that such a distinction does generally not exist in the physical realm as, except in rare limestone areas, groundwater does not flow in underground streams[29]. Therefore, considering that law deals with facts, its concern with this scientific myth is misguided[30], except in the rare cases where the law rightly applies the riparian rights doctrine to underground stream.

One difficulty with the application of the absolute ownership doctrine relates to subterranean basins. Where groundwater exists in a basin underneath lands of different owners, it is arguably not an underground stream as it does not flow, though its boundaries may be reasonably ascertainable. The withdrawal of water by one overlying land owner would evidently affect water available for other overlying land owners. Some courts have, inspite of evidence of the interconnection of such

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[29] C.L. McGuiness, The Role of Ground Water in National Water Situation Water Supply Paper 1800 (Washington, D.C.: United States Geological Survey, 1963) at 104.

[30] Underground streams occur frequently in law because courts in some United States jurisdictions treat subsurface flows of surface water as underground streams: Howard v. Perrin (1904) 8 Ariz. 347, 76 P. 460 affirmed (1906) 200 U.S. 71; City of Los Angeles v. Pomeroy (1899) 124 Cal. 597, 57 P. 585; Medano Ditch Co. v. Adams (1902) 29 Colo. 317, 68 P. 431; Public Utility Commission v. Nataorium Co. (1922) 36 Idaho 287, 211 P. 533; Ryan v. Quinlan (1912) 45 Mont. 521, 124 P. 512; Strait v. Brown (1881) 16 Nev. 317; Taylor v. Welch (1876) 6 Oreg. 198.

groundwaters, applied the absolute ownership doctrine[31]. It has been submitted that in a subterranean basin scenario, the riparian rights doctrine and not the absolute ownership doctrine should apply[32].

II. American Common Law Water Doctrines:

The preceding discussion centered on water rights doctrines under the common law of England in their original formulations. Certain American modifications to the English common law doctrines have crystallized into a distinct body of legal doctrines which may be called the American common law water doctrines. These are the doctrines of reasonable use, correlative rights, prior appropriation and equitable apportionment. Over time, the doctrines as originally

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[31] The Salt Union Ltd. v. Brummer, Mond and Co. (1906) 2 K.B. 822; the court maintains that each of the overlying land owner has absolute ownership right over the basin even though in drawing the water underneath his land, the water supply of another is affected. The court however, warned that the land owner extracting water must ensure that his pumping facilities are not directly connected underneath the land of his neighbour.

[32] A.D. Reid "Ground Water At Common Law" in La Forest, supra, note 9 at 415: argues that the requirement of "flow" is not the reason the riparian rights doctrine applies to a stream hence it applies also to lakes and ponds; but rather because 1) a stream can be utilized by more than one person and 2) the boundaries of a stream are sufficiently known so that legal rights and liabilities of a landowner are judicially cognizable and enforceable as the law cannot enforce something that is not definite or ascertainable. He argues that, like a stream, lakes and pond, groundwater basin has definite or ascertainable boundaries and can be utilized by more than one person, and since the doctrine applies to streams, lakes and ponds, it should also apply to groundwater basin. In support of this proposition, see 93 Corpus Juris Secundum (C.J.S.), s.92 provides that "the rule vesting the ownership of percolating waters in the owner of the land does not apply to the waters of an artesian basin underlying the lands of several owners"

developed have, in some American jurisdictions, been further modified by statutes in response to changing water demands. While some American jurisdictions apply one or two of the doctrines to both surface and groundwater, others apply separate doctrines to surface and groundwater. The merits and demerits of these doctrines are examined and, where appropriate, criticized or recommended for Canada.

a) The Reasonable Use Doctrine:

This doctrine was developed to attenuate the inadequacies of the riparian rights and the absolute ownership doctrines. It thus, applies to both surface and groundwater. Unlike the riparian rights doctrine, the reasonable use doctrine, while not permitting waste, permits the use of surface water for "extraordinary" purposes such as irrigation and industrial uses[33]. Such use of water, however, must be on a riparian land. In jurisdictions where the doctrine applies to groundwater, the use must be on or relate to the overlying land otherwise it would amount to an unreasonable use and trespass.[34] The use of water must be reasonable and must allow a flow downstream that does not jeopardize a similar use of water by other riparian

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[33] Tyler v. Wilkson (1827) 24 Fed. Cas 472 (C.C.R.I.): enunciated by Justice Story; Bassett v. Salisbury Mfg. Co. (1862) 43 N.H. 569.

[34] Forbell v. City of New York (1900) 164 N.Y. 522, 58 N.E. 644; Higday v. Nickolaus (1971) 469 S.W. 2d 859.

owners.[35] This means that water diverted for reasonable uses must be substantially returned to the watercourse in order to avoid injury to reasonable uses by downstream riparians. This doctrine has been applied in Canada.[36]

b) The Correlative Rights Doctrine:

Developed and followed in California, the doctrine is an improvement upon the reasonable use doctrine. Under this doctrine an overlying land owner is not permitted to waste water. He is entitled to a reasonable use of groundwater in proportion to his land acreage. Importantly, where no injury would be caused to other land owners and the water needs of an overlying land owner have been satisfied, the doctrine allows surplus or excess water to be used in non-overlying lands[37] The doctrine promotes safe yield of aquifers by allowing the court or water administrators to order each water user to reduce withdrawals in proportion to his

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[35] F.J. Trelease supra, note 20 at 74: submits that what is a reasonable use is vague and unsettled. This is for the courts to decide having regard to the circumstances of each particular case: Pabst v. Finmand 190 Cal. 124 at 129, 211 P. 11, 13.

[36] Lockwood v. Brentwood Park Investments Ltd. (1967) 64 D.L.R. (2d) 212 appealed (1970) 10 D.L.R. (3d) 143: the appeal allowed the award of damages instead of injunction granted by the lower court. However, in principle, both decisions maintained that only a substantial (i.e. unreasonable) diminuition of flow should sustain a riparian action; James v. Town of Bridgewater (1915) 49 N.S.R. 188.

[37] Burr v. Maclay Rancho Water Co. (1908) 154 Cal. 428, at 435-437, 98 Pac. 260; D. Aiken, "Nebraska Groundwater law and Administration" (1980) 59 Neb. l. Rev. 917 at 926: the doctrine also allows one who stores imported water underground to have exclusive right to it.

land acreage or in proportion to the quantity of water he has been extracting for the previous five years (which is the statutory limitation period in California)[38]. Thus it prevents groundwater overdraft.

c) The Prior Appropriation Doctrine:

The riparian rights doctrine adopted in the water-rich eastern United States was not suitable for the arid and semi-arid western United States[39]. Early settlers in western United States, particularly in California, needed water for irrigation and mining and had to draw water for these purposes from surface water bodies

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[38] City of Pasedena v. City of Alhambra (1949) 33 Cal. 2d 908, 207 P. 2d 17: Here, all the groundwater users including a municipality had violated the correlative rights doctrine. The court held that each of them had acquired a prescriptive right to the level of withdrawal which was in violation of the correlative rights doctrine. In order to avoid aquifer depletion, the court ordered each user including the municipality to reduce withdrawals in proportion to its rate of pumping five years previous. But municipalities or public entities were exempted from being affected by prescriptive rights of private groundwater users in City of Los Angeles v. City of San Francisco (1975) 123 Cal. Reptr. 1, 537 P 2d 1250. Under the doctrine all groundwater users have equal rights: Katz v. Walkinshaw (1903) 141 Cal. 116, 135-136, 74 Pac. 766. In times of water shortage each is entitled to a reasonable share of what is available: Cohen v. La Canada Land and Water Co. (1904) 142 Cal. 437, at 439-440, 76 Pac. 47.

[39] R.E. Clark, Waters and Water Rights ed.(Indianapolis: The Allen Smith Co., 1967) Vol I at 31: "In the midwestern and eastern United States 'water rights' are an essential though peripherial part of real property law. Because of different climatic, topographical and geographical conditions, the two areas have developed different legal doctrines. The sub-humid West devised institutions and practices for bringing water to semi-arid land inorder to encourage agriculture, or for use in mining."

regardless of whether or not their lands abutted them[40]. Although originally developed for surface water allocation, it also applies to groundwater as considered below.

> Aiken sums up the fundamental principles of this doctrine:
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> > The doctrine of prior appropriation is based on two fundamental principles: 1) water rights are acquired, not as an incident of land ownership, but by diverting water from a stream for beneficial use, and 2) conflicts are generally resolved on the basis of priority: the earliest ('senior') appropriator has a better right over the subsequent ('junior') appropriator[41].

Application of water to beneficial uses is a precondition for appropriating water under this doctrine. This precondition is important. It prevents waste of water as

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[40] W.A. Hutchins, Water Rights Law in the Nineteen Western States (completed by H. Ellis and J.P. DeBraal) Miscellaneous Pub. No. 1206 (Washington, D.C.: Natural Resource Economics Division, Economic Research Service, United States Department of Agriculture, 1977) Vol. III at 81. For a detail discussion on this point, see Hutchins, ibid. Vol. I, chapter 6 subtitled "Establishment of the Appropriation Doctrine in the West- Origins of the Appropriation Doctrine".

[41] D. Aikens, "Nebraska Groundwater Law and Administration" (1980) 59 Neb. L. Rev. 917 at 920 n.8: "In its modern version, appropriative water rights are acquired by application to a state water administrator, traditionally referred to as the state engineer. Priority is established when the application is received by the state engineer, and is perfected (completed) when water is ultimately used. Conflicts between users are resolved by the administrative enforcement of priorities: when a senior appropriator is unable to divert the quantity of water to which he is entitled, he informs the state engineer who administratively orders upstream junior appropriators to stop diverting stream flow in inverse order of priority until the senior appropriator is able to divert the quantity of water to which he is entitled."Kinball v. Gearhart (1859) 12 Cal. 27 at 29-31: traditionally, water was appropriated by placing a notice of intention to divert water at the point of the intended diversion. Actual diversion of the water for beneficial use is however, necessary to perfect the right, particularly in Colorado: Denver v. Northern Colorado Water Conservancy District (1954) 130 Colo. 375, 386, 276 Pac. (2d) 992; Colorado River Conservation District v. Rocky Mountain Power Co. (1965) 158 Colo. 331, 406 Pac. (2d) 798, 800; Safranek v. Limon (1951) 123 Colo. 330, 228 P. 2d 975; Lamot v. Riverside Irr. District (1972) 179 Colo. 134, 498 Pac. 2d. 1150; Denver v. Sheriff (1939) 105 Colo. 193 at 199, 96 Pac.2d 836.

waste cannot be considered a beneficial use. Unlike the previously discussed doctrines, the prior appropriation doctrine does not depend on the ownership of adjoining or overlying land. For this reason, water can be extracted by a non-riparian owner or non-overlying land owner to wherever it is needed.

Traditionally, the doctrine permits transfer of water or water rights from one user to another. In Thayer v. California Development Co., the court stated:

> Under the law of this state as established at the beginning, the water right which a person gains by diversion for beneficial use is a private right, a right subject to ownership and disposition by him, as in the case of other property. All the decisions recognize it as such.[42]

Also, unlike the riparian rights, the doctrine does not condone non- use of water[43]. An appropriator cannot retain his right where he is not using the water or not using it for beneficial purposes. He is deemed to have abandoned the right and another person can appropriate it. One cannot, therefore, use his right to hold up water when other people would put the water to beneficial uses.

d) The Equitable Apportionment Doctrine:

The equitable apportionment doctrine has been described as a doctrine of "federal common law that governs disputes between states concerning their rights to

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[42] (1912) 164 Cal. 117 at 125.

[43] California Civil Code 1872, sections 1410-1422: codified the prior appropriation doctrine. See also, Washington v. Oregon (1936) 297 U.S. 517 : where the court stated inter alia that non use of water under the prior appropriation doctrine triggers the lost of the right.

use the water of an interstate stream."[44] A fortiori the doctrine can, arguably, be applied to interstate aquifers.

The doctrine seeks to mitigate the hardship which otherwise would be caused by the application of the law of any particular state party to a dispute. In Kansas v. Colorado[45], Kansas residents had, under Kansas' riparian law water rights to the Arkansas river, an interstate river. Colorado residents under Colorado's prior appropriation law also had water rights to the Arkansas river. They established businesses which relied on water supplies from this river. Kansas sought for an injunction against Colorado to stop using the water as it was affecting water supplies to its residents. The court denied the injunction and rejected the application of both Kansas' riparian law and Colorado's prior appropriation law. Instead, the court enunciated and applied the equitable apportionment doctrine to protect Colorado's economies established and dependent on water supplies from the Arkansas river[46].

The doctrine has been followed in disregard of state law even where the

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[44] Colorado v. New Mexico (1982) 459 U.S. 176 at 183.

[45] (1907) 206 U.S. 46.

[46] See also, Wyoming v. Colorado (1922) 259 U.S. 419, 42 S.Ct. 552; Washington v. Oregon (1936) 297 U.S. 517; Nebraska v. Wyoming (1945) 325 U.S. 589 at 618: the court stated, "If an allocation between appropriation states is to be just and equitable, strict adherence to the priority rule may not be possible. For example, the economy of a region may have been established on the basis of junior appropriations. So far as possible those established uses should be protected though strict application of the priority rule might jeopardize them."

disputing states have similar water laws[47]. As a rule, the courts would, however, use state laws as a guiding principle where they are the same or similar[48]. It has been held that the equitable apportionment doctrine can be applied to protect conservation of water for future uses. In Colorado v. New Mexico (hereinafter Colorado I) a Special Master (Arbitrator) had apportioned to Colorado 4,000 acre feet of water a year from the Vermejo river, an interstate river. The Master was of the opinion that if New Mexico's conservation measures were efficient, it would compensate for Colorado's proposed diversion. He also found that the injury to New Mexico would be outweighed by the benefit to Colorado. New Mexico appealed the

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[47] Connecticut v. Massachussetts (1931) 282 U.S. 660, 51 S.Ct. 286 (hereinafter cited to 282 U.S. 660): Connecticut sought an injunction to prevent Massachussetts from diverting the Connecticut river to supply water to the city of Boston. Both states were riparians and so Connecticut argued that since the diversion would impair the quality and substantially diminish the quantity of water it was receiving the injunction should be granted. The court rejected this argument. It applied the equitable apportionment doctrine and weighed the injuries and benefits to either party. It refused the injunction: at 670-671; A similar decision was reached in New Jersey v. State of New York (1931) 283 U.S. 336, 51 S.Ct. 478 (hereinafter cited to 283 U.S. 336) at 343: the court said that given the quasi sovereign status of states and the many people whose interests are represented by a state, justice would not be done by applying any inflexible rule as represented in the internal laws of states. Even where states have similar laws, yet there are differences in matters of detail and practice.

[48] Nebraska v. Wyoming (1945) 325 U.S. 589 at 618: "apportionment calls for the exercise of informed judgment on a consideration of many factors. Priority of appropriation is the guiding principle. But physical and climatic conditions, the consumptive use of water in the several sections of the river, the character and rate of return flows, the extent of established uses, the availability of storage water, the practical effect of wasteful uses on downstream areas, the damage to upstream areas as compared to the benefits to the downstream areas if a limitation is imposed on the former-these are all relevant factors. They are merely an illustrative, not an exhaustive catalogue. They indicate the nature of the problem of apportionment and the delicate adjustment of interest which must be made."

decision on the ground that proposed diversion by Colorado would be injurious to it. In response to New Mexico's argument, the court stated its willingness to apply the equitable apportionment doctrine to protect future uses. It, however, found that the Master did not consider all the relevant factors in reaching his decision. It then remanded the case to the Master to determine the following issues: a) whether water from the river could reasonably be made available for diversion by Colorado, and b) the injuries and benefit to the parties if the diversion was allowed. The Master again reached the same decision[49]. New Mexico appealed again and this led to Colorado v. New Mexico (hereinafter Colorado II). In this case Colorado was required to prove a specific reasonable conservation measures by New Mexico which would compensate for the proposed diversion and to also prove that the benefit of the proposed diversion to it would outweigh the injury to New Mexico. The court found that Colorado could not discharge this burden and could not point to any specific future benefits for which it needed the water that would justify the proven injury to New Mexico. The Court nevertheless reiterated that the equitable apportionment doctrine was flexible enough to protect future uses in a proper case.[50]

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[49] (1982) 459 U.S. 176: New Mexico argued that since there was no junior appropriators' economies in Colorado dependent on the water but rather Colorado was diverting the water for unexplained future uses, there was no basis to apply the equitable apportionment doctrine. New Mexico maintained that prior appropriation doctrine should, therefore, be applied to grant the injunction sought.

[50] (1984) 467 U.S. 310 at 317-323: The court stated at 315 that: "A state can carry its burden of proof in an equitable apportionment action, only with specific evidence about how existing uses might be improved, or with clear evidence that a (conservation) project is far less efficient than most other projects. Mere assertions about the relative efficiencies of competing projects will not do."

One commentator has observed that this is a departure from the traditional goal of the doctrine which is to protect junior appropriators' economies established or dependent on a particular water supplies.[51] To the extent that the traditional goal of the doctrine is to protect economic interests only, this departure is commendable for it has the potential to protect environmental values as well.

It has been said that the burden of proof requirement in Colorado II is difficult to meet and may compel alternative ways of settling interstate water disputes[52]. Some experts suggest resolving such disputes by agreement or mutual legislation[53]. Attention is now turned to whether this doctrine can be a viable option for resolving interprovincial groundwater allocation disputes in Canada.

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[51] R.A. Simms "Equitable Apportionment- Priorities and New Uses" (1989) 29 Natural Res. J. 549 at 561-562: argues that the court in Colorado I misunderstood balancing of equities as applied in Nebraska v. Wyoming supra note 46 and Kansas v. Colorado supra note 45. According to Simms, in these two cases, the conflicts were between two existing uses and therefore, justifiably necessitated the balancing of the economic benefits and injururies of the parties if water was denied or made available. But in Colorado I, the conflict was between an existing use in New Mexico and a speculative or future use in Colorado. Simms submits that giving water to a future use at the expense of an existing use was wrong and inconsistent with the equitable apportionment doctrine. He further submits that giving water for a future use in Colorado means admitting new users to a watercourse which has already been fully appropriated and giving those new uses priority over existing uses in New Mexico.

[52] G.W. Sherk, "Equitable Apportionment After Vermejo: The Demise of A Doctrine" (1989) 29 Natural Res. J. 565 at 583: suggests arbitration, mediation, conciliation and free water market.

[53] National Water Commission, Water Policies for the Future Final Report to the President and to the Congress of the United States (hereinafter National Water Commission) (Washington, D.C.: U.S. Government Printing Office, 1973) at 244-245

III. Common Law Water Doctrines and Interprovincial Water Allocation:

Unlike the American Constitution[54], the Canadian Constitution neither provides for judicial settlement of interprovincial disputes nor the law that would apply to such disputes. This constitutional lacuna was to be remedied by the Federal Exchequer Court Act which gave the Federal Court the power to hear interprovincial disputes where the provinces agree to submit a dispute to it and have passed a legislation to that effect[55]. To date, all provinces with the exception of Quebec have passed such legislation[56].

Jurisdiction of the Federal Court over interprovincial disputes does not settle the question of the applicable law. There is no federal legislation providing for the apportionment of interprovincial waters among provinces. Some commentators have, therefore, suggested the application of the English common law riparian rights

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[54] The Constitution of the United States supra Chapter Two, note 120, Art. 3 s.1 provides: "The judicial power of the United States shall be vested in one supreme court, and in such inferior courts as the Congress may from time to time ordain and establish." Art. 3 s.2 provides: "The judicial power shall extend to all cases in equity and law, arising under this constitution, the laws of the United States, and treaties made, or which shall be made, under their authority...to controversies to which the United States shall be a party;-to controversies between two or more states." See also, P.W. Low and J.C. Jefferies Jr., Federal Courts and the Law of Federal-State Relations 2nd. edition (Westbury, New York: The Foundation Press Inc., 1989) at 289-305: discusses the power of the federal courts to make federal common law; M.H. Redish Federal Jurisdiction (St. Paul, Minnesota: West Publishing Co., 1985) at 183-189: discusses American federal common law.

[55] R.S.C. 1952, c.98 s.30.

[56] Pearse et al, supra, Chapter One, note 22, at 73: submit that provinces which have passed such legislation may revoke it where they do not anticipate favourable decisions from the court in respect of matters which they consider very important.

doctrine as received in Canada[57]. Zimmerman argues that

> considering ...that the provincial ownership of water rights is a form of riparian ownership, the provinces rights being limited to the watercourses and sections thereof within their boundaries, provincial water rights ownership for all intents and purposes is riparian ownership and to conform to the British North American Act (s.109), riparian law must and should apply in all interprovincial cases[58].

As to the argument that the riparian rights doctrine does not meet present day water needs,[59] Zimmerman submits that it would allow the provinces to buy and sell their water rights to allow for the expanded use of water for development.[60]

Alternatively, it is submitted that the American reasonable use rule could be used to allow provinces to use water for "extraordinary" purposes while maintaining their riparian status. Although the concept of reasonable use is vague,[61] the American Second Restatement of Torts has provided a useful guidelines for the

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[57] Canadian Environmental Law Research Foundation, "An Overview of Canadian Law and Policy Governing Great Lakes Water Quantity Management" (hereinafter C.E.L.R.F.) (1986) 18 Case W. Res. J. Int'l L. 109 at 148-149: argues that Arts. 499-504 of the (Lower Canada) Civil Code are provisions similar to the common law riparian doctrine and that Quebec would not, therefore, raise any objection. See also G.V. La Forest, "Interprovincial Rivers" (1972) 50 Can. Bar Rev. 39 at 43; Miner v. Gilmour (1858) 14 E.R. 861.

[58] M. Zimmerman "Interprovincial Water Use Law in Canada: Suggestions and Comparison" in D. Gibson Constitutional Aspects of Water Management supra, Chapter Two, note 86, vol.II, Part II, (page numbering omitted but by plain count the reference is at page 63).

[59] K.C. MacKenzie supra, Chapter Two, note 109 at 505.

[60] Zimmerman supra note 58, 31-32: in his own words "... a downstream province can always sell an interest in its right to undiminished flow to an upstream province in return for some compensation."

[61] Trelease supra note 20 at 74.

application of the doctrine[62].

The application of the original riparian rights doctrine to interprovincial surface water would suggest a corresponding application of the absolute ownership doctrine to interprovincial groundwater. This is because under the original English common law only the absolute ownership doctrine can apply to percolating groundwater. As we have seen, this does not promote the beneficial use of water. It is a rule of capture. It fosters conflicts rather than their resolution. But where the riparian rights doctrine is applied to interprovincial underground streams or groundwater basins as earlier canvassed, it would ensure that groundwater withdrawal in one province does not substantially affect groundwater available to another province.[63] It does not matter whether it is the original riparian rights doctrine or its reasonable use version that is applied. Both versions do not tolerate substantial

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[62] Restatement (2nd) Tort, s.850 provides that a riparian is liable for making an unreasonable use of water of a watercourse that causes harm to another riparian's reasonable use of the water on his land. Section 850A gives the following guidelines for determining the reasonable use of water: "a) the purpose of the use; b) the suitability of the use to the watercourse or lake; c) the economic value of the use; d) the social value of the use; e) the extent and the amount of the harm it causes; f) the practicality of avoiding the harm by adjusting the use or method of use of one proprietor or the other; g) the practicality of adjusting the quantity of water used by each proprietor; h) the protection of existing values of water uses, land, investments and enterprises; and i) the justice of requiring the user causing the harm to bear the loss." This reformulation of the reasonable use doctrine comes close to the equitable apportionment doctrine.

[63] Chasemore v. Richards supra note 20 at 150: the court was ready not to apply the absolute ownership doctrine if there had been evidence that the groundwaters were underground streams, a hydrological connection of the plaintiff's and the defendant's groundwaters. The court would have applied the riparian law had there been such evidence. This is also part of the common law of England received in Canada and may be applied in appropriate cases in Canada.

"extraordinary" uses of water to the injury of other riparians. Furthermore, the application of either version of the doctrine would prevent groundwater overdraft. The prior appropriation doctrine would not be suitable because in times of water shortage it would deny the junior appropriator province water for the benefit of the senior appropriator province regardless of the social importance of the engagement of the junior.

A more satisfactory approach to resolving interprovincial water disputes is the equitable apportionment doctrine. The flexibility of the doctrine would help provide satisfactory results having regard to the circumstances of each particular case. It is directed to equitable results, ensuring that no jurisdiction wastes water or appropriates water which it does not really need[64].

Zimmerman rejects the doctrine as an option for Canada, suggesting that the doctrine allows the courts to decide how jurisdictions should best use their water instead of deciding only the water rights of the parties.[65] This writer disagrees with this view. The purpose of equity is to mitigate the hardship or injustice which insistence on the application of the law would produce. In seeking to apply equity considerations, a court needs to be informed of all the circumstances of a particular case in order to have justifiable reasons on which to base its decision. This would, therefore, rightly engage the court in going beyond the bare legal rights of the parties to the benefits of those rights to them in the circumstances. As we have seen, in

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[64] Colorado II supra, note 50.

[65] Zimmerman supra, note 58 at 61-62.

Colorado II, Colorado could not prove that it really needed the water it was diverting for any beneficial use that would justify injury to New Mexico. It was, therefore, equitable to disallow Colorado's diversion.

Also, given the flexibility of the doctrine and the many factors it takes into consideration in each particular case, it most likely would discourage groundwater withdrawal in one province which leads to overdraft in another. It is, therefore, submitted that the equitable apportionment doctrine would better serve the resolution of interprovincial surface and ground water disputes in the absence of a federal legislation[66]. But, as we have seen,[67] the federal government is not interested in settling interprovincial disputes by judicial or legislative means. Judicial means would nevertheless be resorted to should extra legislative and extra judicial efforts fail.

IV. CRITIQUE OF THE COMMON LAW WATER DOCTRINES

i) In several respects the riparian rights doctrine falls short of meeting present water needs. The doctrine does not allocate or reallocate water according to the social, environmental or economic importance of the activities of the riparian owners. It treats them as equals so that in times of water shortage a use which may be considered more beneficial by the jurisdiction concerned is not given priority over a

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[66] La Forest, "Interprovincial Rivers" supra, note 57 at 43: it is generally believed that Canadian courts would likely apply this doctrine.

[67] See supra Chapter Two, notes 110-119 and accompanying text.

less beneficial use[68]. Under the doctrine it is not possible to transfer water or water rights to non-riparian owners[69] whose uses might be more beneficial to the society. Where a riparian owner transfers his rights to a non-riparian owner, the transfer is only good as between both parties and does not bind other riparian owners.[70] This means that a non-riparian transferee of water rights cannot maintain an action against other riparian owners for substantially diminuishing the flow or impairing the water quality. At the same time, an action can be maintained against him by other riparian owners for interfering with either water quantity or quality. Although transfer from one riparian owner to another is allowed, there is no incentive to do this because a transfer of riparian rights cannot be made separately from the riparian land. Where, therefore, riparian owners are not willing to dispose of their lands, there can be no transfer of the riparian rights.[71]

By limiting water use to riparian lands, the doctrine denies water supplies to drier areas and the society at large. The requirement of using water only for domestic purposes jeopardizes extraordinary purposes such as irrigation and industrial uses of water. This, however, benefits instream uses including the recharge of alluvial

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[68] D. Percy, "Water Rights in Alberta" (1977) 15 Alta. L. Rev. 142 at 144.

[69] A.R. Lucas, Security of Title in Canadian Water Rights (Calgary: Canadian Institute of Resources Law, The University of Calgary, 1990) at 6.

[70] R.S. Campbell et al, "Water Management in Ontario-An Economic Evaluation of Public Policy" (1974) 12 Osgoode Hall L.J. 475 at 499; Duckworth v. Watsonville Water and Light Co. 158 Cal. 206, 110 P. 927; Omerod v. The Todmorden Joint Stock Mill Co. (1883) 11 Q.B.D. 155.

[71] Campbell et al, supra note 70, at 499: further submit that the doctrine does not regulate the ordinary use of water by riparians.

aquifers, aquifers hydrologically connected with surface water bodies, and nourishing of the environment as more water is left in the stream to maintain the natural flow. More water to recharge alluvial aquifers may minimize the impact of groundwater overdraft.

The doctrine also prevents arrangements which could help a water user secure preferred water supplies during dry seasons[72] as all riparian owners have equal and correlative rights to water in a stream.[73] The doctrine does not guarantee a riparian owner a specific quantity of water because of the continuous admission of new riparian owners whose aggregate use of water, even with the return flow, may affect the water flow. Where, for example, a riparian owner has undertaken an investment in anticipation of using certain amount of water within the ordinary use or reasonable use limit, the admission of new riparian owners means that less water would be available to him. He may incur some losses as a result. The admission of new riparian owners make water available to more people. However, an endless list of riparian owners may diminuish the water quantity available to each which might be too small

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[72] D. Chesman, "Memorandum on Riparian Rights" in Water Law and Policy Issues in Canada supra Chapter Two, note 42, at 65: submits that the doctrine presumes that water flow and consumption cannot be divided outside the water basin without the prior unanimous consent of all the riparians. Even where such a unanimous consent exists a new riparian is not bound. The newcomer may jeopardize the deal if he refuses to give his consent.

[73] Lucas, Security of Title in Canadian Water Rights supra note 69, at 6; Seneca Consol. Gold Mines Co. v. Great Western Power Co. (1930) 29 Cal. 206 at 219-221, 287 Pac. 93: a riparian is not entitled to a "constant invariable specific quantity of water;" but rather he is entitled to "take a proportional share from the stream- a correlative right which he shares reciprocally," with other riparians: Prather v. Hoberg (1944) 24 Cal. (2d) 549 at 559-560; 150 Pac. (2d) 405.

to serve any beneficial purpose.

The retention of riparian rights even where the water is not being used denies other people water that could be put to beneficial uses.

In sum, the riparian rights doctrine does not meet modern water needs. This has necessitated the modification of the doctrine in almost all jurisdictions including England. The English Central Advisory Water Committee has recommended that the "rights of riparian owners would have to be curtailed and abstractions from rivers and aquifers controlled if water resources were to be managed effectively."[74] The problems posed by the riparian rights doctrine to optimum utilization of surface water apply to groundwater where an "underground stream" is subject to the riparian rights regime.

ii) Like the riparian rights doctrine, the absolute ownership doctrine does not promote optimum beneficial use of water. An overlying land owner is free to draw down the water table and apply the water to any number of wasteful purposes without incurring any liability. His action may jeopardize businesses relying on groundwater supplies in adjoining land. Where there is inter-connection between surface water and groundwater, groundwater mining by him might dry up the surface water body and wetlands and might put the ecosystems in danger. This may also

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[74] L.E. Taylor, "The Planning and Development of Water Resources in England and Wales, 1965-1985" in W.O. Wunderlich and J.E. Prins, Water for the Future: Water Resources Development in Perspective (Rolterdam; Boston: A.A. Balkema Publishers, 1987) at 355.

cause the intrusion of contaminants into groundwater systems. However, the House of Lords in Sedleigh-Denfield v. O'Callaghan[75] attenuated a malicious use of groundwater permitted in Bradford v. Pickles[76] by introducing the principle of a reasonable user.

Considering the importance of beneficial uses of water and improved knowledge of groundwater processes, this doctrine has undergone vigorous statutory modifications in most Canadian jurisdictions. The doctrine has even been modified in England where it originated[77].

iii) The reasonable use doctrine does not permit the use of surface or groundwater outside of the riparian or the overlying land. Thus, it does not make water available for beneficial uses outside of such lands. The doctrine does neither rank the beneficial value of the water using activities nor reallocate water according to the importance of such activities in times of water shortage. Thus, to some degree, the doctrine is tied to the vestiges of the riparian rights doctrine. According to one writer, the intent of the doctrine "was to accommodate some new uses of the water but to cling to as many of the vestiges of the old law as possible."[78]

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[75] (1940) A.C. 880.

[76] Supra note 23.

[77] Taylor, supra, note 74: The reference to cutting down the abstraction of water from aquifers contradicts this doctrine and therefore, suggests reforms.

[78] W.R. Walker, "Towards A More Flexible Water Law" in Water for the Future supra, note 74 at 336: argues that the rigidity of the common law doctrines was such that the high demand for water for irrigation and industrial purposes only permitted

The doctrine does not prevent the drilling of new wells and the extraction of any amount of water for any use whatsoever, provided it is not wasted and not used in non overlying lands. Thus groundwater mining is not forbidden under the doctrine. This doctrine may therefore, condone contaminants intrusion into groundwater systems due to overdraft although such use might not be considered reasonable.

iv. The correlative rights doctrine is not entirely satisfactory either. It permits the use of water outside the overlying land only where there is surplus water regardless of the beneficial importance of such use.

v. The prior appropriation doctrine does not allocate water according to the beneficial importance of the activities of water users. Under the doctrine the headgate or the well of a junior appropriator would be shut down in times of water shortage in order to satisfy the water needs of a senior appropriator regardless of the beneficial importance of the activity of the junior appropriator. Critics say because of the slow movement of groundwater, the closing of a junior's well might not necessarily make water available in the senior's well[79].

The doctrine may provide a basis for interbasin transfer of water by prior appropriators to where water is needed for economic purposes. Except where restraint and sound judgment are applied, this might pose ecological problems.

"reasonable withdrawals as long as downstream users were not harmed and the water was used within the same drainage basin."

[79] Aikens, supra, note 41, at 922.

Where many people are entitled to use a particular water source, the diversion or extraction of water by the prior appropriators to wherever they need it denies water to the several subsequent appropriators. This might not always be in the interest of the public.

Where a water source has been fully appropriated, new appropriators are not admitted[80] regardless of the beneficial importance of their proposed activities. The amount of water withdrawn by each appropriator under the doctrine is regulated only by limiting him to his historic allocation, the quantity he traditionally withdraws[81]. Apart from the historic allocation limitation, the doctrine does not regulate water quantity. One is free to mine groundwater provided one puts water to a beneficial use and does not exceed one's historic allocation. Subject to the same conditions, surface water can also be diverted to a level that does not leave enough water for instream uses and for the recharge of alluvial aquifers[82]. And because the doctrine insists on

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[80] Ibid at 931.

[81] Rocky Ford Irrigation Co. v. Kent Lake Reservoir Co. (1943) 104 Utah 202, 135 P 2d 108: where an appropriator changes his point of water diversion or the use to which he puts the water, he cannot be allowed more water than his historic allocation. See also Enlarged Southside Irrigation Ditch Co. v. John's Flood Ditch Co. (1949) 120 Colo. 423, 210 P. 2d 982; City of Westminster v. Church (1968) 167 Colo. 1, 445 P. 2d. 52. This is particularly prohibited where the change of use or increase in volume of water consumed causes injuries to other users.

[82] It is possible to mine groundwater or overdraw surface water bodies and yet not exceed the historic allocation limit. This can happen where the first appropriator historically draws large quantity of water for irrigation purposes. This does not lower the water table as he is the only user of the groundwater basin. Over time, other appropriators are admitted to a point where the basin is fully appropriated. The cummulative withdrawals by all the appropriators may affect the water table. If then the junior appropriators were stopped from withdrawing water in order to make water available to the senior, given the cummulative effect of the previous

"diversion" and "application" of water to beneficial uses, it does not accommodate instream uses of water because water in the stream, arguably, does not meet "diversion" requirement. Furthermore, limiting withdrawals to historic allocation might not make enough water available for present needs. Nevertheless, not admitting new appropriators to already fully appropriated water sources and limiting withdrawals to historic allocation may leave enough water for mutual recharge of surface and groundwater.

Like the other doctrines, this doctrine is, flexible and can be reformulated to deal with water need problems as they arise[83]. The reformulation can be done by legislation.

vi. With the exception of the equitable apportionment doctrine, a common criticism to all these doctrines is that they promote, directly or indirectly, private interests rather than the interest of the society at large. With the exception of the prior appropriation doctrine, all of them are attached to private proprietary rights. If "beneficial use of water" is to be construed as synonymous with public interest, encompassing environmental conservation, social and expanded economic use of water, these doctrines must fail to promote beneficial use of water. Legislative efforts must thus intervene to redefine water rights and uses in the interest of the society.

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withdrawals and the slow recharge of groundwater, there may be groundwater mining before the senior could meet his historic allocation limit.

[83] S.E. Clyde "Adapting to the Changing Demand for Water Use through Continued Refinement of the Prior Appropriation Doctrine: An Alternative Approach to Wholesale Reallocation" (1989) 29 Natural Res. J. 435.

It is only in this way that present and future needs of water can be met.

B. PROVINCIAL STATUTORY REGIMES FOR GROUNDWATER ALLOCATION

The preceding discussion has been a consideration of water doctrines under the English and American common law. While Canadian jurisdictions, with the exception of Quebec, received the English common law into their laws[84], some of their laws have been influenced by American common law. Legislation has, however, been enacted to modify both laws to suit local circumstances[85]. The extent to which this has improved water management and public benefits is considered below.

As previously discussed,[86] property rights in water belong to the provinces by virtue of section 109 of the Constitution. Pursuant to their property and civil rights power under s.92, the provinces also have the power to define the water rights of their residents. There is, therefore, no federal law allocating water or determining water rights of Canadians in the provinces. But the apportionment of water uses

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[84] Whyte and Lederman supra, Chapter Two, note 36; ITO-International Terminal Operators Ltd. v. MIIDA Electronics Inc. et al. (1986) 28 D.L.R. (4th) 641, at 644-645: discusses the adoption of English common law in Canada albeit with respect to admiralty matters. More importantly, it applied federal common law to resolve a case which arose from Quebec, a civil law jurisdiction. According to the case, federal law promotes uniformity of law among the provinces.

[85] Where appropriate references are made to statutory modifications of the English and American common laws by some American jurisdictions with a view to exposing how this promotes better water allocation management.

[86] See supra Chapter Two.

under the Constitution brings federal and provincial interests in conflict in certain cases. For example, water uses for fisheries[87] and navigation[88] (instream uses) which fall under federal jurisdiction, are interrelated with the allocation of both surface and ground water rights by the provinces.[89] An allocation regime should, therefore, reserve some amount of water for instream uses. This would also benefit ecological support. Such concerns and the need to attend to water scarcity and conservation, necessitate the concerted efforts of federal and provincial governments to be efficiently managed. Federal-provincial agreements on water resources have centered on surface water.[90] No such agreement is specifically directed to managing groundwater allocation in such away that surface water frequented by fish which is recharged by groundwater retains certain level of water to support fish habitat. The

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[87] R.S.C. 1985, c. F-14 ss.20(4) and 22(1)(3): empowers the minister to ensure that sufficient quantity of water is left in waters frequented by fish to support fish and fish habitats.

[88] R.S.C. 1985, c.N-22, s.5(1): dams and impoundments which affect surface water flow are prohibited except with the permission of the minister.

[89] We have seen in Chapter One that groundwater provides base flow for surface water and freshwater for fish spawning. Where the allocation of groundwater in the provinces promotes overdraft, that will diminish the surface stream flow hydrologically connected with it. This will affect fish habitat and even navigation. Although the effect of groundwater withdrawal on fishery and navigation is indirect, it is nevertheless profound and would, therefore, merit federal-provincial cooperation.

[90] See Saunders supra Chapter Two, note 28; Slater, supra Chapter Two, note 108; Barton supra Chapter Two, note 116; Lucas, supra, Chapter Two, note 110; D. Percy, supra, Chapter Two, note 113; Federal Water Policy: A Progress Report supra, Chapter Two, notes 114 and 115, for a review of several such agreements.

following discussion centers on the provisions of provincial water allocation statutes[91] and canvasses areas appropriate for a unified federal and provincial efforts. Criticisms and recommendations are made where appropriate. The water allocation statute in each province governs both surface and groundwater allocation and vests the allocation management of both in a single authority. Therefore, references to "water" include surface and groundwater.

I. OWNERSHIP OF WATER

The property in and the right to use water is vested in the crowns of the provinces of British Columbia[92], Saskatchewan[93], Alberta[94], Manitoba[95], Nova Scotia[96] and Newfoundland[97] and in the federal crown for the Territories[98]. In

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[91] It was stated in Chapter Two that the federal government has legislative jurisdiction over the Northwest Territories and Yukon Territory (hereinafter Territories) in much the same way as the provincial governments have legislative jurisdictions over their repective provinces. For this reason groundwater allocation regime in the Territories is discussed together with the management of the same in the provinces.

[92] Water Act (hereinafter B.C.) R.S.B.C. 1979, c.429, s.2: makes reference to water in a stream. "Stream" is defined in s.1 as including groundwater.

[93] Water Corporation Act (hereinafter Sask.) S.S. 1984, c.W-41, s.41(1).

[94] Water Resouces Act (hereinafter Alta.) R.S.A. 1980, c.W-5, s.2(1).

[95] The Water Rights Act (hereinafter Man.) R.S.M. 1988, c.W-80, s.2.

[96] Water Act (hereinafter Nova.) R.S.N.S. 1980, c.500, s.3(1).

[97] Department of Environment and Lands Act (hereinafter Nfld) S.Nfld. 1989, c.21, s.19(2).

the Territories the rights of a riparian owner to use surface water and, arguably, underground stream in a defined and known channel for domestic purposes and the right to use water for fire fighting and flood control purposes are not vested in the federal crown.[99] There is a difference, albeit theoretical, between not vesting property in and right to use water in the crown and vesting it in the crown but excluding use of the water from the licensing regime considered below. This latter approach is followed in the other provinces above mentioned. The difference will be discussed later on in this work.[100]

The water allocation statutes of Ontario[101], New Brunswick[102], and Prince Edward Island[103] do not vest the property in and the right to the use of water in the provincial crowns. The same is true of the Water Courses Act[104] and the (Lower Canada) Civil Code.

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[98] Northern Inland Waters Act (hereinafter NIWA) R.S.C. 1985, c.N-25, s.4(1).

[99] Ibid s.5(a)(b); Nova.s.3(1): the right to use water in the land lying and being the Garden Lots in the County of Lunenberg is not vested in the Crown.

[100] Infra note 250 and accompanying text.

[101] Ontario Water Resources Act (hereinafter Ont.) R.S.O. 1980, c.361. The Lakes and Rivers Improvement Act R.S.O. 1980, c.229, s.2(b) provides that one of the purposes of the Act is to protect the interest of riparian owners.

[102] Water Act R.S.N.B. 1973, c.W-5 which vested property in and right to the use of water in the crown was repealed by the Clean Environment Act R.S.N.B. 1975, c.12. Part of the Clean Water Act (hereinafter N.B.) S.N.B. 1989, c.6.1 governs water allocation. Section 9 of the Act vests control (not property right) of water in the province in the Crown.

[103] The Environmental Protection Act (hereinafter PEI) S.PEI. 1988, c.19.

[104] R.S.Q. 1977, c.R-13.

II. LICENSING REGIMES

Most provinces regulate water through licensing schemes.[105] A water use licence specifies the rate, quantity, duration and times of use, the manner in which, and the undertaking in respect of which water is to be used. Quebec has no statute providing for the licensing of water use.[106] The licensing regime under British Columbia's Water Act does not as yet apply to groundwater[107] but only to surface water.[108] Thus, the reference to this Act is only in respect to surface water. As the Act is also intended to apply to groundwater, reference to it is important. Another reason for the reference is that an underground spring in a defined and known channel is treated as surface water under the Act[109].

Where licensing schemes exist, they are built around a variety of aspects. The following pages will discuss the criteria and aspects upon which those regimes that rely on licensing schemes are built.

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[105] Alta. s.5(1); Sask. s.41(2)(3)(4), s.43(1)(4); Man. s.3(1)(2); Ont. s.20(3); Nova.. s.7; Nfld. s.33; PEI. s.25; N.B. s.14; NIWA s.4(2).

[106] CELRF supra, note 57, at 134-135.

[107] B.C. s.3.

[108] Ibid s.2.

[109] Steidman v. Erickson Gold Mining Corporation (1987) 43 D.L.R. (4th) 712 at 717, 726: underground spring on one's land in British Columbia is regarded as a stream and subject to the law of surface water which at common law is the riparian rights doctrine but is replaced by a licensing regime under the Act.

a) Beneficial Use of Water:

A typical definition of beneficial use of water is found in the water statutes of Nova Scotia and Newfoundland which define beneficial use of water as

> a use of water, including the method of diversion, storage, transportation and application, that is reasonable and consistent with the public interest in the proper utilization of water resources, including but not being limited to domestic, agricultural, industrial, power, municipal, navigational, fish and wildlife and recreational uses.[110]

Water use licences are not issued where the proposed use does not fit into this definition.[111] The definition emphasizes public interest and thus represents a dramatic departure from the common law water doctrines. It covers a broad array of uses which accommodates social, economic and environmental values. Arguably, under this broad definition of beneficial use water allocation should take into account groundwater recharge of surface water where both are hydrologically connected. This would help to maintain recharge at a reasonable level to supply water for navigational and recreational purposes and for fish, wildlife and ecosystem supports. In the same vein, surface water recharge of aquifers should not be unreasonably impeded. Beneficial use of water therefore, suggests a "holistic" approach to water allocation management.

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[110] Nova. s.2(a); Nfld.. s.2(a).

[111] Ibid.

Although the other provinces do not define "beneficial use" in their water statutes, their conception of beneficial use is similar to that of Nova Scotia and Newfoundland. This can be deduced from the recognized water uses in their statutory table of water use priorities or in their administrative practices.[112] More specifically, the cancellation of water use licences in the public interest in some jurisdictions suggests the emphasis placed in their concept of beneficial use of water.[113] For example, the overall goal of the Saskatchewan Water Corporation in managing water allocation is "to manage, develop and protect the water resources of Saskatchewan in the public interest."[114]

Generally, use of water for a beneficial purpose is a condition for issuance of licences. Alberta has an interesting set of conditions which should be commonly shared by all jurisdictions. It will issue licence for groundwater use where the use will

> a) not unreasonably interfere with the water supply of the existing nearby water users. b) not damage the aquifer being used or other nearby aquifers. c) be adequate to provide sufficient quantities of water for the intended purpose. d) be used for a beneficial purpose

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[112] See for example, B.C. ss.4(e), 12(2); Man. s.9; Alta. s.11(1); Sask. s.16(1): no table of priorities but this subsection mentions beneficial water uses; NIWA s.26, Northern Inland Waters Regulations (hereinafter NIWR) C.R.C. 1978, c.1234, s.5; Ontario does this in practice, see D. Percy The Framework of Water Rights Legislation in Canada (Calgary: The Canadian Institute of Resources Law, 1988) at 78-79.

[113] NIWA s. 14(b)(iii); Man. s.15.

[114] Saskatchewan Water Corporation, Corporate Mandate (Moose Jaw: The Corporation, 1988) s.2.2.

(emphasis added)[115]

In the Territories, water use licences are tied to the maintenance of water quality. Section 11(2)(c) of NIWA provides that water use licences would not be issued unless the waste to be generated by the undertaking in respect of which water is to be used is to be treated and disposed in a manner that maintains water quality standards prescribed under s.29(e). To ensure that this is done s.11(2)(d) requires that the applicant furnish security. The terms and conditions of water quantity and quality are included in the same licence[116]. Making water quality maintenance a condition for water allocation is one way of stating that pollution is not a beneficial use of water although this may be allowed to a certain degree in order not to totally stifle economic activities. The Territories are the only jurisdiction where this is done. It is submitted that, regardless of the water situation of the other jurisdictions, this is a desirable approach to adopt. Pollution can limit the quantity of water available, and not every water user can afford the expense of water treatment.

Other conditions may vary from jurisdiction to jurisdiction depending on their water situations.[117] All conditions are geared towards beneficial uses of water. We

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[115] Water Resources Administration Division, Alberta Environment, Ground Water Projects How to Obtain an Approval to Use Ground Water for Non Domestic Purpose (hereinafter Ground Water Project) (Edmonton: Alberta Environment, date omitted, obtained from Alberta Water Resources Division) at 2.

[116] H.I. Rueggeberg and A.R. Thompson, Water Law and Policy Issues in Canada supra, Chapter Two, note 42, at 28: this helps in the integration of water quantity and quality management.

[117] B.C. s.4; Sask. s.41(4); Man. s.5(1)(2); Ont. s.20; Nova. s.7; Nfld. s.33(b)(t)(u)(v); PEI. s.25(l)(k); N.B.. s.14(3)(c)(d); Alta. s.15; NIWA ss.11, 12.

have seen that the concept of beneficial use is broad. The environmental arm of the concept encompasses instream uses: the interrelationship of water and ecology. This is a recognition of the unity of the aquatic environment. A unified federal and provincial approach to managing water for beneficial uses is not only demanded by the unity of the aquatic environment but also by the fact that some beneficial uses, for example those relating to fish habitat and navigation, fall under federal jurisdiction.[118] It is inconceivable for fish habitat to be maintained in a way that promotes fish spawning if there is not enough water in the streams frequented by fish. Excessive withdrawal of surface water or groundwater which feeds surface water may be harmful to fish habitat. It may also impede navigation. While there might be no obvious need at present for federal and provincial unified action in this area, the need for such actions will be inevitable in the future as population and water demand increase. High demand for irrigation water as well as the relative scarce supplies of water in the prairie provinces, for example, necessitate the need to ensure that instream uses are not unduly deprived of water. This cannot be effectively achieved without a unified effort.

Beneficial uses of water command different degrees of importance in different jurisdictions depending on their water situation, social, economic and environmental objectives. Water is a finite resource and should, therefore, be made available first

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[118] Fisheries Act R.S.C. 1985, c.F-14; Navigable Water Protection Act R.S.C. 1985, c.N-22,

to uses considered most important. For this reason and for administrative convenience, most jurisdictions have water use priority tables.

b) Priority of Water Use:

In British Columbia, Alberta, Manitoba and Nova Scotia water use licences are issued in the order of time of application. The first person to apply secures superior rights over subsequent licensees: the principle of "first in tim first in right" is modelled upon the American prior appropriation doctrine[119]. Where two applications are made at the same time and in respect of a common source of water supply, priority is decided according to the ranking of water use purposes in the statutory table of water use priorities.[120]

Manitoba and Alberta, however, circumscribe a principle of "first in time first in right" which does not respect the importance of water use purposes by providing for the cancellation of a low priority water use licence in favour of a high priority water use purpose subject to the payment of compensation.[121] Both jurisdictions

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[119] B.C. s.12(1); Alta. s.11(2); Man. s.8(1)(2)(3). (Nova Scotia) Water Licence and Permit Regulations (hereinafter Nova. Water Licence) (1990) N.S.Reg. 95/90, s.8(3)(4).

[120] B.C. s.12(2): water use priorities are in the other of: "domestic, hydraulicking, storage, conservation, fluming, conveying and land improvement purposes"; Man. s.8(4), s.9: domestic, municipal, agricultural, industrial, irrigation and other purposes; Alta.. s.11(3), s.11(1): domestic, municipal, irrigation and agricultural, industrial and water power purposes, instream uses etc. Nova Scotia has no priorities table. The Minister decides priority in such cases: see Nova. Water Licence supra note 119, s.9.

[121] Man.. s.14(1); Alta.. s.11(4)(5)(6)(7).

do not seem to adopt this approach in the initial allocations which they base on the "first in time first in right" principle. They use the approach after the fact: reallocation of water when the need arises.

By contrast, the Territories are not a prior allocation jurisdiction. Under s.11(2)(a) of NIWA licences will not be issued unless the Water Board is satisfied that the proposed use will not affect the water use of existing licensees or potential licensees who have precedence[122] over the applicant pursuant to s.25. Under s.25(1) a water user would have precedence to take full allocaton before others if his water use purpose is prescribed by the Governor to be of a higher priority in the water management area concerned. Under s.11(2)(b) and s.26, a licence will not be issued to an applicant whose proposed use is higher in priority than existing uses unless he pays compensation to the lower users for any adverse injury sustained. Thus for both initial allocation and reallocation, the Territories employ the table of water use priority. It is only where two applications are for the same water use purpose that the principle of "first in time first in right" is applied.

Ontario is said to respect water use priorities fixed by administrative discretion in allocating water.[123] Other provinces do not have priority of water use purposes in their statutes. In Nova Scotia, the appropriate minister is empowered to authorize

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[122] NIWA s.26(d); NIWR supra,note 110, s.5: priority is in the order of: agricultural, conservation, industrial, municipal, power, water engineering, storage, and recreational purposes.

[123] D. Percy The Framework of Water Rights Legislation in Canada supra note 112, at 78-79: priorities are in the order of: domestic, farm, fire prevention, municipal, industrial, commercial and irrigation purposes.

any person to use any water for such purposes and on such terms and conditions the minister may deem fit. Injury caused to others by a person so authorized to use water can only be compensated at the discretion of the minister.[124] It is plaussible that this provision can be used to permit a water use which the minister considers more important but it certainly does not give the minister a clear mandate to transfer water rights from what he considers to be a lower water use to a higher water use. Again, the fact that compensation is discretionary rather than mandatory suggests that the legislature might not have intended this provision to be used to reallocate water in this way. Saskatchewan can cancel existing water rights granted under the former Water Rights Act subject to compensation[125]. But this is not for purposes of reallocating water to uses which water admininstrators may consider more important, albeit this may be incidentally achieved.

While it may be argued that priority of water use purposes is not necessary for water-rich provinces, Ontario's approach contradicts this argument as it is generally a humid province. A humid jurisdiction may have many people who want to draw water from the same source because the location is suitable for their needs. Where water from that source cannot meet the needs of all, a priority of use system would determine, in the light of the overall interest of the society, what needs should be met. It helps to maximize water uses. Unfortunately, relatively water-short Saskatchewan and interior British Columbia do not follow this approach. British

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[124] Nova. s.4(1).

[125] Sask. s.41(1)(3).

Columbia's table of water use priorities is only used to resolve conflicts between water use applications made at the same time.

For provinces following priorities of water use table, it is not clear what will happen where, for example, water use related to fish habitat, a federal interest, is subordinated to water use for irrigation, a provincial interest, as is clearly the case in Manitoba and Alberta.[126] Water use conflicts would not be obvious where supply is abundant. But where supply is scarce, as is bound to be the case as demand increases due to increase in population and expansion of water consumption activities, conflicts would be inevitable. How such conflicts, particularly when a federal interest is involved will be resolved will be discussed later on.[127]

c) Transfer of Water Rights (Licences):

Efficient transfer of water use licences is in the interest of the society as it makes water available to more beneficial uses. It also makes water available to those who otherwise might not have access to water supplies from a particular source which they consider important for their undertakings.

Expropriation of water rights for low beneficial uses in favour of high beneficial uses is one way of transferring water rights. There are, however, other ways. For example, in British Columbia, the transfer of appurtenancies to which

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[126] Man..s.9; Alta.s.11(1).

[127] Infra, notes 153-157 and accompanying text.

licences attach automatically transfers the licences.[128] A licence can also be transferred separately from the appurtenancy with the approval of the Comptroller of Water.[129] By contrast, in Manitoba a licence expires upon the transfer of its appurtenancy. But the minister can, upon an application by the transferee of the appurtenancy, transfer the licence to him.[130] Alberta does not allow the transfer of a licence separately from the appurtenancy although the Lt. Governor may permit some exceptions.[131] Nova Scotia permits tranfer by amendment to the licence.[132] The Territories allow the transfer of a licence with the approval of the Water Board who must be satisfied that the transfer would not contravene the terms and conditions of the licence and the provisions of NIWA and the regulations thereunder.[133] For groundwater only, Saskatchewan permits the transfer of a licence with the approval of the appropriate authority.[134] The right to use allocated groundwater in Prince Edward Island terminates upon the transfer of the property

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[128] B.C.. s.13.

[129] Ibid s.16.

[130] Man.. s.11.

[131] Alta.. s.23(2).

[132] Nova. Water Licence supra note 117, s.11(b).

[133] NIWA s.15(1)(2).

[134] Groundwater Regulations 1984 with Amendments (Office Consolidation), s.36 (being regulation made under the Groundwater Conservation Act R.S.S. 1978, c.G-8 as amended).

on which the well is located.[135]

There are no transfer provisions in the water statutes of the other provinces. Ontario allows transfer in practice with the approval of the Director of Water Resources.[136] But the transfer is not done separately from the land to which the licence or permit is attached.[137]

d) Amendment and Cancellation Of Water Use Licences:

Licences are commonly laden with terms and conditions to ensure that water is not misused. Each licensing jurisdiction may amend or cancel licences when the terms and conditions in them or the provisions of the water statute are breached.[138] Amendments or cancellations may also be made for reasons which the government deems proper in the interest of the general public. For example, British Columbia, Nova Scotia and the Territories may cancel a licence if, for three successive years, water is not put to a beneficial use.[139] The Territories may amend

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[135] Water Well Regulations 1990 No. EC188/90, s.7(6).

[136] Percy, The Framework of Water Rights Legislation in Canada supra, note 112, at 81-82.

[137] Campbell et al, supra, note 70, at 498-499.

[138] B.C. ss.15, 20; NIWA s.14; Alta. ss.42, 50(2), 51(1)(b)(c); Sask.. ss.41(5), 64; Ont. s.20(6); Nova. s.7 and regulations made thereunder; Nfld. s.33(b)(t)(u)(v); and regulations made thereunder; PEI. s.25(i)(l)(k) and Water Well Regulation 1990 No. EC188/90, s.7(5); N.B. s.14(3) and regulations made thereunder.

[139] B.C. s.20(2); Nova. Water Licence s.12(1)(2); NIWA s.14(c).

a licence in a water shortage or change of water quality situation or in public interest.[140] Alberta may cancel a licence if the minister is satisfied that the licensee has abandoned his rights.[141] Manitoba and Saskatchewan would cancel a licence where it is in the interest of the public but in the case of the latter it is limited only to water rights granted under the former Water Rights Act[142]. It is submitted that this power should be extented to cover all water rights. Other reasons for cancellation may vary from jurisdiction to jurisdiction. "Public interest" is an unmbrella phrase for all of them.

e) Resolution of Private Water Use Conflicts in the Provinces:

An efficient water allocation system must have a mechanism for resolving water use conflicts. Resolution of conflicts should reasonably be influenced by the ranking or importance of the conflicting beneficial uses.

i) Resolution of Conflicts By Administrative Discretion:

The "priority of use" table is meant to help in the resolution of conflicts. But this is not always the case because of the overall provisions of the law establishing the

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[140] NIWA s.14(b).

[141] Alta. s.51.

[142] Man. s.15; Sask. s.42(1).

table as discussed later.[143] Thus, administrative discretion is sometimes used to resolve conflicts. For example, water administrators in Alberta insert a standard clause in water use licences which states that

> the rights and privileges hereby granted are subject to periodic review and to modification to ensure the most beneficial use of the water in the public interest and more particularly to ensure the preservation of the rights of other water users"[144].

Such clauses are helpful in promoting a more beneficial management of water resources as insistence on statutory rights may at times, lead to absurdity. In such instances, therefore, administrative discretion should be exercised. A typical example of water use conflicts resolved by administrative discretion is presented in the following Alberta experience: Groundwater use for oilfield injection diminuishes the quantity and impairs the quality of groundwater available for domestic and agricultural uses in Alberta engendering serious water use conflicts. A number of

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[143] Infra, notes 148, 150 and accompanying text.

[144] Percy The Regulation of Groundwater in Alberta (Edmonton: Environmental Law Centre, 1987) at 19: argues that this clause cannot be used to deny one his right where one has complied with the provisions of the Water Resources Act. At 19-29: Percy decries the practice of Alberta water administrators in granting preferential groundwater use to domestic and agricultural users to the detriment of oilfield injection users even where oilfield injectors have secured their rights under the Act. According to him, oilfied injectors are made to comply with the following conditions: 1) they are to monitor on a regular basis wells of residents within two miles of their own wells. 2) If they detect or a well owner complains of unreasonable interference with his groundwater supplies by the wells of oilfield injectors, the injectors should at their own expense within 12 hours provide a temporary water supply to the complainant, and then investigate the cause of the problem. If the cause is not detected, the injectors are presumed to have caused it and must therefore, provide a permanent water supply to the complainant at their own expense. A failure to do this by the injectors might lead to the cancellation of their licences.

interim groundwater allocation policies were adopted to resolve this conflict[145]. In March 1990, a final policy was issued which, inter alia, provides that: 1) potable groundwater use for oilfield injection purposes is restricted to only one-half of the long term yield of a particular aquifer, that is, permitting a 37% draw down limit in the first year and up to 50% over the life of the project; 2) initial approval is for one year. An extension for five years would, however, be granted only if aquifer performance meets the terms and conditions of the approval, namely: a) there must be no unreasonable negative effect on other wells in the community, and b) if applications for water use licences received do not exceed the aquifer yield capacity; and 3) a licence applicant must investigate the availablitity of alternative non-potable surface and groundwater supplies to him including non water alternatives[146].

Critics argue that the policy has the effect of derogating from the prior allocation principle enshrined in ss.11 and 35 of the Water Resources Act as it would deny water to oilfield injectors even when their applications are made first in time in favour of domestic and agricultural groundwater users[147].

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[145] Alberta Department of the Environment, Draft Interim Groundwater Allocation Policy for Oilfield Injection Purposes (Edmonton: Department, 1985) revised in June 1986 as Revised Draft Interim Groundwater Allocation Policy for Oilfield Injection Purposes (Edmonton: The Department, 1986) and further revised October, 1986 as Groundwater Allocation Policy for Oilfield Injection Purposes (Edmonton: The Department, 1986).

[146] Alberta Department of the Environment, Groundwater Allocation Policy for Oilfied Injection Purposes (Edmonton: The Department, 1990): The policy applies only to potable groundwater. It however, does not define "potable".

[147] Lucas,"Security of Title In Canadian Water Rights" supra, note 69, at 82: argues that "if injection uses are licensed, then the time limitation (specified duration of their licences) which has the effect of transferring water to later agricultural users,

This is only one example for the type of challenge groundwater managers face in allocating the resource. Potable groundwater is limited in supply and should, therefore, be put not only to the most beneficial use, but also to uses to which non-potable water cannot be applied, such as drinking and livestock watering. Oilfield injection is a beneficial use of water but it can rely on non-potable water. Waste water from the operation causes serious water quality impairment. Even where there is no available non- potable water supply for oilfield operations, the negative impact of the operation on water quality should reasonably lead to the kind of policy above discussed. Although this may not be legal under the Water Resources Act as some critics maintain, a simple solution is to amend the Act to give water administrators the mandate to make and enforce this kind of policies - policies which would negate the undesirable effect of the "first in time first in right" principle.

It is, however, acknowledged that leaving conflict resolution to administrative discretion may not always produce the best result. There is no guarantee that bureaucrats will always decide conflicts according to what may reasonably be considered more beneficial uses. They may or may not be guided by the water situation in their provinces. Furthermore, discretion is easily abused. Clear legal guidelines to the exercise of such discretions are, therefore, important.

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is contrary to ss.11 and 35 priority provisions (of the Water Resources Act). To the extent that the quantity limitation, and the investigation of alternatives requirements, have the effect of denying licences for the benefit of future uses, the Controller lacks authority to deny priority to oilfield injection applicants."

ii) Resolution of Conflicts By Means of Priority Tables:

The table of water use priorities which is meant to help in the resolution of conflicts does not always contain all possible beneficial uses of water. For example, the table for the Territories does not contain domestic water use.[148] It is, therefore, not clear whether, in the event of water use conflicts, licensed water users would take precedence over non-licensed riparian owners using surface and underground stream for domestic purposes.[149] It is, however, submitted that since the right to use water for domestic purposes is excluded from the rights vested in the Crown, water use licences issued by the Crown should not affect such rights.

Alberta, Manitoba, Nova Scotia and British Columbia resolve conflicts according to the "first in time first in right" principle. They, with the exception of Nova Scotia,[150] resort to the priority table where two applications are made at the same time in respect of a common water source. But there is no provision in the statutes of British Columbia and Alberta specifying what happens where such applications are also in respect of uses which rank equal on the priority table. Manitoba anticipates this problem and provides that in such a situation, the conflicts

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[148] NIWR s.5.

[149] There is a proposed amendment to NIWA which may settle this and other questions: see B. Gibson, "Water Management North of 60^{0N}: The Administration of Inland Waters" (Obtained from the Water Resources Division, Indian and Northern Affairs Canada).

[150] Nova. Water Licence s.9: the minister resolves such conflicts.

should be resolved as may be prescribed in the regulations.[151] Although cases of this nature may be rare, it is advisable to provide ways of dealing with them.

Where the priority table is not triggered in a conflict situation in these prior allocation provinces, the well of a junior appropriator would be shut down to make water available to a senior appropriator in accordance with the "first in time first in right" principle. But where a senior's well is dried up owing to a junior's withdrawal, it does not necessarily mean that there is water shortage. The movement of groundwater is slow and it might take some time for water to reach the senior's well. Therefore, before shutting down a junior's well it is important to determine the cause of the inadequate supply to the senior's well. Where, for example, the cause is the inadequacy of the senior's pumping facilities or that his well is not deep enough, there should be no need to shut down the junior's well as improved pumping facilities or a deeper well would make water available to the senior. However, the allocation of costs of this improvement between the junior and the senior might be contentious. In Alberta, for example, the junior is required to pay the costs.[152] This may not always be a fair approach.

In Saskatchewan, conflicts are administratively settled by the Saskatchewan Water Corporation in accordance with the provisions of the Water Corporation Act.[153] In Ontario, the Director of Water Resources can prohibit the taking of

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[151] Man. s.8(5).

[152] D. Percy, The Regulation of Ground Water in Alberta supra note 144, at 11.

[153] S.S. 1984, c.W-41, ss.60-72.

water by one which interferes with the water rights of another or require that such taking be licensed.[154] This, however, concens only the settlement of unlicenced water use conflicts. Where uses are licensed, there is no clear way in the statute of settling conflicts arising in this respect.

f) Resolution of Federal-Provincial Water Use Conflicts:

Distinct from water use conflicts in individual provinces involving activities under provincial jurisdiction, are conflicts between federal activies, for example, fishery and navigation and provincial activities, for example, irrigation and hydro-power projects. Hydro-power projects alter fish habitat, and may in some cases, impede navigation. How such conflicts are resolved is important to water management. In A.G. Canada v. Aluminium Co. of Canada[155] it was held that the provincial proprietary right to hydro-power projects must be qualified to allow the application of federal fishery power.

Judicial settlement of federal-provincial disputes carries the connotation of "winner" and "loser". This gives rise to political tension between the two governments and consequently creates a less favourable working relationship than needed for a more efficient and effective management of water resources. Therefore, as much as possible, such confrontations must be avoided. This could be achieved by

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[154] Ont.s.20(4): taking of water for domestic or fire fighting purposes is, however, excepted.

[155] (1980) 115 D.L.R. (3d) 495; 10 C.E.L.R. 61.

coordinating, from the allocation stage, federal and provincial water uses. This would entail some compromises on both sides where necessary in order to have a workable management.

Unfortunately, in dealing with water use conflicts, the Federal Water Policy does not address areas of potential water use conflicts between federal and provincial activities. The policy only focuses on employing demand-management in the geographical jurisdiction of the federal government and encouraging the provinces to adopt the same.[156] In the view of the federal government, introducing realistic water prices through demand-management will help to conserve water and discourage waste which leads to water use conflicts. Arguably, this view considers waste as the only cause of water use conflicts. It is submitted that water use conflicts can arise even in the strictest conservation regime if supply is scarce and demand increases due to population increase or increase in water consumption activities such as irrigation.

However, the policy further commits the federal government to "encourage an integrated resource planning and management approach to augmentation and allocation of water supplies in order to ensure that the full range of values are considered."[157] Pursuant to this goal, the federal government has entered into bilateral agreements with some provinces. It is reported that the federal and Prince Edward Island governments entered into a working agreement in 1987

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[156] Federal Water Policy supra, Chapter One, note 52, at 23.

[157] Ibid, at 20: federal policy is to "participate in and encourage integrated resources planning that will allow for the incorporation of fish habitat conservation measures early in the planning process."

which covered "special surveys and demonstration projects related to groundwater, surface water and the estuarine environment using a multi-sectoral and integrated water management approach."[158] Also,

> "On the prairies, PFRA works closely with provincial agencies....to provide water for municipal and agricultural (irrigation and on-farm water) uses, for water-based recreation, and waterfowl and fisheries habitat enhancement...."[159]

On the score of encouraging integrated water supplies, the policy seems to offer a basis for federal-provincial cooperation in allocating water resources in such a away that both federal and provincial activities are considered, and conflicts averted.

The preceding discussion centered on licensing regime of water allocation. There are, however, some water uses which are not covered by this regime. The implication is that these uses are under the common law regime.

III. UNLICENSED WATER USES

There are two categories of water which are not licensed. One is unlicensed water the use of which is not permitted. It is left to the discretion of the Crown to

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[158] Federal Water Policy: A Progress Report supra Chapter Two, note 112, at 37.

[159] Ibid.

determine how in the future it should be used in the public interest.[160] It is reserved water the use of which may be permitted in times of water shortage or serious pollution of existing supplies. This water remains unlicensed and unused until the Crown decides otherwise. The other category is water the use of which is permitted without license. These are surface or groundwater for domestic purposes in Saskatchewan,[161] Manitoba,[162] Alberta,[163] Ontario[164] and the

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[160] NIWA s.30; B.C. s.44(1); Man. s.13; Sask. s.41(3)(b); Alta. s.12; Nova. s.3(1): the water reserved in the County of Lunenberg. The detail of this reservation is not clear from the statute. The ownership of the Lunenberg water is not vested in the Crown and the water is exempt from licensing regime. This strongly suggests that the water might have been reserved for present use without license. It is assumed that this water is currently in use. There are no reservation provisions in other provinces.

[161] Sask. s.44(2)(5), Ground Water Regulation supra, note 134, s.2(c) defines domestic purpose as "household and sanitary purposes, the watering of stock, the spraying of crops, the watering of non commercial lawns, and gardens adjoining private residences, but does not include the sale or barter of water for such purposes".

[162] Man.s.3(1)(2), s.1 defines domestic purpose as "the use of water obtained from a source other than a municipal or community water distribution system, at a rate of not more than 25,000 litres per day, for household and sanitary purposes, for the watering of lawns and gardens and the watering of livestock and poultry."

[163] Alta.s.2(2)(3): a riparian owner or an overlying land owner can use surface or ground water in whatever quantity he requires for domestic purposes. Section 1 defines domestic purposes as "household requirements, sanitation and fire prevention, the watering of domestic animals and poultry and the irrigation of a garden one acre adjoining a dwelling house on the land of a riparian owner."

[164] Ont.s.20(5), s.20(1) defines domestic purpose as the taking of water by any person other than a municipality or a public utility company for ordinary household use including watering of livestock, poultry, lawns and home garden but does not include the watering or irrigation of crops grown for sale.

Territories.[165] Others are surface or groundwater not exceeding 50,000 litres per day for any purpose in Ontario,[166] private surface or groundwater supplies outside the "protected areas" in New Brunswick,[167] less than 4 litres of groundwater per second in Prince Edward Island,[168] ground or surface water in the amount of 23,000 litres or less per day in Nova Scotia,[169] unrecorded water for domestic purposes[170] and groundwater in British Columbia,[171] water use exempted from

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[165] NIWA s.5(a)(b): makes it clear that only riparian rights to use water for domestic purposes are exempt from licensing regime. A fortiori there is no right to use percolating groundwater for domestic purposes as riparian rights do not apply to such water. It however, applies to underground stream in a defined and known channel. Such water can, therefore, be used for domestic purposes without licence. The definition of "domestic use" is similar to that of Ontario and Saskatchewan.

[166] Ont.s.20(3).

[167] N.B. s.14(1)(3)(a)-(e): provides only for the licensing of water in "protected areas". There is no provision for the licensing of water use outside the "protected areas".

[168] Water Well Regulations supra, note 138, s.7(1)(a).

[169] Nova. Water Licence s.5(1)(a). Also storage of water in an amount less than 25,000 cubic metres: s.5(1)(d), and water for fire fighting purposes:s.5(2) are exampt from licensing.

[170] B.C.s.42(1)(2), s.1 defines "unrecorded water" as "water the right to the use of which is not held under a licence or under a special or private Act." I: also defines a domestic purpose as the "use of water for household requirements, sanitation, fire prevention, the watering of domestic animals and poultry and irrigation of gardens not exceeding 1012 meters sq. adjoining and occupied with a dwelling house." Steidman v. Erickson Gold Mining Co. (1987) 43 D.L.R. (4th) 712, 717, 726.

[171] The proclamation needed under B.C. s.3 to make the Water Act applicable to groundwater has not been made: Personal Communication with A.P. Kohurt, Acting Head, Groundwater Section, Water Management Division, British Columbia, dated February 04, 1992. see Appendix.

licensing regime by the Governor in Council in the Terrirories,[172] and surface and groundwater in Quebec.

In all common law jurisdictions unlicensed water uses are governed by common law water doctrines. For jurisdictions which do not licence domestic water uses, it is submitted that the riparian rights doctrine is intended to apply in its original formulation. Accordingly, industrial or irrigation use of water are not included in domestic purposes. Use of water for industrial or irrigation purposes may be permitted, for example, in New Brunswick where unlicensed use of water is not restricted to domestic purposes.[173]

Any jurisdictions which would not follow the Penno and Pugliese decisions,[174] would apply the absolute ownership doctrine to unlicensed use of groundwater. As we have seen,[175] this doctrine encourages waste or even groundwater mining. Groundwater hydrologically connected to surface water may be drawn down to a degree that dries up the surface water. According to one commentator, one "can use groundwater even to the extent that it causes your

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[172] NIWR s.11: allows the use of water without a licence "(a)(i) for municipal purposes of an unincorporated settlement, or (ii) for water engineering purposes; (b) where the proposed use will continue for less than 270 days; or (c) (where) the quantity proposed to be used is less than 50,000 gallons per day".

[173] Lockwood v. Brentwood Park Investments Ltd. (1967) 64 D.L.R. (2d) 212 appealed (1970) 10 D.L.R. (3d) 143: permitted reasonable "extraordinary" use of water.

[174] Supra note 25.

[175] Supra notes 19-24 and accompanying text.

neighbour's well to go dry..."[176]

For example, in Berscheid v. Comptroller of Water British Columbia's Water Appeal Board held that where groundwater wells interfere with surface water flow, the surface water user has no cause of action against the well owners. According to the Board,

> ...the Water Act is clear that there is no legal control over groundwater, and even if there is a direct relationship between Shannon Lake and Marshall Brook, the licensees on Marshall Brook have no legal grounds of complaint if Shannon Lake drops in level.[177]

Suggesting that British Columbia's groundwater use regime is inefficient, British Columbia's Environment has commented that "water shortages and pollution are on the rise, especially in the case of groundwater."[178]

The flaw of the common law groundwater regime is also seen in the Alberta case of Schneider v. Town of Olds[179] where it was held that a landowner who withdrew groundwater for domestic purposes had no remedy where the water in his well was dried up by actions of his neighbour. If the plaintiff was to deepen his well

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[176] C. Harvey, "Riparian Water Rights: Not Dead Yet" (1990) 48 Advocate at 519.

[177] Appeal No. 89/04 WAT. (July 17, 1989) at 5: the wells which interfered with the surface water were drilled with the approval of the Comptroller under the Public Utilities Act and not under the Water Act. The Public Utilities Act has been repealed by the Energy Act S.B.C. 1973 c.29 but the power thereunder is now exercised by the Comptroller under the Water Utilities Act R.S.B.C. 1979, c.430. The application of both laws conflict in some cases even though administered by one authority.

[178] British Columbia Environment, Environment 2001: Strategic Directions for British Columbia (Victoria: British Columbia Environment, 1991) at 24.

[179] (1970) 8 D.L.R. (3d) 680.

or improve his pumping facilities in order to obtain water, he would have to bear the cost alone. However, if he had been licensed to draw water before his neighbour, he would have enjoyed priority and protection.[180] Had the groundwater been underground stream, and had the court been willing to apply the riparian rights doctrine, the plaintiff would have been protected.

It has been argued that groundwater uses for domestic purposes are best protected against the adverse effect of neighbouring water uses by licenses[181]. A licensing regime will give a domestic user priority over other users where such use is first in the statutory table of priorities. As between domestic users, the regime is also a proper way of limiting users to a specified quantity of groundwater so that a withdrawal does not affect the supplies of one's neighbour. Canadian jurisdictions impose no limitations on domestic water use.[182] There is, therefore, obvious potential for abuse. Also, where there are many groundwater users, unrestricted withdrawal may lead to waste, groundwater mining, contaminants intrusion or even subsidence, the sinking of land due to the removal of water which supports it.

It is safe to conclude, therefore, that leaving the use of unlicensed water to common law regime is bad management. However, the adverse consequences of the absolute ownership doctrine have, been attenuated by new developments in case law

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[180] Lucas, "Security of Title in Canadian Water Rights" supra, note 69, at 19.

[181] D.R. Percy, The Regulation of Groundwater in Alberta supra, note 144, at 10.

[182] Except Manitoba which limits it to 25,000 litres per day, see supra note 162.

in Manitoba and Ontario. In Penno v. Government of Manitoba, the Manitoba government intending to control flood, dug a drainage ditch running beneath the plaintiff's farm below the water table. As a result, the aquifer sunk and affected plaintiff's farm production which relied on percolating water from the aquifer. Rejecting the absolute ownership doctrine, Matas J.A. held that

> the case is to be decided on principles of negligence and should not be confined to an examination of the common law decisions dealing with refinements and distinctions of landowner's rights over surface or percolating water, or water in defined or undefined channels[183].

Also, in Re National Capital Commission and Pugliese, the Ontario Court of Appeal suggested that the law of nuisance or negligence can be applied to prevent a landowner from extracting percolating groundwater in a way that causes injuries to his neighbour. According to Howland J.A.

> 1. An owner of land does not have an absolute right to the support of water beneath his land not flowing in a defined channel, but he does have a right not to be subjected to interference with the support of such water, amounting to negligence or nuisance. 2. Such an owner does have a right of action a) in negligence for damages resulting from the abstraction of such water, or b) in nuisance for damages for unreasonable user of lands in the abstraction of such water.[184]

The absolute ownership doctrine as enunciated in Acton v. Blundell[185] suggests that an overlying land owner does not have proprietary right to percolating

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[183] (1975) 64 D.L.R. (3d) 256 at 273. The defendant was held liable in negligence and alternatively in nuisance. This is further discussed in Chapter Four.

[184] (1977) 79 D.L.R. (3d) 592 at 621 (Ontario C.A.) affirmed on slightly different ground (1980) 97 D.L.R. (3d) 631 (S.C.C.)

[185] Supra, note 20.

groundwater before it reaches his well and so cannot maintain an action against one who intercepts such water. Traditionally, an action in nuisance also requires proprietary right on the part of a plaintiff. The Penno[186] and Pugliese[187] decisions have been commended for dispensing with proprietary right as the only requirement to sustain an action in nuisance.[188]

Nuisance actions need not be based exclusively on proprietary rights. It can be based on some "protectable" rights. As Howland J.A. stated in Pugliese: "in order for the plaintiffs to succeed in their action they must, in my opinion have a right which the law deems worthy of protection."[189] Such "protectable" right need not be a proprietary right but may be a right which arises from a duty of care owed by a defendant to a plaintiff in a particular case. Such a duty is determined by the test of reasonable foreseeability.[190] Although this proposition fits more into a negligence action than a nuisance action, the Judge maintained that it would sustain both actions. Thus, the fact that a plaintiff does not have a proprietary right in percolating water drained to his injury does not bar him from recovering in negligence or nuisance against the tortfeasor. It is submitted that the "protectable"

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[186] Supra note 183.

[187] Supra note 184.

[188] P. Girard, "An Expedition to the Frontiers of Nuisance" (1979-80) 25 McGill L.J. 565, at 573, 577: submits that "the whole function of tort law is to create a regime of civil responsibility separate from that of contract and conceptually distinct from the law of property."

[189] (1977) 79 D.L.R. (3d) 592 at 615.

[190] Ibid at 616.

right principle should be embodied in legislation to immunize it from being overruled. Other provinces may improve their unlicensed groundwater regime by following Penno and Pugliese decisions. As this is likely to happen, one may safely say that in Canada, the absolute ownership doctrine is no longer a good law. Nevertheless, the best improvement is a licence regime.

Unlike other provinces Quebec has no legislation requiring permits for the use of water, nor does it have a mechanism for the reallocation of water in times of water shortage[191]. This is a serious gap in Quebec law and may affect the efficient allocation of water for beneficial uses.

IV. OVERDRAFT AND CONTAMINANTS INTRUSION INTO GROUNDWATER SYSTEM

To avoid overdraft and contaminant intrusion, groundwater allocation decisions must be guided by reliable information on the quantity of water available, safe yield of aquifers, general hydrological conditions of a particular area, and potential or actual pollution sources.[192]

The following is an examination of the measures taken by some jurisdictions to avoid overdraft and contaminants intrusion. These measures include the

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[191] CELRF supra note 57, at 134-135.

[192] The rate of groundwater extraction that causes groundwater *mining* is not necessarily the same as the rate that causes contaminants intrusion. In coastal areas for example, a certain rate of groundwater extraction could lead to salt water intrusion without causing overdraft.

determination of aquifer safe yields, the monitoring of groundwater levels, and well location, spacing and construction guidelines.

Some jurisdictions require licensees to keep records of their water use rates and quantities and to report them to the appropriate authorities on an annual basis or upon request.[193] Such records help water managers to know, where the safe yield of an aquifer is already determined, whether or not withdrawal is excessive so as to take appropriate measures, for example, reducing the quantity under the licence.

Determining safe yields of aquifers demands technical and financial resources and qualified personnel. Inadequacy of these resources has impeded a satisfactory determination of safe yields of aquifers in some jurisdictions. For example, in Saskatchewan, aquifers are poorly documented so that the safe yields of some aquifers are not known. To overcome this problem, the province has embarked upon developing management plans for the major aquifers.[194] However, most allocation requests are in areas not yet covered by such management plans. Allocations in these areas are thus based upon limited knowledge of safe yields.[195] For Manitoba,

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[193] NIWR supra note 112, s.15(1); B.C. s.19: only for surface water; (Saskatchewan) Groundwater Regulations, supra, note 134, s.35; Nova. Water Licence supra note 119, s.14.

[194] Personal communication with Nolam Shaheen, Hydrogeologist, Hydrology Branch, Water Management Division, Saskatchewan, dated February 14, 1992. see Appendix: the Regina Aquifer Management Plan is one of such plans.

[195] Ibid.

allocation decisions are based on safe yields of aquifers where they are known.[196] A fortiori, where safe yields are not known allocation decisions do not respect them. This is also true of groundwater allocation within the "protected areas" in New Brunswick.[197]

Newfoundland does not currently take safe yields of aquifers into account in allocating groundwater because the province has a sparse population out of which 20% to 30% depend on groundwater and there has been no case of overdraft. Another reason is the lack of technical and human resources to identify specific aquifers and their yields.[198]

Good groundwater management should not wait until there is overdraft before determining safe yields of aquifers. Population growth is not static but increases over time. While 20% to 30% may depend on groundwater today, a greater percentage may depend on it tomorrow.

Some jurisdictions require the monitoring of groundwater level before allocating it. In Saskatchewan, for example, allocations are preceded by the installation of monitoring wells, and pumping tests ranging from 24 hours to 30 days

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[196] Personal communication with Jim Petsnik, Aquifer Data Geologist, Groundwater Section, Water Resources Branch, Department of Natural Resources, Manitoba, dated February 19, 1992. see Appendix.

[197] Personal Communication with Douglas Craig, Groundwater Protection Hydrogeologist, New Brunswick, dated March 12, 1992. see Appendix.

[198] Personal communication with Wasi Ullah, Director of Water Resources Division, Newfoundland dated January 21, 1992, see Appendix.

are conducted.[199] Alberta[200] and New Brunswick[201] have similar requirements for potential groundwater users. In Newfoundland licensed well drillers must submit reports of monitoring of groundwater levels. Information on well yields, locations, owners and usage is displayed through a computerized data system.[202] New Brunswick[203] and Saskatchewan[204] also require well drilling reports to be submitted. British Columbia neither licenses well drillers nor requires them to submit reports as a matter of duty.[205]

According to Environment Canada, extracting groundwater at rates which would not cause overdraft or contaminants intrusion in the provinces "could be and have been implemented by a single management agency...charged with groundwater

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[199] Nollan Shaheen supra, note 194; See also, Groundwater Regulations supra, note 132, s.20(1)(2): pumping test required for both domestic wells and wells for other purposes; Section 34(c) requires maintenance of permanent observation wells in the producing aquifers.

[200] Ground Water Project supra, note 115, at 14-18.

[201] Water Well Regulation-Clean Water Act Reg. 90/79 1990, s.32

[202] Wasi Ullah supra, note 198.

[203] Water Well Regulations-Clean Water Act supra, note 201, ss.33, 34.

[204] Groundwater Regulations supra, note 134, s.17.

[205] Water Management Branch, Ministry of Environment, Groundwater Program (Victoria: Water Management Branch, 1985) 1. See also, Water Management Branch, Ministry of Environment, Groundwater Data Base Systems (Victoria: Water Management Branch, 1988) 1-2: British Columbia relies on the goodwill of well drillers to voluntarily report wells drilled and their locations.

management."[206] However, we have seen that some provinces have not as yet determined the safe yields of major aquifers which store groundwater allocated to users. The implementation of the extraction rates that prevent groundwater overdraft cannot, therefore, be satisfactory. Ontario has reported groundwater overdraft.[207] This, perhaps, is because it knew the safe yield of the particular aquifer involved. It is submitted that overdrafts might be occurring in some other provinces unknown to the authorities because the safe yields of the particular aquifers are not known. Until adequate financial, technical and personnel resources are made available to determine safe yields of aquifers in all the provinces, groundwater allocations in respect to them will continue to be precarious.

In addition to controlling extraction rates of groundwater, most jurisdictions use well regulations and similar laws to avoid contaminants intrusion. In Saskatchewan, for example,

> every well shall be constructed as to prevent contamination or pollution of the water in the well or in the aquifer and where required, well casings and cribbings shall be set and cemented, or driven.[208]

The Saskatchewan Groundwater Conservation Act was designed

> a) to obtain logs of wells drilled and information on formations and materials encountered during drilling operations in order to assist in groundwater and geological studies; b) to provide for the conservation,

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[206] DOE Groundwater Strategy supra, Chapter One, note 77, at 15.

[207] A Primer On Water supra, Chapter One, note 29 and accompaying text.

[208] Groundwater Regulations supra, note 134, s.28: provides for procedures for well abandonement so that it does not create a pollution risk.

> development and utilization of groundwater resources and to prevent pollution and contamination of groundwater.[209]

Unfortunately the Act does not apply to wells drilled for domestic water supplies.[210]

In Manitoba, the Groundwater and Water Well Act provides that "no person shall drill a well without taking reasonable precautions to avoid polluting, or contaminating or diminishing the purity of groundwater in the area".[211] Wells drilled for purposes of using groundwater for oil production are, however, exempt. Other provinces generally regulate well construction, location, spacing and maintenance.[212] British Columbia does not have an enforceable well regulation. It has only guidelines which provide, inter alia, that "...well should be kept at least 100 feet from possible sources of contamination in accordance with regulation No.42 under the Health Act".[213] It is only this part of the guidelines that relates to the

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[209] R.S.S. 1978, c.G-8 as amended 1984, s.3.

[210] Ibid s.4(2).

[211] R.S.M. 1987, c.G-110, s.10(1)(2).

[212] Alberta, Groundwater Development Act R.S.A. 1980, c.G-11.1 New Brunswick, Water Well Regulation-Clean water Act supra, note 198, Ontario Regulation 612/84, Ont. s.21(1): groundwater can be extracted by digging a well only in the areas designated by the Director of Water Resources.; The Well Drilling Act S.Nfld. 1981, c.14, and Nfld. Well Drilling Regulations 1982, No.31/82; PEI, Well Water Regulations 1990, No. EC/188/90.

[213] Water Management Branch, Ministry of Environment, Guidelines for Minimum Standards in Water Well Construction, Province of British Columbia (Victoria: Water Management Branch, 1982) at 2-12; Water Management Branch, Ministry of Environment, Design Guidelines for Rural Residential Community Water Systems (Victoria: Water Management Branch, 1985) at 3.

Health Act that can be enforced.

Prince Edward Island typifies a jurisdiction with strict well regulation presumably because, as discussed earlier,[214] it has a 100% dependence on groundwater for its potable water supplies. For this reason, its well regulation is examined in more detail. For purposes of well drilling, the province designates "restricted areas". In these areas permits are required to construct wells and all wells must be contructed in a manner prescribed in the regulation unless otherwise permitted.[215] A well constructor is required to submit a well construction report to the authorities within 30 days of completion of a well and must record thereupon provincial property taxation and building permit numbers where applicable.[216]

A permit is required for the construction of groundwater exploration well of certain diameter which will pump certain quantity of water or which will be used as an observation or monitoring well for groundwater quantity and quality.[217] Section 8(1) of the Water Well Regulation prohibits the construction of a well in a manner which derogates from existing natural protection against contaminants. For this reason, s.8(2) provides for well equipment standards which must be strictly complied

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[214] Supra, Chapter One, note 70 and accompanying text.

[215] Water Well Regulation supra, note 138, s.5: schedule shows the "restricted areas".

[216] Ibid s.4(a)-(c).

[217] Ibid s.6(1)(a)-(d).

with.[218]

Section 9(1) enumerates well spacing distances within a restricted area. For example, wells are not allowed to be constructed at a distance less than 100 meters from a manure or sewage lagoon; less than 150 meters from a waste disposal site; or less than 45 meters from preparation or storage areas for pesticides or commercial fertilizers.[219] In addition to avoidance of contaminants intrusion, good well spacing also minimizes groundwater use interferences and interferences with surface water where both are hydrologically connected.

More importantly, under s.13(1)

> no person shall install a well pumping equipment which causes excessive draw-down of the water level of the well as evidenced by turbidity of the water drawn from the well.

Well design is required to suit geologic and groundwater conditions. Section 10(1) provides that

> no person shall construct a well other than in a manner which a) adapts to the geologic and groundwater conditions existing at the site of the well; b) seals off water bearing formations that contain contaminants; and c) leaves no artificial openings to the well.

Under s.11(1) completed well must be disinfected by a method prescribed in schedule D and the top of the well casing must be covered with a well cap which reasonably prevents contamination and is manufactured for that purpose.[220] Under s.10(6) well casing is done in a particular manner using the method prescribed in schedule

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[218] Ibid: Schedule B enumerates the well equipment standards.

[219] Ibid s.9(1)(g)(h)(l).

[220] Ibid s.11(1)(c)(d).

C and using contaminant-free materials. Section 12 requires abandoned wells to be closed using the method prescribed in schedule E.

The provisions of the Prince Edward Island Water Well Regulation, if properly enforced, are sound enough to deal with contaminants intrusion and overdraft. While the strictness of the regulation might have been necessitated by the province's heavy dependence on groundwater, it is a good model for provinces whose regulations are not so strict but who nevertheless face actual or potential groundwater overdraft or contaminants intrusion.

Groundwater overdraft or contaminants intrusion into groundwater system cannot be considered a beneficial use of water. It is, therefore, important that steps be taken to deal with actual or potential misuse of groundwater in this way. A crucial aspect of good groundwater management is to avoid problems which otherwise might develop to the detriment of the public. The provinces alone cannot deal with the problem of overdraft and contaminants intrusion. We have seen that technical and financial resources are needed to determine the safe yields of the aquifers. This is an area that the federal government can play a leading role. A unified efforts are, therefore, needed to deal with this problem.

V. CONJUNCTIVE MANAGEMENT OF SURFACE AND GROUND-WATER

There are two aspects of conjunctive management of surface and groundwater which are important to beneficial uses of water. The first is a

conjunctive use of both sources of supply in a complementary fashion. The second is a use which takes into account the hydrological connection of both sources of water supply so that the use of one does not jeopardize the use of the other.

a) Complementary Conjunctive Use:

In a broad sense "conjunctive use" means "any scheme that capitalizes on the interaction of surface and ground water to achieve a greater beneficial use than if the interaction were ignored."[221] Both sources of water need not be hydrologically connected for this to be done. According to one writer,

> "Independent operation of surface or underground reservoirs designed to produce a long term safe and dependable yield requires extraction rates that roughly equal rates of replenishment. Conjunctive operation of surface and underground reservoirs allows for the temporary overdrafting (i.e. extractions beyond safe yield) of surface reservoir during wet years and overdrafting of underground reservoirs during dry years. The additional yield resulting from conjunctive management is obtained from saving water that might otherwise be wasted during wet years from overflow and a reduced amount of evaporation"[222]

Again, knowledge of safe yields of aquifers or surface water is important in order to know the extraction rates that will be at equillibrum with rates of replenishment. Overdrawing of surface water in wet seasons saves the use of groundwater. Because of ready return flow in wet seasons, the overdraft of surface

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[221] H.J. Morel-Seytoux, "Value and Role of Conjunctive Use of Surface and Ground Water in River Basin Water Management" in Water for the Future supra, note 74, at 515.

[222] Smith, supra note 2, at 670.

water is only temporary. Meanwhile, groundwater is stored up in aquifers. The use of this water in dry seasons saves the use of surface water which is already being affected by evaporation.[223] Alternating the use of these sources of water supply in this way helps to make water available all year.

The implementation of such a scheme is particularly important in areas with limited water supplies such as interior British Columbia, southern Ontario, and the prairie provinces. It would help to reduce the expense[224] and social and environmental injury associated with interbasin transfers.

b) Allocation Management of Hydrologically Connected Surface and Groundwater:

Some of the discussion in Chapter One centered on the hydrological connection between surface and groundwater. While surface water is better managed on a watershed basis, groundwater is better managed on a groundwater basin basis. Depending on permeability, where a watershed overlies a groundwater basin, water from the watershed recharges the groundwater and vice versa. Also, water can be transported from one watershed through aquifers to another watershed if hydrological

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[223] Ibid at 670-671.

[224] For the economic aspects of conjunctive management of surface and ground water, see A. Sahuquillo, "Economic Aspects of the Conjunctive Use of Ground and Surface Water" in Groundwater Economics supra, Chapter Two, note 9, at 347-357; N. Buras and S.C. Nunn, "Central Issues in the Combined Management of Surface and Ground Water" in Groundwater Economics supra note 9, at 317-344.

and geological factors are favourable.[225] Surface and groundwater outside a watershed and a groundwater basin can also be hydrologically connected.

Whether surface and groundwater allocations respect hydrological connections depends on the mandate given to water managers under the statutes. In most Canadian jurisdictions, surface and ground water quantity allocations are governed by a single statute. In each of these jurisdictions the statute vests allocation management of both water in a single authority.[226] To different degrees the water statutes of Ontario[227], Nova Scotia,[228] Newfoundland,[229] Prince Edward Island,[230] New Brunswick[231] and the Territories[232] go further to bring surface

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[225] Mack supra, Chapter One, note 3, at 71-74: a watershed is a "land area bounded by topograghic highs within which surface runoff drains through one outlet." "A groundwater basin is a geographic area containing one or more aquifers (which may or may not be hydraulically connected) and bounded by the limits of these aquifers." Thus a watershed is a surface water equivalent of a groundwater basin.

[226] Alta.: the minister appointed by the Lt. Gov. through the Controller; Sask.: Saskatchewan Water Corporation; Man.: the minister appointed by the Lt. Gov.

[227] Ont.: with the exception of ss. 20, 21, all other sections deal with water quality. Section 15(1) vests management of both surface and groundwater quantity and quality in the Minister of the Environment who discharge this function through the Director of Water Resources.

[228] Nova.: the Minister of the Environment administers both surface and groundwater quantity and quality.

[229] Nfld.: the Minister of the Environment and Land manages both surface and ground water quantity and quality.

[230] PEI.: the Minister of Community and Cultural Affairs manages surface and ground water quantity and quality.

[231] N.B.: the Minister of the Environment manages surface and ground water quantity and quality.

and groundwater quantity and quality management under a single administration.

It is, therefore, reasonable to expect an efficient coordination of the mangement of both supplies by the appropriate single authority in each of these jurisdictions. One would expect that the allocation management of surface water would not be to the injury of groundwater users and vice versa in terms of quantity and quality. Thus, where, for example, one's proposed surface water use would injuriously affect the quantity or quality of groundwater potentially or actually being used by others, licence would be denied. This may, however, vary from jurisdiction to jurisdiction depending on their water situations and priorities of water uses.

Unfortunately, there is nothing in the laws of these jurisdictions which indicates that surface and groundwater allocations should be managed in this way. The requirement of water quality maintenance as a condition for water allocation in the Territories,[233] arguably, endorses such a management approach. However, this is limited to only water quantity affecting quality and does not include quantity affecting quantity. The requirement in jurisdictions such as Alberta and the Territories for a licence applicant to show that his water use would not affect others or pay compensation where others are affected does not, it is submitted, contemplate cross uses of surface and ground water.

It is important that the law makes express provision for the management of hydrologically connected surface and groundwater in the way canvassed here.

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[232] NIWA : the Federal Minister of Indian Affairs through the Water Board administers both surface and groundwater quantity and quality.

[233] NIWA s.11(2)(c).

Regrettably, even where the legal mandate is in place, inadequate financial and technical resources needed to determine such hydrological connections is a constraint to a satisfactory realization of such management.[234]

VI. GROUNDWATER CONSERVATION AND WATER PRICING

It has been established that Canada's water supply is not as abundant as it may seem at first glance and that areas of relatively scarce supply exist.[235] Management of Canada's water resources must thus incorporate conservation and avoid waste.

Water waste in Canada can be partly attributed to cheap prices of the resource. A 1983 survey shows that for the 12 large municipalities (with 100,000 people or more) the water prices ranged from $1.77 to $16.89. This low price, particularly where based on an unmetered rate, is said to put average household water use to about 20,000 litres per month.[236] For example, Calgary and Edmonton have about the same population. While most of Calgary uses unmetered water pricing system, Edmonton is metered.[237] A survey shows that residential water consumption in the unmetered part of Calgary was 300 litres more per capita

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[234] DOE Ground Water Strategy supra, Chapter One, note 77, at 18.

[235] Supra, Chapter One, notes 25, 28, 29 and accompanying text.

[236] Canada Water Year Book, supra, Chapter One, note 55, 20-23.

[237] M. Gysi, "The Cost of Peak Capacity" (1981) 17 (No.6) Water Resources Bulletin, 956-961.

daily than in metered Edmonton, while demand in metered part of Calgary levelled off with demand in metered Edmonton.[238] In Canada as a whole, average per capita water consumption in several cities dropped by 30% to 50% after the installation of meters.[239] However, waste of water persists in many other cities and in other sectors. For example, there is over-irrigation in Alberta attributed to government subsidy of irrigation cost.[240]

Water conservation can be encouraged by introducing water demand-management to supplement the present traditional water supply management. Demand-management can help to ensure that the true economic value of water is reflected in the price charged.[241] Therefore, economic approach as already

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[238] M. Gysi and G. Lamb, "An Example of Excess Urban Water Consumption" (1977) 4 (No.1) Can. J. of Civil Engineering, 66-71.

[239] F.B. Mackenzie, "Urbanization and the Hydrological Regime" (1987) 215-217 Can. Bull. of Fisheries & Aquatic Sciences, at 289.

[240] D. Tate, "Canadian Water Management: A One-Armed Giant" (1984) 9 (No.3) Canadian Water Resources J. 1 at 4.

[241] D. Tate, Water Management in Canada: A State of the Art Review. (Ottawa: Inland Water Directorate, Water Planning and Management Branch, Environment Canada, 1990) 1 at 5. See also, B. Mitchell, " The Value of Water As A Commodity (1984) 9 (No.2) Canadian Water Resources J., 30-37; A.P. Grima, Residential Water Demand Alternative Choices for Management (Toronto: University of Toronto Press, 1972). Demand-management will eliminate block rate water pricing system by which less price is charged for more water units consumed, and flat rate system by which a fixed amount is charged regardless of the quantity of water consumed. It will also get rid of non-metering system especially for irrigation and may eliminate government subsidy of irrigation cost. Canada Water Year Book, supra, Chapter One, note 55, at 23 reported that government irrigation subsidies in western Canada are up to 85% and that Alberta farmers pay a one time fee of up to $124 per hectare as a contribution towards the capital cost of providing irrigation water. But on annual basis they pay water rate ranging from $3.70 to $24. 70 per hectare. This is considered to be too cheap.

discussed, can be used to conserve water.[242] Different jurisdictions impose different water rates taking into account different conditions. For example, in Prince Edward Island, rates and charges are fixed in accordance with the generally accepted public utility practices in the light of local conditions and circumstances.[243] Unfortunately, water pricing has not been designed with conservation in mind.[244]

There is, however, a new direction towards increased conservation of water resources in the provinces. British Columbia, for example, is working towards restructuring water prices, restricting use, educating the public on the value of water, improving irrigation methods, and installing more efficient water recycling systems in industries.[245] Manitoba is developing a new policy on integrated conservation of water resources, wetlands, and soil through land use practices.[246]

The federal government has assumed a role in water conservation. The government is willing to

> "undertake, support and promote joint federal-provincial examination of the costs and pricing of water for both consumptive and non-consumptive water uses; encourage the application of pricing and other strategies, such as the beneficiary/polluter pays concept, to encourage

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[242] See Supra, Chapter Two.

[243] (PEI) Water and Sewage Act R.S.PEI 1988, c.W-2, s.10(1)(2)(a)(b); See also, Ont. s.43(2)(c), s.43(11)(13); B.C. s.45.

[244] See for example, British Columbia's Environment, Planning for the Future: Sustaining the Water Resource (Victoria: B.C. Environment, 1991) at 14.

[245] Ibid at 15.

[246] Land and Water Strategy, Land and Water Strategy: The Process Begins (Work Book on Water) (Manitoba: Land and Water Strategy, 1989) at 9.

efficient water use."[247]

The government has also indicated interest in developing "new water-efficient technologies and industrial processes that minimize costs, and encourage water conservation and improved water quality".[248] The role assumed by the federal government is strategic to helping the provinces achieve water conservation. One of the goals of sustainable development is to make resources (water) available for present and future uses. Unity of federal and provincial efforts is important to meet this goal. Moreover, given that some provinces have scarce water supply, federal role is important to coordinate supplies in such away that water-rich provinces can willingly share their supplies with less fortunate provinces. This can easily be done if water resources are managed on watershed and groundwater basin basis which follows geographical, rather than political boundaries. Furthermore, conservation of water resources is also a service to the ecological environment supported by water.

VII. CRITICISMS AND RECOMMENDATIONS

a) Government ownership of water offers a legal basis to manage the resource in the interest of the public. This undercuts common law private rights in water which foster individual interests rather than the interest of the society at large. According to Corker, the common law water doctrines:

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[247] Federal Water Policy supra, Chapter One, note 52, at 8.

[248] Ibid.

> leave almost untouched the problem of operating a groundwater reservoir in the collective common interest of those it serves. Indeed defining individual water rights sometimes complicates the achievement of unified management in the optimum interests of those it serves[249].

Unfortunately, the water statutes of Ontario, New Brunswick and Prince Edward Island do not vest property in and the right to the use of water in their respective Crowns although they prohibit certain water uses without licence. At least in theory, a collapse of their regulatory regimes for any reason whatsoever, automatically triggers the common law rights. Arguably, this would not be the case if the property in and the right to use water were vested in the Crown because upon a collapse of the statutory regime, this right will revert to the Crown.[250]

Constitutionally, the provinces have legislative power over water resources but the Constitution does not abrogate common law rights in water. While common law private rights in water do not prevent government from regulating the resource, such regulation should, at least in theory, stem from government ownership of the resource. If water is to be used in the interest of the public, government as trustee of the public should own the resource in trust for the public. Private ownership of the

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[249] C.E. Corker, Groundwater Law, Management and Administration. Prepared for the National Water Commission. (Arlington, Virginia, U.S.A.: National Water Commission, 1971) at 201: where a single person, for example, the government owns a groundwater basin, it can then through an agency implement efficient integrated management. Such an agency would have power to make quick management decision, purchase water or water rights for the basin in times of water shortage, charge water price or pumping tax, acquire or dispose property, determine management and protection strategies. The Saskatchewan Water Corporation has similar or even greater powers over surface and groundwater in the province: ss.16 to 52 of the Water Corporation Act S.S. 1984 c.W-41.

[250] Supra note 100.

resource is irreconcilable with public interest.

b) Public interest is central to the concept of "beneficial use" of water. Unlike the private ownership regime, the broad concept of beneficial use would, for example, accommodate avoidance of groundwater mining, contaminants intrusion, land subsidence and even the use of water to artificially recharge groundwater in areas experiencing overdraft.[251]

An aspect of the "beneficial use" approach is to make water available first to the most important uses. The categories of beneficial uses are never closed because changes in a society might give rise to new water uses considered beneficial. The water use priority tables of British Columbia, Alberta, Manitoba, and the Territories seem to be rigid, requiring strict compliance in all circumstances. Flexibility of water use priority tables to respond to future more important beneficial uses is crucial. This can be appreciated from the fact that the tables are not exhaustive of possible beneficial uses. Flexibility can be introduced by allowing some administrative discretion to complement the tables. In Colorado, for example, the State Water Engineer is given the power to make rules to maximize water use and not to rely only on the priority system[252]. While this is not precisely referring to the priority table, it indicates that discretion can attenuate the rigidity of priority tables. Discretion

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[251] Arizona State, for example, reccognizes artificial recharge of groundwater as a beneficial use: see Ariz. Rev. Stat. 1987, s.45-801-818.

[252] Fellhauer v. People (1968) 167 Colo. 320, 447 P. 2d. 986; Colorado Springs v. Bender (1961) 148 Colo. 458, 366 P. 2d. 522 at 555.

should, however, be guided by some criteria to avoid abuse. Water appeal boards as in Saskatchewan and British Columbia,[253] for example, are important to review administrative decisions and to quash them where appropriate. In this way, the law would respond more efficiently to the changing needs of the society.

Priority of water use, whether statutorily entrenched or left in the hands of bureaucrats is important to ensure, especially in areas with limited water supplies, that water is first allocated to uses considered more beneficial. Care must, however, be taken to ensure that whatever use that is considered more beneficial does not cause groundwater overdraft or contamination of potable groundwater.

Even more inappropriate than the rigid application of priority tables is the prior allocation principle of "first in time first in right" which British Columbia, Alberta, Manitoba and Nova Scotia apply in making their initial allocations. Even California, the state where this principle originated, has abandoned it in respect of certain water uses. Domestic and municipal water uses now have precedence over any other purpose regardless of the time applications for them are made.[254] This approach saves time and expense of reallocating the water to a higher user after it has first been allocated to a lower user. Given that all applications for water uses might not be made or considered over a given period of time, it is not possible to know and to wait for all applications for the higher uses to be made so as to give them the first priority. Thus situations are likely to arise where some low priority

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[253] Sask. s.77; B.C. ss.38, 39, 40.

[254] California Water Code (West 1971) s.106.

water uses are permitted before applications for higher uses are made and considered. Therefore, expropriation provisions for the reallocation of water from lower to higher uses would appear essential. However, where an application for a higher use is made before water is allocated to a lower use the application of which is made first, allocation should respect the higher use. There is no need for allocating water to the lower use because the application is made first only to reallocate it to the higher use by expropriation. The Territories already have this approach in place. They are not a prior allocation jurisdiction. The prior allocation provinces should follow this example. British Columbia would have to go further by making its table of water use priority apply for purposes of expropriation.

A further concern is that the prior allocation system does not permit the sharing of available water supplies in times of shortage. Therefore, prior allocation jurisdictions must provide for flexibility in the transfer of water rights. Such transfers are impeded by the requirement that the appurtenancies be transferred at the same time because a transferror may not be willing to dispose of the appurtenancy. These requirements, according to Percy, also increase the cost of transfer and might be unsuitable for the user's purpose as the water right cannot be moved separately from the land. Percy further criticizes restricting transfer by requiring a transferee to obtain official permission before he can use water for purposes different from the original purposes. Instead, he advocates unrestricted transfer.[255]

What seems to be a compromise between unrestricted and restricted transfer

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[255] Percy, The Framework of Water Rights Legislation supra, note 112, at 32.

approaches is the position generally adopted in the American prior appropriation states. It is captured in the following quote:

> ...appropriative water rights may be severed from the land to which they are appurtenant and transferred. Changes in point of diversion, place, or nature of use or other changes with the potential to affect the rights of other users require state agency or court approval. A simple change in ownership of a water right usually requires no such approval.[256]

While this writer disapproves of transfer of water rights made conditional upon the transfer of the appurtenancies, he also disagrees with the unrestricted transfer approach. Transfers which would increase pollution of groundwater or lead to groundwater overdraft should be disallowed or laden with conditions which would negate these adverse effects. As the American position holds,[257] transfers which do not injure the rights of others need not be approved. However, whether or not the rights of others are injured is not determined subjectively or by the transferee and the transferor alone. Such determinations fall on the authorities. As the quoted American position implies, transfers involving change in the nature of use or point or place of diversion almost invariably affect the rights of others. Such transfers thus need approvals.

Canadian provinces may do well to follow this approach. Alberta is currently revising its water statute with transferability of water rights being one of the major

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[256] N.K. Johnson and C.T. DuMars, "A Survey of the Evolution of Western Law in Response to Changing Economic and Public Interest Demands" (1989) 29 Natural Res. J. at 347.

[257] Ibid.

revisions expected.[258] Alberta would be well advised to allow transfer separately from land and to require approval only where the water rights of others are to be affected.

Some writers advocate a liberalized transfer of water rights which leans towards a water market[259] as opposed to the other transfer approaches. Again we can look to the United States for a model. A water market is already in place in California but with qualifications for the protection of certain uses. The California Water Code requires the State Department of Water Resources to establish a program to facilitate exchange of water rights and to report to the legislature ways of facilitating a water market.[260]

Although efforts should be made to facilitate the transfer of water rights, an unqualified water market is not desirable because it explains "beneficial use" only in economic terms. We have seen that "beneficial use", at least in the Canadian context, transcends purely economic gains to include environmental and social values. Under an unqualified market approach, economically more powerful uses would thrive, arguably at the expense of other, equally important, uses. Some writers are, therefore,

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[258] Alberta Environment, Water Rights Background Paper (Edmonton: Alberta Environment, 1991) Vol. 2, at 10.

[259] G.A. Gould "Transfer of Water Rights" (1989) 29 Natural Res. J. 157; Sherk supra, note 50.

[260] (West 1989) ss.470-483.

sceptical about the survival of social water use values under a market regime. [261] For example, in Prince Edward Island where groundwater supplies 100% of the potable water, an unqualified market approach may place potable groundwater entirely in the hands of pollution-generating industries at the expense of domestic and municipal and livestock watering purposes. Similarly, if this approach were to be used to settle the controversy surrounding the use of groundwater for oilfield injection in Alberta, the limited potable groundwater in the area might end up exclusively in the hands of the injectors.

Furthermore, a water market may strip the government of the power to control pollution through the determination of water uses, rates, quantities, and even place of use. Potable water may be used for flushing industrial waste when non-potable water would be a viable alternative. Water conservation efforts may also slack off because there would be no government backed incentive to conserve water. Canadian jurisdictions should, therefore, ignore the idea of a water market except it is qualified to protect environmental and social uses of water. Government control is, therefore, indispensable if this is to be achieved.

A form of such controls is government power to cancel or amend licences in the public interest. But the exercise of such powers should be fettered by certain criteria to avoid arbitrariness and undue insecurity of water use rights which might

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[261] S.J. Shupe et al, "Western Water Rights: The Era of Reallocation" (1989) 29 Natural Res. J. 413.

threaten investments. One writer has criticized the expropriation powers given, for example, to the Saskatchewan Water Corporation as too broad and absolute.[262] The same can also be said of the Minister's power under the (Nova Scotia) Water Act to authorize water use by anyone even to the injury of others and to determine at his discretion whether to allow compensation or not.[263]

Government control of water use for beneficial purposes also engages the establishment of efficient ways of resolving water use conflicts. It has been demonstrated that the resolution of water use conflicts in prior allocation provinces where the table of priority of uses is not triggered is done based on the principle of "first in time, first in right". This could be contentious where the junior appropriator is asked to pay the cost of improving the senior's well or pumping facilities.[264] Again, this problem has been addressed in a variety of ways in the United States.

In Colorado, for example, a junior's well would not be shut down where that will not make water available to the senior within a reasonable time or the senior has not exercised his conjunctive use of surface and ground water available to him.[265] In otherwords, if the senior could have access to enough surface water supplies, there is no need for him to insist on getting groundwater the supply of which the junior's

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[262] D. Percy, "Water Rights Law and Water Shortages in Western Canada" (1986) 11 No.2 Can. Water Res. J. at 18-19.

[263] Supra note 124 and accompaying text.

[264] Supra notes 152 and accompanying text.

[265] Colo. Rev. Stat. Ann 1973, s.37-92-301(3)(a)-(d), s. 37-92-502(2). This reference and subsequent references cited herein are now in a single volume-vol.15 (1990 Replacement) which contains s.37 art. 80 to s.37 art. 92.

well has interfered with.

In State ex rel Crowley v. District Court the rule was established that if it is in the interest of a junior appropriator for a senior to improve his diversion facilities, the junior may pay for the improvement or buy out the senior's right. Or the senior may pay for the improvement or buy out the junior's right. But according to Getches where in the light of historical use, a senior's well is not reasonably adequate to capture water, a junior's well cannot be closed[266].

Under the Crowley Rule economic interest seems to be the only criterion in determining who should pay for improvement costs or buy out one's right. The rule seems to focus only on the parties concerned and does not seem to consider the impact of the interest of the winner or loser on the broader interest of the society.

Perhaps a more rational balance of the interests of a junior and a senior appropriator while also considering the interest of the society at large is captured in the following quotes:

> a well owner is not liable for withdrawal of groundwater unless the withdrawal: a) causes unreasonable harm by lowering the water table or reducing artesian pressure, or b) exceeds the owner's reasonable share of the total annual supply, or c) has a direct and substantial effect on surface supplies.[267]

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[266] Getches supra, note 11, at 257-258. But where a senior cannot economically afford a deeper well, he can maintain action: City of Colorado Spring v. Bande (1961) 148 Colo. 458, 366 P. 522; Baker v. Oregon Idaho Foods Inc. (1973) Idaho 575, 513 P. 2d. 627; Wayman v. Murray City Corp. (1969) 23 Utah 2d. 97, 458 P. 2d 861.

[267] Restatement (2nd) of Tort, s.858. Under the traditional American rule all water uses on the overlying land were deemed reasonable regardless of the harm caused to the adjoining land owners: Bristor v. Cheatham (1953) 75 Ariz. 227, 255 P. 2d. 173.

These criteria encapsulate the main concerns of groundwater management for the benefit of the society at large. In other words, if a withdrawal by a junior groundwater user does not fall into any of these criteria, even though it causes the well of another to go dry, the junior is not liable. A person so affected has to improve his pumping facilities or deepen his well at his own expense. The water table is not drawn down, the user has not exceeded his limit, neither has he substantially diminished the surface water (if any) connected thereto. He has not done anything which contradicts the fundamental principles of good groundwater management. If such measures are not in place, there would be frivolous complaints by senior appropriators. Indeed, this can even apply to water users in non-prior allocation jurisdictions.

This proposition might be helpful to both prior and non-prior allocation jurisdictions in cases of conflict between water use purposes. Although the quantity of water one is entitled to is usually specified in the licence and one may not be liable where his water withdrawal within his limit causes injury to another,[268] this proposition would provide a good ground to amend a licence to reduce the quantity of water thereunder where that "causes unreasonable harm by lowering the water table or reducing artesian pressure." The proposition can also be used to resolve conflicts between unlicenced domestic water users who are not limited to any specific quantity of water as in Alberta, Ontario, British Columbia and Saskatchewan.

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[268] But see (PEI) Water Well Regulation supra, note 138, s.7(4).

c) The quantity of water withdrawn for unlicensed and even for licensed uses can also be limited by the imposition of realistic water prices that reflect the value of water. Limiting the quantity of water withdrawn for unlicensed uses can also be achieved under the principle of "protectable rights". However, while this principle is a commendable judicial initiative, it falls short of protecting the interest of the society. It is only for the protection of private or individual interest. Furthermore, it does not impose a limit on the quantity of groundwater one withdraws or prevent overdraft or waste except where this injures another person. Yet using groundwater in this way even without injury to any particular person may engender serious consequences for the society in the long run. The protectable rights principle therefore, offers limited help for efficient management of groundwater allocation.

It is, therefore, important that unlicensed water uses be phased into a licensing regime to avoid abuses particularly in jurisdictions where there is no upper limit of the quantity of groundwater that can be withdrawn per day. It is reasonable to expect that setting the upper limit must take into account the water yielding capacity of the aquifers, the density of users in the locality and other related variables. This might necessitate keeping and reporting records of such uses to help monitor the impact on water levels and the over-all hydrology. There should also be some flexibility to permit the reduction of the upper limit where appropriate.

Licensing groundwater use is even more important for British Columbia as the province's groundwater is entirely unregulated. The application of its Water Act to groundwater would effectively abolish the absolute ownership doctrine as it did the

riparian rights doctrine.[269] Suggestions made for improving water management under the Act will apply to groundwater whenever the Act applies to it.

d) Groundwater overdraft is by no means a problem to be ignored. As earlier mentioned,[270] Ontario is already facing this problem. Unfortunately the Ontario water statute does not provide a specific measure that can adequately deal with the problem. Apparently, the problem was not in the contemplation of the legislature.

Subsection 20(6) of the Ontario Water Resources Act (OWRA)[271] is broad enough to enable the Director of Water Resources to take measures to reduce groundwater withdrawal in areas of actual or potential groundwater mining. Under this provision the director can issue, refuse, or cancel water use permits or attach any conditions to them as he deems fit. This power can also be used to reserve surface water for the recharge of affected aquifers where both are hydrologically connected. The subsection contemplates the director's action only in respect to licenced

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[269] Schillinger and Ponderosa Trout Farm v. Williamson Blackstop and Landscaping Ltd. (1977) 4 B.C.L.R. 394 at 396: Justice Monroe stated that: "....the riparian rights to the use of water no longer exist in British Columbia". The Judge said the only way to acquire the right to use water of a stream in British Columbia is under the Water Act licensing regime. Thus, riparian rights to use water are effectively abolished. See also, M.B. Clark, "Water, Private Rights and the Rise of Regulation: Riparian Rights of Use in British Columbia 1892-1939" (1990) 48 Advocate 253 at 262: argues that the Water Act Amendment Act of 1925 S.B.C. 1925, c.61 abolished riparian rights to water use in British Columbia but that the judiciary was reluctant to subscribe to this until the Schillinger case supra; W.S. Armstrong, "The British Columbia Water Act: The End of Riparian Rights" (1962) 1 U.B.C. L. Rev. 533.

[270] A Primer On Water supra, Chapter One, note 29.

[271] R.S.O. 1980, c.361.

groundwater users. This means that domestic users might not be asked to reduce withdrawals where they cause groundwater mining or contaminants intrusion. This is a serious weakness in this law. The Alberta Water Resources Act[272] suffers from a similar weakness. Section 13(1)(2) of the Act provide that in cases which the Lt. Governor considers to be emergency, water licences may be suspended or the authorized quantity reduced subject to payment of compensation to the licensees. This does not apply to unlicensed water users. These legal weaknesses have to be remedied.

The authorities may adopt a number of strategies in dealing with the problem of overdraft. Yet another time, American approaches offer some options for Canadian jurisdictions. The California correlative rights doctrine would ensure that each user reduces his withdrawal in proportion to his usual entitlement under his licence in such a way that the aggregate reduction would achieve safe yield. But for domestic users who are not licenced and who are not limited to any specific quantity of water, it is difficult to determine by how much each user should reduce withdrawal under this approach. Reduction in proportion to historical withdrawal trend or quantity is only possible where the record of that is kept. Otherwise, the water authorities would have to use their discretion to determine how much reduction each user should have to make.

A more useful guide is the Arizona model. Areas affected by groundwater mining in Arizona are designated "Active Management Areas" (AMAs). Each AMA

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[272] R.S.A. 1980, c.W-5.

has a safe yield goal and a time limit within which to achieve it. AMAs are set for the achievement of safe yield by the year 2025. The time started running in 1980. The Arizona Director of Water Resources is required to adopt management plans to achieve this goal. Such plans include restricting residential development in the areas, mandatory water conservation program (which may include water pricing and strict regulation of withdrawal), and augmentation plans such as artificial recharge of aquifers. Only activities consistent with the achievement of the goal are permitted in the AMAs.[273]

In Nebraska "control areas" are designated where the development or utilization of groundwater has caused or would cause in a reasonably foreseeable future

> a) an inadequate groundwater supply to meet present or reasonably foreseeable needs for beneficial use of such water supply; b) dewatering of an aquifer, resulting in a deterioration of the quality of such groundwater sufficient to make such groundwater unsuitable for the present purposes for which it is being utilized.[274]

A control area may adopt the following measures:

> a) It may determine the permissible total withdrawal of ground water for each day, month, or year and allocate such withdrawal among the groundwater users; b) It may adopt a system of rotation for use of groundwater; c) It may adopt well spacing requirements more restrictive than those found in sections 46-609 and 46-651; d) It may require the installation of devices for measuring groundwater withdrawals from wells; and e) It may adopt or promulgate such other reasonable rules and gulations as are necessary to carry out the

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[273] Ariz. Rev. Stat. 1987, ss.45-401-655, 45-801-818.

[274] Nebraska Ground Water Management and Protection Act 1989, c.46 art.6, s.46-658(1).

purpose for which a control area was designated"[275]

Where an aquifer(s) is non-rechargeable or recharge is little, American approach is to assess the quantity of water stored in the aquifer and then set a time frame for it to last, say 40 years. Allocations and conservation are planned in such a way that the aquifer is not depleted before the time set.[276] In this way waste is avoided. For example, Nebraska designates "management areas" specifically for the preservation of groundwater reservoir. A life goal is set for the groundwater reservoir and withdrawals are regulated in a way consistent with the set life goal[277]

Under s.21(1) of the OWRA groundwater can be extracted by digging a well only in areas designated by the director and with a permit containing conditions as the director deems fit. This may be developed into an AMA or "control area" for areas experiencing actual or potential groundwater mining in Ontario. The Territories are divided into water management areas[278] but this does not address any special groundwater problems. Water uses in the areas are regulated as in other jurisdictions which do not have similar designation. Again, such areas can be a useful guide for

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[275] Ibid s.46-666(1).

[276] National Water Commision supra, note 53, at 240. This does not mean absolute depletion as some water has to be left for ecosystems support and for the avoidance of land subsidence.

[277] Nebraska Ground Water Management and Protection Act supra note 274, ss.46-673.06, 46-673.08

[278] NIWR s.3(1)(2): Seven water management areas are designated for the Northwest Territories and six for the Yukon Territory.

dealing with special actual or potential groundwater problems. Canadian jurisdictions can adapt the American approaches to their situations when the need arises.

e) The benefits of conjunctive allocation of surface and groundwater cannot be overemphasized. Prior appropriation system modified by statutes as in prior allocation provinces is said to be particularly suitable for the management of hydrologically connected surface and groundwater. According to Balleau, this is because where a junior appropriator's use of groundwater affects a senior's use of surface water, the system would permit payment of compensation.[279] But the object of managing water in this way is not to injure others and pay compensation, rather to improve avoidance of injuries to others. Payment of compensation comes in only where injury is inevitable and the use causing the injury is considered more beneficial.

The United States National Water Commission recommended that

> where surface and ground water supplies are interrelated and where it is hydrologically indicated, maximum use of the combined resource should be accomplished by laws and regulations authorizing or requiring users to susbstitute one source of supplies for the other[280].

One advantage of such an approach is to prevent the shutting down of a junior appropriator's well or surface water diversion headgate in order to make water available to a senior appropriator. Under this approach, where the senior

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[279] W.P. Balleau, "Water Appropriation and Transfer in A General Hydrogeologic System" (1988) 28 Natural Res. J. 269 at 283-291: submits that the transfer of water rights permitted under the allocation system ensures the reallocation of water to new and more beneficial uses. Thus optimal beneficial use of ground and surface water in an integrated fashion is well served under this allocation regime.

[280] National Water Commission supra, note 53, at 233.

appropriator's groundwater supplies are affected by the action of the junior, the senior is allowed to divert surface water instead of calling for the closure of the junior's well interfering with his supplies. The same principle applies if the senior's surface water supplies are affected by the junior's withdrawal of surface or groundwater connected thereto. Again transferability of water rights is important here to enable the senior to substitute or transfer his surface water rights to groundwater use and vice versa as the case may be.

Colorado's approach provides an interesting concept. The 1969 Colorado Water Right Determination and Administration Act provides:

> ...It is the policy of this State to integrate the appropriation, use, and administration of underground water tributary to a stream with the use of surface water in such a way as to maximize the beneficial use of all of the waters of this State[281].

The Act further provides for the substitution of surface water rights in a stream for rights in underground water tributary to that stream without loss of priority in cases where one's right to use surface water from the stream has been injured by the withdrawal of underground stream tributary to that stream[282]. While

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[281] Colorado Revised Statute (CRS) s.37 art.92-102(1). New York and Connecticut states among others apply one rule, namely riparian rights doctrine and its statutory modifications to surface streams and groundwater connected to them: Stevens v. Spring Valley Water Works & Supply Co. (1964) 247 N.Y.S. 2d. 503 affirmed (1964) 255 N.Y.S. 2d. 466;Collens v. New Canaan Water Co. (1967) 155 Conn. 477.

[282] Colo Revised Statute (CRS) s.37 art. 92-301(3)(a)-(d), s.37 art. 92-502(2); Safranek v. Limon (1951) 123 Colo. 330, 228 Pac.(2d) 975 at 977: the Colorado Supreme Court stated: "It is the presumption that all groundwater so situated finds its way to the stream in the watershed of which it lies , is tributary thereto, and subject to appropriation as part of the waters of the stream...The burden of proof is on one asserting that such groundwater is not so tributary, to prove that fact by clear

it might not be necessary to apply the Colorado model in all the provinces or generally in a particular province, there is certainly the need to apply it in localized areas of relative water shortage earlier mentioned.

Furthermore, a conjunctive management of hydrologically connected surface and groundwater would improve water quality management because the prevention of pollution of one evidently prevents the pollution of the other. For this reason alone, all jurisdictions regardless of their water situations should endeavour to pursue this approach.

VIII. CONCLUDING REMARKS:

The recommendations above may help individual provinces improve their laws to meet modern needs. But more compelling is the need to unite water resources

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and satisfactory evidence." There is, however, no such conjunctive management in respect of groundwater which is not tributary to a stream in Colorado: 1965 Ground Water Management Act, CRS. Ann. s.37 art. 90-102 (1973) defines non tributary groundwater otherwise known as "designated groundwater" as "that groundwater which in its natural course would not be available to and required for the fulfillment of decreed surface rights, or groundwater in areas not adjacent to a continuously flowing natural stream wherein groundwater withdrawals have constituted the principal water usage for at least 15 years preceding the date of the first hearing on the proposed designation of the basin, and which in both cases is within the geographic boundaries of a designated groundwater basin." Colorado also has augmentation provision whereby a junior appropriator is allowed to store water underground during the period of surplus water supplies and to use it to compensate a senior appropriator in dry seasons whose supplies are affected by the junior's withdrawal. In this way the junior's well or headgate is not shut down in dry season: see generally, H.J. Morel-Seytoux supra, note 221, at 519-520.

management efforts, a goal which must be pursued aggressively.[283] Unfortunatley, the agreements already discussed[284] do not, in the main, address groundwater concerns.

Currently, each province pursues its water allocation policy independently of the others notwithstanding the unity of water resources and the environment. Thus, for example, a more humid province like Ontario does not have regard to the effect of its water use law on relatively water scarce prairie provinces. Although the laws of the provinces are generally uniform in the sense that they establish licensing schemes, yet active federal involvement is needed in some areas. The needs of modern society have influenced changes at common law and in the statutes and still necessitate the cooperation of federal and provincial governments.

The concept of "beneficial uses" draws upon economic, social and environmental uses of water, a "holistic" water allocation approach. The allocation of groundwater in a province might affect surface water connected to it which inturn might affect fisheries and navigation interests which are under federal jurisdiction. Also, the uneven distribution of surface water across Canada should warrant unified efforts to ensure that water is made available to provinces with scarce supplies. Rather than undertake inter-basin transfer projects, groundwater resources can be developed to meet the needs. As the quality of groundwater might differ in the

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[283] Note that the law may not adequately respond to this need because of constitutional barriers. Political agreements as already discussed in Chapter Two are a better approach.

[284] Supra note 90.

provinces, managing water resources on a watershed or groundwater basin basis will blur political boundaries so that communities with scarce supply or supply of poor quality which geographically fall under a particular watershed or groundwater basin could receive water from it regardless of whether all or part of the watershed or groundwater basin is located in another province. Political boundaries could deny communities good quantity and/or quality water which geographical boundaries could make available to them.

Futhermore, the resource needs to be conserved. Conservation strategies including water pricing and conjunctive use of surface and groundwater particularly in areas of scarce supplies can be developed with the help of the federal government for the benefit of the provinces as already indicated in the Federal Water Policy To develop, supply and conserve groundwater to meet present and future needs require, inter alia, charting of aquifers, assessing and determining their yields and quality, and related studies. These projects demand financial and technical resources which the federal government may be in a better position to provide wholly or on a shared-cost basis with the provinces. Federal-provincial agreements on these subjects specifically addressing groundwater concerns should be reached and implemented aggressively.

The foregoing discussion centered on the water use laws of the provinces. Water use, though diverse and broad as suggested by the concept of "beneficial uses", is only one arm of water management. Water quality protection is another arm.

Water use and water quality protection are not lumped into one regime. Although water use statutes in some provinces make reference to protection from pollution,[285] this is by no means their primary focus. Therefore, primary pollution control belongs to a different regime. This is discussed in Chapters Four and Five. Admittedly, water use and water quality protection demand separate expert management. However, the integration of both as, for example, in the Territories where the issuance of water use licences is dependent upon the maintenance of water quality is canvassed in Chapter Six.

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[285] See for example, Ont. supra note 101, ss.14, 15(3), 17(1); Nova. supra note 96, s.7(1)(a)(b)(d), s.15.

CHAPTER FOUR

LEGAL PROTECTION OF GROUNDWATER QUALITY

The maintenance of beneficial groundwater uses demands that the resource be protected. In addition to technical or scientific protection, legal protection is crucial to the preservation of groundwater for posterity. Legal protection of groundwater can be based upon common law or statutory regime. In large part, the latter regime has overtaken the former in response to modern reality.[1] Nevertheless, a discussion of the common law regime provides a background understanding of the need for a statutory regime.

There are two aspects of common law regime. One comprises the water law doctrines, the other the private common law: tort or delict. As we have seen,[2] the water law doctrines are largely concerned with water allocation. However, they also bear relevance upon water quality protection as examined below.

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[1] Prior to the advent of legislation there were common law doctrines some of which are still good law which protect water quality. The water law doctrines examined in Chapter Three and the common law (private law) doctrines which govern tortious liability are examined here. Where appropriate, Quebec civil law is discussed. It is submitted that the inadequacies of these laws to protect groundwater necessitated the legislative regime. Whether or not present legislation is adequately protecting groundwater is also discussed. Where appropriate American experience is relied upon to canvass for a more effective groundwater protection legislation, strategies and programs for Canada.

[2] Supra, Chapter Three, notes 2-66 and accompanying text.

A. COMMON LAW REGIME:

I. WATER LAW DOCTRINES:

a) The Riparian Rights Doctrine:

A riparian owner is entitled to have the water of a stream abutting his land come to him in its natural quality, that is, "without sensible alteration in its character or quality".[3] As one scholar put it

> a riparian owner has no right to pollute a stream in the smallest degree; and 'pollution' sufficient to found an action will occur when there is a sensible alteration in the quality of the water sufficient to found a prescriptive right.[4]

The "natural flow" theory which ensures that a riparian owner receives water in its natural quality has been followed in Canada. For example, in Crowther v. Town of Coburg Middleton J. endorsed the riparian right "...to the water in its natural

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[3] John Young v. Bankier Distellery Co. (1893) A.C. 691 at 698: per Lord MacNaughten; See also, Mason v. Hill (1833) 110 E.R. 692; Wood v. Waud (1849) 3 Exch. 748, 154 E.R. 1047. But see Swindon Waterworks v. Wilts & Berks Canal Navigation Co. (1875) L.R.7HL 697, 704: where Lord Cairns seemed to permit reasonable use of water by a riparian owner, although it was not clear whether he was referring to flow only or to both flow and quality. If reasonable use of water also refers to quality, it means that a reasonable alteration of the quality can be allowed.

[4] P. Anisman, "Water Pollution Control in Ontario" (1972) 5 Ottawa L. Rev. 342 at 352.

condition".[5] Also the Supreme Court of Canada has held that:

> the right of a riparian proprietor to drain his land into a natural stream is an undoubted common law right, but it may not be exercised to the injury or damage of the riparian proprietor below, and it can afford no defense to an action for polluting the water in the stream. Pollution is always unlawful and in itself constitutes a nuisance.[6]

Given the focus on "sensible alteration", a riparian owner need not wait for a substantial alteration of water quality before bringing an action for impairment of the water quality.[7] The law presumes damage once it is shown that the natural quality of the water has been derogated from. For example, in a case where water was turned from "soft" to "hard", the defendant was held liable to the plaintiff riparian owner.[8] Liability has also been sustained where the temperature of water in a stream was increased.[9]

Thus, while the reasonable use theory has been employed in Canada to temper the natural flow theory of riparian rights doctrine with regard to water flow or quantity,[10] it has been resisted with regard to water quality. The riparian rights

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[5] (1912) 3 O.W.N. 490 at 492-493, 1 D.L.R. 40 at 42.

[6] Groat v. City of Edmonton (1928) S.C.R. 522 at 532, (1928) 3 D.L.R. 725 at 730: per Rinfret J. See also, McKie v. K.V.P. Co. (1948) O.W.N. 386 at 387, (1948) 3 D.L.R. 201 at 209; Van Egmond v. Seaforth (1884) Ont.R. 599 at 608; Gauthier v. Naneff (1971) 1 Ont. R. 97, 14 D.L.R. (3d.) 513, 517.

[7] McKie v. K.V.P. Co.,supra, note 6.

[8] John Young v. Bankier Distellery Co., supra, note 3.

[9] Wood v. Waud (1849) 3 Exch. 748, 154 E.R. 1047; Pride of Derby v. British Celanese Ltd (1953) 1 All E.R. 179 (C.A.).

[10] Lockwood v. Brentwood Park Investments Ltd. (1970)10 D.L.R. (3d) 143; see supra, Chapter Three, note 34.

doctrine, therefore, offers more protection to water quality than it does to water flow.

The provision of art.503 of the Quebec Civil Code is similar to the common law riparian rights doctrine. In Carey Canadian Mines Ltd v. Plante the Quebec Court of Appeal held the defendant liable for polluting a river which ran through the plaintiff's land rendering it unfit for drinking and bathing.[11] As under the riparian rights doctrine, the plaintiff here was entitled to the natural quality of the water in the river.

The riparian rights doctrine protects the quality of underground stream in much the same way as it does surface water.[12] The protection of surface water under this doctrine offers indirect protection to groundwater recharged by it.

b) The Absolute Ownership Doctrine:

This doctrine which applies to percolating groundwater offers no protection whatsoever to the quality of the resource. An owner is free to use the resource however he chooses[13] including polluting it regardless of the effect on his neighbours. But as we shall see, the torts of nuisance and negligence have been used to temper this undesirable result.

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[11] (1975) C.A. 893.

[12] Chasemore v. Richards (1859) 11 E.R. 140 at 150. See also, Dickinson v. The Grand Junction Canal Company 7 Exch. Rep. 300 at 301.

[13] See supra, Chapter Three note 29.

c) The Reasonable Use Doctrine:

This doctrine permits reasonable use of groundwater or surface water. Unlike the riparian rights doctrine, injury under this doctrine must be material, substantial or unreasonable before an action can be sustained.[14] A fortiori, reasonable alteration of groundwater quality is condoned. Referring to the position in the United States, one writer states that the reasonable use doctrine thus allows "normal industrial pollution"[15] of water. However, Canadian jurisdictions do not apply this doctrine to water quality.[16] Canadian common law, accordingly, gives stronger protection to water quality than American law.

d) The Correlative Rights Doctrine:

This doctrine was developed principally to check or reduce the rate of withdrawal of groundwater to avoid overdraft. Thus it protects groundwater quality incidentally, that is, only to the extent that it prevents heavy withdrawal which might

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[14] Webb v. Portland Manufacturing Co. (1838) 29 Fed.Cas. 506; Embrey v. Owen (1851) 6 Exch. 353, 155 E.R. 579.

[15] C. Harvey, "Riparian Water Rights: Not Dead Yet" (1990) 48 Advocate 517 at 521.

[16] Groat v. City of Edmonton (1928) S.C.R. 522.

cause contaminants intrusion.[17] Although not applicable in Canada, Canadian jurisdictions experiencing actual or potential overdraft[18] may incorporate this doctrine in their statutes with appropriate modifications to suit their local circumstances.

e) The Prior Appropriation Doctrine:

Groundwater protection under this doctrine has been stated by the California Supreme Court in Wright v. Best as follows:

> ...an appropriator of waters of a stream, as against upper owners with inferior rights of user (sic), is entitled to have the water at his point of diversion preserved in its natural state of purity, and any use which corrupts the water so as to essentially impair its usefulness for the purposes to which he originally devoted it, is an invasion of his rights. Any material deterioration of the quality of the stream by subsequent appropriators or others without superior rights entitles him to both injunction and legal relief.[19]

This statement is ambiguous. It is not clear whether, under this doctrine, the natural purity of water is to be preserved as is the case under the riparian rights doctrine or whether only a material deterioration is prohibited as is the case under the reasonable use doctrine. It is also possible that the court was proposing a hybrid

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[17] See supra, Chapter Three, notes 37 and 38 and accompanying text.

[18] For example, Ontario, see supra, Chapter One supra note 29 and accompanying text.

[19] 19 Cal. 2d 368, 121 P. 2d 702 at 709: also applies to groundwater. The doctrine is adapted to groundwater: see Chapter Three; See also, Rocky Ford Irrigation Co. v. Kents Lake Reservoir Co. 135 P. 2d 108 at 114; Arizona Copper Co. v. Gillespie (1909) 100 Pac. 465 affirmed (1912) 230 U.S. 46, 37 S.Ct. 1004.

of the two approaches. However, both are inconsistent and cannot coexist. The situation was subsequently clarified in Rocky Ford Irrigation Co. v. Kents Lake Reservoir Co. where the court held that only a material or unreasonable deterioration is forbidden.[20]

The rule in Wright v. Best, while protecting a senior appropriator's water supply from a junior's activity, denies a similar protection to the junior from a senior's polluting activity. However, in State of Utah v. California Packing Corp. it was held that a junior appropriator takes his water subject to any reasonable pollution caused by a senior.[21] Does this suppose then that a senior will be liable for an unreasonable pollution of the junior's water supply? This is not clear. According to one writer, while a junior appropriator pays compensation to a senior for polluting his water, it is not certain whether the reverse is the case.[22]

Clearly, this doctrine is unsuitable for the protection of ambient groundwater quality as much as it leaves the water supply of a junior appropriator unprotected. Fortunately, there is no indication that Canadian jurisdictions that follow the prior appropriation doctrine in allocating water follow it in protecting water quality.[23]

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[20] 135 P. 2d 108 at 114.

[21] (1943) 141 P. 2d 386.

[22] R. Robie, "Relationship Between Water Quality and Water Rights" in C. Johnson and S. Lewis ed. Contemporary Developments in Water Law 1970 at 72, 75-76 cited at Aiken supra Chapter Three, note ~~39~~ 41, at 941.

[23] See the water statutes of Alberta, British Columbia, Manitoba and Nova Scotia, supra, Chapter Three.

All water law doctrines above examined fail to offer adequate protection to groundwater. The riparian rights doctrine, which is comparatively more protective, does not apply to percolating groundwater. For this reason, tort law or delict is often invoked to protect individual rights to unpolluted groundwater. What follows is an examination of different branches of tort law, and delict which could help protect groundwater.

II. TORT LAW AND DELICT:

a) Trespass:

The requirements of this cause of action make it little suited to protect groundwater. Trespass can only be employed where there is a direct physical act interfering with one's land. In most cases, pollution does not involve such "direct physical act". For example, in South Port Oil Corp. v. Esso Petroleum an ocean-going oil tanker spilled oil in the estuary of United Kingdom. The oil, by the agent of wind, spread to the shores and caused damage to the plaintiff's property. In his judgment, Lord Denning stated:

> in order to support an action for trespass to land the act done by the defendant must be a physical act done by him directly on to the plaintiff's land... This discharge of oil was not done directly on to their foreshore but outside in the estuary. It was carried by the tide on to their land, but that was only consequential, not direct. Trespass

therefore, does not lie.[24]

Denning's view seems to be followed in Canadian jurisprudence. In Steadman v. Erickson Gold Mining Corp. indirect pollution of an underground stream was held not to support an action in trespass.[25] Conversely, direct aerial spraying of pesticide on a farm was held to be trespass.[26] At the same time, the drifting of pesticide on to another's farm after it had been sprayed elsewhere was held not to constitute trespass.[27]

One writer has argued that this distinction is illogical and arbitrary because even direct aerial spraying of pesticides which sustains a trespass action necessitates wind carriage of pesticides.[28] The agent of wind thus makes pesticide spraying an indirect act. However, if available, trespass could be a powerful tool for environmental protection as it is actionable per se and requires no proof of actual damage.[29]

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[24] (1954) 2 Q.B. 182 at 195-196, 204: But Lord Morris was of the view that an action in trespass can lie under such circumstances.

[25] (1988) 43 D.L.R. (4th) 712 at 734.

[26] Friesen v. Forest Protection Ltd. (1978) 22 N.B.R. (2d) 146 (NBSC) But see Kerr et al v. Revelstoke Building Materials Ltd. (1976) 71 D.L.R. (3d) 134.

[27] Newman v. Conair Aviation Ltd. (1972) 33 D.L.R. (3d) 474 (BCSC).

[28] E.J. Swanson, "The Common Law: New Developments and Future Trends" in D. Tingley ed. Into the Future: Environmental Law and Policy for the 1990s (Edmonton: Environmental Law Centre, 1990) 79 at 84.

[29] Entick v. Carrington (1765) 19 State Trials 1029 (C.P.); J.G. Fleming, The Law of Torts 3rd ed. (Sydney, Australia: The Law Books Co. Ltd., 1965) at 17.

b) Negligence:

To succeed in negligence, a plaintiff has to prove that the defendant owed him a duty of care, that the duty has been breached, that the breach has resulted in damage, and that the damage was reasonably foreseeable and not remote in the circumstances.[30] The plaintiff is not relieved of this burden of proof except in cases where the doctrine of res ipsa loquitur applies.[31] Negligence has been successfully invoked to redress groundwater contamination.[32]

The legal situation in Quebec is not significantly different. Under arts. 1053 and 1054 of the Civil Code every person capable of discerning right from wrong is liable for any damage caused to another by his fault or the fault of his servant, whether the fault is by a "positive act, neglect or want of skill". In addition to proof of fault the plaintiff must establish that the resulting damage was a direct and immediate consequence of the defendant's default.[33]

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[30] Overseas Tankship (U.K.) Ltd. v. The Miller Steamship Co. Pty. Ltd. (Wagon Mound No.2) (1967) 1 A.C. 617.

[31] That is, where the cause of the harm is so clear that it speaks for itself.

[32] Corkum v. Lohnes (1981) 43 N.S.R. (2d) 477 at 484 where the defendant knew that his action would contaminate aquifer but failed to take reasonable care to avoid it, the court referred to negligence as a possible cause of action. See also, Penno v. Government of Manitoba (1975) 64 D.L.R. (3d) 256 at 271-274: per Matas J.A.; Pugliese v. National Capital Commission (1977) 79 D.L.R. (3d) 592 at 615, 621: per Howland J.A. Although these cases were in connection with groundwater withdrawal, there is no reason why the principle should not apply to groundwater contamination.

[33] (Lower Canada) Civil Code art.1075: contrast with common law test of foreseeability.

c) Nuisance:

The historical basis of nuisance is to hold those whose activities cause unnecessary discomfort to others responsible for injuries caused by such activities and thus discourage them from continuing to cause the harm.[34] Nuisance, therefore, arises from an unreasonable interference with another's use and enjoyment of property.[35]

There are two kinds of nuisance, namely: public and private nuisance. A public nuisance is an interference with public rights so widespread that no single individual is expected to take action to prevent or to stop it.[36] For this reason, only the Attorney General is permitted to bring an action in public nuisance or to consent to a relator action by a private person. In Canada, the decision of the Attorney General to bring such an action is in his absolute discretion.[37] A private person not permitted by the Attorney General has no right to bring an action in public nuisance except when he suffers injury which is direct, substantial and beyond that suffered by

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[34] M. Katz "The Function of Tort Liability in Technology Assessment" (1969) 38 U. of Cinn. L. Rev. 587 at 606.

[35] A.M. Linden, Canadian Tort Law 3rd ed (Toronto: Butterworths, 1982) at 531; Fleming, Law of Torts supra note 29, at 365-366.

[36] W. Estey, "Public Nuisance and Standing to Sue" (1972)10 Osgoode Hall L.J. 563: Examples of infringement of public rights are endangerment of public health and safety, or the obstruction of highways and navigable waters.

[37] Grant v. St. Lawrence Seaway Authority (1906) O.R. 298 at 303-304 (Ont. C.A.); Hickley et al v. Electric Reduction Company of Canada (1970) 21 D.L.R. (3d) 368 (Nfld S.C).

the general public.[38] There is, however, a trend in public law towards granting standing more liberally to private persons.[39]

The difficulty of both establishing a direct and substantial injury beyond that suffered by the public at large or obtaining the permission of the Attorney General for a relator action has made private nuisance a popular alternative. Even cases which ordinarily would fall under public nuisance have been held proper for private nuisance actions.[40] According to one scholar, once a private person's property interest has been injured liability follows in private nuisance action and it does not

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[38] Hickey et al supra note 37: some fishermen were barred from bringing an action for loss of fish to pollution notwithstanding that their livelihood depended on fishing. According to the court they suffered no injury beyond that suffered by the public at large. See also, Tessler v. Gonzales (1985) 58 B.C.L.R. 10; Canada Paper Co v. Brown (1922) 63 S.C.R. 243 Benjamin v. Storr (1874) 30 L.T. 362: the injury suffered by the private person must be "particular, direct and substantial loss above that suffered by the public at large."

[39] See for example, Minister of Finance v. Finlay (1986) 2 S.C.R. 607, 33 D.L.R. (4th) 321; Borowski v. Minister of Justice of Canada (1981) 2 S.C.R. 575, 130 D.L.R. (3d) 588; McNeil v. Nova Scotia Board of Censors (1976) 2 S.C.R. 265, 55 D.L.R. (3d) 632; Thorson v. A.G. Canada (1975) S.C.R. 138, 43 D.L.R. (3d) 1. This trend which some have suggested should be extended to private law realm is yet to affect environmental protection.

[40] Canada Paper Co. v. Brown (1922) 66 D.L.R. 287 at 298 (S.C.C.): where fumes and vapours from the defendant's activities damaged crops of several persons, the court held that each of the person affected can maintain an action in private nuisance. See also, Palmer v. Stora Koppard Engs Bergslags Akhebolog (1983) 2 D.L.R. (4th) 397 at 485-486: where a group of people sought an injunction against pesticide spraying, the court rejected the argument that it was a public nuisance. According to the court, even if it was a public nuisance, the claim related to risk to health which includes a special damage entitling the plaintiffs to bring the action without the consent of the Attorney General. How widespread a nuisance can be to qualify as a public nuisance is vague and this can be exploited in favour of private nuisance actions.

matter whether the injury affected other members of the society as to amount to a public nuisance.[41]

Liability in nuisance is "strict". It does not matter that the defendant took reasonable care to avoid the injury.[42] But unlike in a riparian action, proof of actual damage and substantial interference with one's enjoyment of land is required to sustain an action in nuisance.[43]

Groundwater polluters who escape liability under the absolute ownership doctrine may be held liable in nuisance. In Ballard v. Tomlinson the defendant was held liable for allowing sewage and waste from his land to contaminate groundwater in the plaintiff's well. According to Lindley L.J. "the right to foul water is not the same as the right to get it".[44] In other words, the absolute ownership rule which allows a person to withdraw any amount of percolating groundwater regardless of the consequences to his neighbours does not apply to groundwater pollution. Rather, the nuisance rule applies. Thus while a well owner may not have a secured right to groundwater supply as he has no proprietary right in the water until he has appropriated it, he has a secured right to get the water unimpaired in quality.

Lindley L.J. further maintained that such nuisance action is not founded only

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[41] J.S.P. McLaren "Nuisance in Canada" in A. Linden, ed Studies in Canadian Tort Law (Toronto: Butterworths, 1968) 324-326.

[42] Humphries v. Cousins (1877) 2 C.P.D. 239 at 245; Chartier v. British Coal Corp. (1938) 76 C.S. 360 at 366.

[43] Bright v. Niagara Racing Ass'n (1921) 20 O.W.N. 46.

[44] (1885) 29 Ch.D. 115 at 126. See also, Hodgkinson v. Ennor (1863) 32 L.T. Q.B. 231; Womersley v. Church (1867) 17 L.T.(N.S.) 190.

upon proprietary right. As he put it:

> The law of nuisance is not based exclusively on rights of property. Light is not property, and yet if a man has a right to have it come to his windows he can maintain an action against those who prevent it from so coming. So air is not property, but a man who poisons the air which another has right to breathe commits an actionable wrong. Upon precisely the same principle, underground water which supplies a well may not be the property of the owner of the well, but he has a right to take and use such water, and upon principle he appears to me to have a right of action against those who poison what he has a right to get. If indeed the well owner had no right to get unpolluted water he would have no right of action, but it lies with those who deny this right to maintain their position. Prima facie, at all events, the right of a man to get water from his well is to get the water as nature supplies it, and if any one contends that he has a right to pollute the natural supply he must establish such right.[45] (emphasis added).

In other words, a protectable right, not necessarily a proprietary right, is sufficient to sustain an action in nuisance. This was also stated in the Canadian cases of Penno and Pugliese[46] This is a desirable improvement upon the traditional proprietary right concept which gives legal protection in private nuisance action based only upon ownership of property. One writer states the scope of protectable right to be "any act by a land owner which subjects his neighbour's lands to interference beyond that which he could reasonably be expected to tolerate is an actionable nuisance".[47]

A British Columbia court has approved the protectable right concept, citing Penno case in support of the proposition that

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[45] Ballard v. Tomlinson (1885) 29 Ch.D. 115 at 126.

[46] See supra, Chapter Three, notes 183 and 184 and accompanying text.

[47] P. Girard, "An Expedition to the Frontiers of Nuisance" (1979-80) 25 McGill L.J. 565 at 577.

> a private right of action in nuisance for water pollution does not depend upon a proprietary right in the water. It is not necessary for the plaintiff to prove he has a proprietary right in the water as a condition precedent to claiming damages against the defendant.[48]

The law of nuisance is more frequently invoked to protect groundwater in Canada. For example, nuisance actions have been sustained where wells were contaminated from the following sources: a road construction operation;[49] gasoline from underground storage tanks;[50] the intrusion of saline water;[51] and polluted surface water.[52] With the protectable right principle, the law of nuisance has been revolutionized and transformed into a veritable weapon in the legal arsenal to win the fight against groundwater pollution.

However, liability in nuisance can be unduly elusive if the courts are strictly minded to balancing the equities of parties. Anglo Canadian courts, however, would generally not have regard to balancing the equities of parties. They maintain that once a plaintiff has suffered tangible physical damage to his property, the liability of the defendant is generally automatic regardless of the reasonableness of his action or the importance of his activity.[53]

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[48] Steidman v. Erickson Gold Mining Corp. (1988) 43 D.L.R. (4th) 712 at 736.

[49] Jackson v. Drury Construction Ltd. (1975) 4 O.R. (2d) 735 at 739-740.

[50] Bennett v. Imperial Oil Ltd. (1961) 28 D.L.R. (2d) 55 (Nfld. S.C.).

[51] Connery v. Government of Manitoba (1971) 15 D.L.R. (3d) 303 (Man. Q.B.).

[52] Corkum v. Lohnes (1981) 43 N.S.R. (2d) 477.

[53] Russell Transport Ltd v. Ontario Malleable Iron Co. (1952) O.R. 621, (1952) 4 D.L.R. 719; Kent v. Dominion Coal & Steel Corp. (1965) 49 D.L.R. (2d) 241.

In some cases, Canadian courts would even impose liability or restrain a public interest activity which interferes with private enjoyment of land. In City of Portage La Prairie v. B.C. Pea Growers Ltd, the Supreme Court of Canada affirmed the damages and injunction awarded by the lower court against the City of Portage for allowing the escape of sewage from its facilities to the plaintiff's land.[54] Also, the economic importance of the defendant's activity does not absolve him from liability.[55]

Clearly, balance of equities is not the rule in Canada. The view has been expressed that where equities need to be balanced, environmental considerations should be emphasized in terms of the impact of pollution on the quality of life and the social ills associated with it as against the social utility of the defendant's operation.[56] The result of such balancing must be in favour of environmental concerns. It has been submitted that

> true, nuisance is a tort which demands some "give and take" between neighbours, but the contamination of one's neighbour's well with manure surely transcends the standard of patience and tolerance which the law demands.[57]

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[54] (1966) 54 D.L.R. (2d) 503; See also, Roberts v. City of Portage La Prairie (1969) 2 D.L.R. (3d) 373; Stephens v. Richmond Hill (1956) 1 D.L.R. (2d) 539 at 583; Burgess v. Woodstock (1955) O.R. 814, (1955) 4 D.L.R. 615.

[55] McKie v. K.V.P. Co. (1948) O.W.N. 386, (1948) 3 D.L.R. 201.

[56] J.P.S. McLaren, "The Common Law Nuisance Action and the Environmental Battle- Well Tempered Swords or Broken Reed" (1972) 10 Osgoode Hall L.J. 505 at 529.

[57] J. Irvine, "Case Comment: Metson v. R.W. DeWolfe Ltd. The Changing Face of Nuisance and Ryland and Fletcher" (1981) 14 C.C.L.T. 225 at 228.

There is a rule under the Quebec civil law which has a similar result as common law nuisance rule. According to one writer, as in common law, in Quebec, the notion of the abuse of proprietary right may give rise to liability without fault.[58] In both legal regimes, liability is based on the latin maxim sic utere tuo ut alienum non laedas.[59] The Supreme Court of Canada has confirmed that common law nuisance principles are "hardly distinguishable" from the principles of Quebec law.[60] Evidence of emerging protectable rights principle as in common law nuisance actions can also be seen in some Quebec cases.[61]

d) The Rule in Rylands v. Fletcher:

This rule was enunciated by Blackburn J.(as he then was) in Rylands v.

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[58] R.I. Cohen, "Nuisance: A Proprietary Delict" (1968) 14 McGill L.J. 124 at 141-142: maintians that art. 1053 of the (Lower Canada) Civil Code which requires the proof of fault is not applicable to nuisance cases. According to him, if fault must be required to sustain a nuisance action, the intensity of the legal duty imposed by art. 1053 must first be determined. He opines that the duty imposed by that article is so high that the effect of the requirement of fault is minimal. And so proof of fault can still not stand in the way of a nuisance action.

[59] Canadian Pacific Railway Co. v. Roy (1902) A.C. 220.

[60] Canada Paper Co v. Brown (1922) 63 S.C.R. 243 at 247: per Idington J.. See also, Robin v. The Dominion Coal Co. (1899) 16 C.S. 195 at 199: where Davidson J. stated that in nuisance law "french and English authorities may be quoted indifferently"; Crawford v. Protestant Hospital for the Insane (1889) M.L.R. 5 C.S. 70 at 73: per Jeffe J; Drysdale v. Dugas (1897) 26 S.C.R. 20 at 23: per Sir Henry Strong C.J.

[61] Katz v. Reitz (1973) C.A. 230; Carey v. Canadian Mines Ltd. v. Plante (1975) C.A. 893.

Fletcher where he stated that:

> ...the person who for his own purposes brings on his land and collects and keeps there anything likely to do mischief if it escapes, must keep it at his peril, and if he does not do so, is prima facie answerable for all the damage which is the natural consequence of its escape.[62]

Liability under this rule is strict[63] and must be strictly proved.[64] It is evident from Blackburn J's statement that the following must be proven: a) that the substance or material which caused the injury was not naturally on the defendant's land but was brought in or accummulated there; b) that it was likely to do mischief; c) that it actually escaped from the defendant's land to the plaintiff's land; and d) that the damage caused to the plaintiff as a result was legally cognizable and compensable.

On appeal to the House of Lords, Blackburn J's decision was upheld but Lord Cairn added a new element to the principle, namely, requiring the substance brought into or accummulated in the defendant's land to be a "non natural user" as a precondition for sustaining liability.[65] The "non natural user" element has aroused some controversies among some legal authorities.[66] A broad construction of "non

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[62] (1866) L.R. 1 Ex 265 at 279-280.

[63] Rylands v. Fletcher (1868) L.R. 3 H.L. 330 at 340: per Lord Cranworth.

[64] Hamilton v. Kettner; Goody v. Kettner (1957) 65 Man.R. 90, 8 D.L.R. (2d) 621 (C.A.).

[65] Rylands v. Fletcher (1868) L.R. 3 H.L. 330.

[66] I.P. Porter Co v. Bell (1955) 1 D.L.R. 62 at 66: per MacDonald J; Cruise v. Niessen (1977) 2 W.W.R. 481.

natural user" increases the chances of liability under the rule and vice versa.[67]

The attitude of Canadian courts generally is to subscribe to a broad interpretation of the "non natural user" element. Even those who favour a narrow interpretation of this element, circumscribe it by holding that a natural use of land would not absolve one from liability for injury caused by one's activity. In Cruise v. Niessen, Solomon J, after admitting that the aerial spraying of herbicides has crystallized into a normal or natural use of land stated:

> It is not the aerial application that makes the user of herbicide liable for damages, it is the action of allowing the herbicide, a dangerous substance, to escape beyond the boundaries of his own property that makes the user liable for damage to neighbours' crops.[68]

This decision can be rationalized on the point that it addresses the risk or harm caused by a particular substance which otherwise would escape redress. As one writer puts it: "when inherently dangerous substances, like pesticides, are commonly used as prudent management the 'non natural user' element may disappear but the risk remain".[69]

The rule in Rylands v. Fletcher has been successfully applied to redress

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[67] See for example, Dunne v. North Western Gas Board (1964) 2 Q.B. 806: where it was held that normal industrial activities properly carried out on one's land may not be a non natural user of land. Here, the escape of electrical materials from the defendant's manufacturing plant which caused injury to the plaintiff was held to be a natural user for which liability was not sustained under the rule. But in Schunicht v. Tiede (1980) 9 C.E.L.R. 134: the Alberta Queen's Bench court denied that aerial spraying of pesticide was a natural user of land notwithstanding that it has become a normal practice.

[68] (1977) 2 W.W.R. 481 at 483-484 reversed on facts not on principle: (1978) 1 W.W.R. 688 (Man. C.A.). See also Bartel v. Ector (1978) 90 D.L.R. (3d) 89.

[69] Swanson supra, note 28, at 90.

groundwater contamination in Canada. In Metson v. R.W. DeWolfe Ltd. the plaintiffs and the defendant were neighbours. The plaintiffs had a well from which they drew potable water needed for their photographic business. The defendant whose farm land was on a slightly higher level applied manure, a normal agricultural practice, to his field. Following some rainfalls the manure washed downwards into the plaintiffs' well and contaminated the groundwater. It was held that the defendant was liable for allowing the manure to escape from its land to injure the plaintiffs. The court held further that if the runoff was mere surface water, the plaintiffs would not have maintained the action. But that the presence of manure, a deleterious substance called for the protection of the plaintiffs and that it did not matter that the defendant had not been negligent.[70] Again, here, the qualification of manure as natural use did not give the defendant the right to cause injury to the plaintiffs.

Judicial ingenuity in these cases has diminished significantly the effect of "non natural user" element under this rule in Canada.

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[70] (1980-81) 14 C.C.L.T. 216 at 220-221: distinguished Loring v. Brightwood Golf & Country Club Ltd. (1974) 8 N.S.R. (2d) 431, 44 D.L.R. (3d) 161 (C.A.) where MacKeigan C.J.N.S. held that where surface water runs off as a result of natural causes to the injury of low land occupier, no action can be maintained. See Stollemeyer v. Trinidad Lake Petroleum Co. Ltd. (1918) A.C. 485 at 496 where the court stated that: "if the pollution occurred because rain water fell on the oily surface of the land and carried the oil to the river, the plaintiff would have no cause of action." Although this is inconsistent with Metson case both can be reconcilled this way: Stollemeyer was a riparian case and a riparian owner has the right of natural drainage and the exercise of this right to the injury of another would rightly not sustain an action. But Metson was not a riparian case and there is no right to set a stage for the contamination of runoff and then allow it to escape into a neighbour's groundwater supply well.

III. DEFENCES:

Unlike delict action under art.1053 of the (Quebec) Civil Code, common law negligence action can be met with the defence of reasonable unforeseeability. However, civil law delict and common law trespass, nuisance and Rylands v. Fletcher rules share the defences of prescription,[71] acquiescence[72] and statutory authority.[73] Only the last defence is discussed herein because of its immediate relevance to environmental protection.

The defence of statutory authority is available under narrow criteria. The defence absolves a defendant from liability for injury arising from the discharge of a duty imposed by statute.[74] Unless the legislature provides for a remedy the injured party has no remedy except the defendant has been negligent in carrying out the duty.[75]

The success of the defence in large part depends on the interpretation given

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[71] B.C. Forest Products v. Nordal (1954) 11 W.W.R. 403 (B.C.S.C.); De Vault v. Robinson (1920) 48 O.L.R. 34, 54 D.L.R. 591 (C.A.); Wood v. Gibson (1897) 30 N.S.R. 15 (C.A.); Hall v. Alexander (1902) 3 O.L.R. 482 (C.A.).

[72] Heenan v. DeWar (1870) 17 Gr. 658 affirmed 18 Gr. 438; Sanson v. Northern Railway (1881) 29 Gr. 459.

[73] In the application of this defence, there is the difficulty of reconciling economic or social activities which cause pollution on the one hand and the need for a clean environment on the other hand.

[74] The Managers of Metropolitan Asylum District v. Hill (1881) 6 App. Cas. 193.

[75] Jones et al v. The Corp. of the City of Victoria (1890) 2 B.C.R. 8 at 9.

to the statute authorizing the defendant's act. Certain presumptions have narrowed down the application of the defence. For example, where the duty imposed by a statute is permissive rather than mandatory, it is presumed that the legislature does not intend injury to private rights.[76]

According to the Supreme Court of Canada, in every case the tests of liability are:

> 1) whether the act which occasioned the injury was authorized by statute; 2) whether the statute contemplated that the powers conferred might cause injury to others; 3) if so, whether the injury complained of was of a kind contemplated by the statute; 4) whether the statute provided for compensation in respect of any injury sustained through the exercise of the powers conferred.[77]

The injury resulting from the exercise of the power conferred by statute must be a necessary and inevitable consequence of the execution of a mandatory statutory duty in order to absolve the defendant from liability. Thus, where sewer water polluted a plaintiff's basement, the Supreme Court of Canada rejected the defence of statutory authority because the pollution was not an inevitable consequence of the discharge of the statutory duty.[78]

Evidently, judicial application of this defence is restrictive. And common or civil law remedies are still available in proper cases. There is, however, the question

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[76] The Managers of Metropolitan Asylum Dsitrict supra, note 74, at 213: per Lord Watson; Pacific Railway v. Parke (1899) A.C. 535.

[77] North Vancouver v. McKenzie Barge and Marine Ways Ltd. (1965) S.C.R. 377 at 383.

[78] Tock et al v. St. John's Metropolitan Board (1990) 64 D.L.R. (4th) 620. See also Dressew Supply Ltd. v. City of Vancouver (1989) 38 B.C.L.R. (2d) 119 (B.C.C.A.).

whether a polluter who has a permit to discharge waste and who has complied with the terms and conditions of the permit and the provisions of the appropriate statute would be liable at common law for injury caused by his act. The judicial approach is to hold the polluter liable as to hold otherwise would amount to the expropriation of private right without compensation.[79]

It has been suggested that since the intention of pollution legislation is to control or minimize pollution, such intention is in harmony with common law rules such as the riparian rights or nuisance principles which aim at the same result.[80] As a general rule, statutes should not, therefore, be interpreted as abolishing these common law rules.[81] Statutes and common law are complementary but diverge where statutes intend to accommodate economic interest by tolerating some amount of pollution[82] and common law insists on the individual right to unpolluted water

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[79] Groat v. City of Edmonton (1928) S.C.R. 522 at 532-533: statutes cannot take away a riparian owner's right to natural water quality without compensation. See also, McKie v. K.V.P. Co. (1948) 3 D.L.R. 201 at 218: the court disregarded an agreement between the provincial Crown and the defendant which authorized the defendant to discharge such amount of waste into the river as was reasonably necessary for its operation without liability.

[80] A. Lucas, "Water Pollution Control in British Columbia" (1969) 4 U.B.C. L. Rev. 56 at 84-85.

[81] C. Harvey, "Riparian Water Rights: Not Dead Yet" (1990) 48 Advocate 517 at 519-520: while riparian rights to water flow has been abolished in British Columbia by the Water Act, riparian rights to water quality survives.

[82] See for example, (Ontario) The Lakes and Rivers Improvement Act R.S.O. 1980 c.229, s.39(1): provides that in granting or refusing injunction against a mill owner upon complaint of impairment of water quality lodged by a riparian owner, the court should a) consider the importance of the mill to the community; or b) grant a suspended injunction or grant injunction upon such terms and conditions as it deems fit; c) in lieu of injunction direct the mill owner to take steps as would minimize,

or compensation in lieu.

Where statutes tolerate certain levels of pollution, compensation in lieu of the right to unpolluted water appears to be a workable compromise and this should be enshrined in such statutes.[83]

IV. DEFFICIENCIES OF THE COMMON LAW[84] AND THE NEED FOR A STATUTORY REGIME FOR GROUNDWATER PROTECTION

The requirement of a direct physical act makes it impossible to sustain a trespass action to redress groundwater contamination. Contaminants must pass through earth materials before reaching groundwater zones so that contamination can only be indirect. A groundwater contamination victim cannot, therefore, have the advantage of a trespass action which needs no proof of actual damage.

A victim can, however, potentially recover in negligence. But the burden of proof could be onerous and may not always be discharged. Moreover, negligence is an after-the-fact cause of action. It is triggered only after a harm has been done. No injunction issues in negligence. Damages are thus the only remedy available. However, where damages are substantial, they may have a deterrent effect on

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avoid, or prevent the injury.

[83] Ibid s.39(2): provides that "nothing in subsec(1) affects any right of the person claiming the injunction to claim damages against the owner or occupier of the mill for any injury, damage or interference".

[84] The deficiencies of the common law are not significantly different from those of Quebec civil law delict, see Cohen, supra, note 58: came to this conclusion after reviewing common and civil law jurisprudence.

polluters. Negligence does not, therefore, serve groundwater protection well.

As in negligence, an injunction, cannot lie in the rule in Rylands v. Fletcher. The rule requires actual escape of a substance from one's land to the land of another and until there is such an escape and injury as a result, the rule cannot be invoked.

Unlike negligence and the rule in Rylands v. Fletcher, nuisance has the remedy of injunction. The burden of proving a direct and substantial damage beyond that suffered by the public at large deters private litigation of public nuisance actions. Private nuisance actions are not free from difficulties either. A groundwater pollution victim cannot succeed unless he proves that he has suffered or will inevitably suffer direct and substantial injury. We have seen that groundwater processes are such that, in most cases, there is a delayed effect of contamination.[85] The effect of groundwater contaminated today may be felt or known ten years in the future. Thus, direct and substantial damage required under private (and even public) nuisance rule cannot always be apparent. Injunctions would, therefore, be denied.

This barrier to litigating nuisance actions makes an action under the riparian rights doctrine attractive. In a riparian action, proof of actual substantial or threatened substantial damage is not required. Alteration of water quality need not be substantial as the rule seeks to protect water in its natural quality. However, a riparian action does not protect percolating groundwater.

The remedies provided by common law confirm its weakness. Except where damages are substantial they do not have a deterrent effect. Although both

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[85] Supra, Chapter One, notes 86-94 and accompanying text.

prohibitory[86] and quia timet[87] injunctions seem effective in controlling pollution, they are equitable remedies given only at the discretion of the courts. The uncertainty in the availability of injunction makes it unreliable.

The irresistable conclusion is that both the common law and civil law delict are specifically designed to protect and resolve conflicting individual interests rather than the broader societal interests such as ambient groundwater protection. It is true that the protection of every individual's interest may be tantamount to the protection of the interest of the society at large. However, not every individual can afford the time and expense required in litigating groundwater contamination as it affects him or her.

With the exception of the protectable rights principle, nuisance actions are tied to proprietary right, a formidable barrier to groundwater protection as a whole. Even the protectable rights principle is also tied to the individual[88] directly affected by groundwater pollution and not to the public at large.

It suffices that:

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[86] McKie v. K.V.P. Co. supra note.... affirmed (1949) S.C.R. 698; Richmond Hill v. Stephens (1956) 1 D.L.R. (2d) 569, (1956) O.R. 88; Burgess v. Woodstock (1955) O.R. 814, (1955) 4 D.L.R. 615; Imperial Gas Light and Coke v. Broadbent (1859) 7 H.L.C. 600 at 612, 11 E.R. 239 at 244; Shelfer v. London Electric Lighting Co. (1895) 1 Ch. 287 (C.A.); Morris v. Redland Bricks Ltd. (1970) A.C. 652.

[87] Gauthier v. Naneff (1971) 14 D.L.R. (3d) 513: This injunction stops the carrying on of an activity which has the potential of causing pollution.

[88] The individual need not own land. It is enough that he is entitled to the groundwater, see Ballard v. Tomlinson supra note 45, Steidman v. Erickson Gold Mining Co. supra note 48.

> ... the common law is useful for an individual or a group with a property interest, sufficient resources, and determination to assist the general environment through the vindication of private property rights. At the same time this combination of prerequisites will occur so rarely that it is illusory to look toward the common law as a systematic tool with which to improve the environment.[89] (emphasis added).

Legislation must, therefore, intervene to give groundwater the needed protection.

B. THE ROLE OF THE FEDERAL GOVERNMENT IN GROUNDWATER PROTECTION-CANADA

As in the case of groundwater use rights, groundwater protection is, by virtue of the Constitution, primarily under the jurisdiction of the provincial governments. Therefore, unless groundwater contamination is accepted as one interconnected problem - a matter of national concern[90] - the federal government can only address groundwater problems indirectly. However, it has jurisdiction over interprovincial groundwater and groundwater in the Territories[91].

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[89] P.S. Elder, "Environmental Protection Through the Common Law" (1973) 12 West Ont. L. Rev. 107 at 112. See also, J.C. Juergensmeyer, "Common Law Remedies and Protection of the Environment" (1971) 6 U.B.C. l.Rev. 215 at 234-237.

[90] See supra, Chapter Two.

[91] The Territories are discussed along with the provinces because their environmental protection legislation is enacted by their individual governments and not by the federal government.

I. LEGAL FRAMEWORK:

a) CONTAMINANT-FOCUSED LAWS:

Owing to the constitutional division of powers, there is no comprehensive legal framework for groundwater protection. The only water legislation is the Canada Water Act which, as discussed earlier, is not as comprehensive as it purports to be as the federal government cannot directly deal with water within the boundaries of each province. Furthermore, the water management powers of the federal government under ss.5 and 6 of the Act to date have been prominently exercised only in respect to surface water.[92] The failure to establish water quality management areas as provided under the Act[93] underscores the weak position of the federal government when it comes to taking direct action to protect both surface and groundwater.

The federal role in groundwater protection as a whole has been only incidental. Most federal environmental laws are contaminant-focused. By controlling the release of contaminants, they incidentally protect groundwater. In addition, the

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[92] See infra, note 171.

[93] Supra, Chapter Two, note 32.

laws are fragmented. With the exception of CEPA, there is no comprehensive appproach to environmental protection. This will become evident from the following discussion of federal legislation.

i) Fisheries Act:

The federal government cannot effect a direct protection of groundwater under the sea coast and fisheries power. Under this power, the government regulates the quality of waters frequented by fish to the extent that fish or fish habitat are not damaged by the introduction of deleterious substances[94]. Groundwater is protected here only to the extent that aquifers recharged by surface water frequented by fish do not receive contaminants from such waters. The power is confined to fish protection and cannot be used to generally manage and protect water quality[95]. Thus a substance that negatively alters water quality may not fall under the Act because it may not harm fish or fish habitat.

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[94] Fisheries Act R.S.C. 1970, c. F-14 as amended (also reproduced in R.S.C. 1985, c.F-14). Section 33(3) of the Act was declared ultra vires the federal Parliament because it did not link the activity it prohibited with the harming of fish or fish habitat: Fowler v. R (1980) 2 S.C.R. 213 at 226. In contrast, Section 33(2) of the Act was upheld because it linked the prohibition of the introduction of deleterious substance to the harming of fish or fish habitat: Northwest Falling Contractors Ltd. v. R (1980) 2 S.C.R. 292 at 301.

[95] A.R. Lucas, "Case Comment" (1982) 16 U.B.C. L. Rev. 145.

ii) Navigable Waters Protection Act:

The exercise of navigation and shipping power is remote to groundwater protection.[96] Section 21 of the Navigable Waters Protection Act provides that

> No person shall throw or deposit or cause, suffer or permit to be thrown or deposited any sawdust, edgings, slabs, bark or like rubbish of any description whatever that is liable to interfere with navigation in any water, any part of which is navigable or that flows into any navigable water.[97]

While the primary purpose of this provision is to avoid obstructions to navigation by prohibiting the deposit of rubbish, it also prevents pollution of such waters and groundwater recharged by them.

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[96] Canada Shipping Act R.S.C. 1970 c. S-9 regulates the design, construction and operation of ships to ensure their seaworthiness and thereby minimize pollution especially from ocean- going tankers. Thus in the event of sea water intrusion into groundwater system, oil contaminats may not intrude from the sea if oil spills from ships were prevented.

[97] R.S.C. 1985, c.N-22: see also s.22. For other federal laws which might indirectly implicate groundwater quality and quantity management on the Canadian side, see International Rivers Improvement Act R.S.C. 1985, c.I-20, ss.2, 4 and 7; International Boundary Waters Treaty Act R.S.C. 1985, c.17 s.4 and Arts.II, III, IV to the schedule.

iii) Canadian Environmental Protection Act (CEPA):

Until the adoption of CEPA, a patchwork of environmental protection legislation existed at the federal level. Although a more comprehensive piece of legislation, CEPA does not directly protect groundwater. It regulates the manufacture, sale, export, import and the release into the environment of toxic substances. The federal government is required in the administration of the Act to "a) take both preventive and remedial measures in protecting the environment...and i) endeavour to protect the environment from the release of toxic substances".[98]

Section 7(1) gives the Minister of the Environment the power to

> a) establish, operate and maintain a system of environmental quality monitoring stations; b) collect, process, correlate and publish on a periodic basis data on environmental quality in Canada from environmental quality monitoring stations and from any other source; c) conduct research and studies relating... to the abatement of environmental pollution...; d) conduct research and studies relating to i) environmental contamination...; e) formulate comprehensive plans and designs for the control and abatement of environmental pollution and establish, operate and publicize demonstration projects and make them available for demonstration;...

Where appropriate, s.7(2) requires the minister to enter into agreement and cooperation with provincial governments. Under s.8 the minister is allowed to formulate environmental quality guidelines, objectives and goals, and codes of

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[98] CEPA as amended S.C. 1989 c.9, s.2. Section 3 defines environment as including water. Water is not defined. It is submitted that Parliament intends water to have a generic meaning, that is, surface and and groundwater.

practice. The Minister of Health, on the other hand, is allowed under s.9 to formulate guidelines, objectives and codes of practice in respect of the elements of the environment which impact on the life and health of the public.

In the past, toxicity of substances was not routinely assessed and in some cases it was only after substances had caused damage that they were found out to be toxic.[99] To avoid this, pursuant to CEPA, the Minister of the Environment and the Minister of Health have established a Priority Substances List which contains substances for toxicity assessment.[100] Due to the complicated process of listing substances, only 44 substances out of approximately 35,000 chemicals in use prior to CEPA were on the List as of 1989. Their assessment is scheduled to be completed in 1994.[101]

Where the Governor in Council is satisfied that a substance is toxic, he is required, upon the recommendation of the Ministers of the Environment and Health, to place the substance on the List of Toxic Substances in Schedule I. Substances on this List are subject to regulations made under s.34 which, inter alia, could be in respect of:

> (1)(a) the quantity or concentration of the substance that may be released into the environment either alone or in combination with any

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[99] Government of Canada The State of Canada's Environment (Ottawa: Government of Canada, 1991) at 21.8.

[100] CEPA s.12.

[101] Government of Canada, supra, note 99.

> other substance from any source or type of source; b) the places or areas where the substance may be released; c) the commercial, manufacturing or processing activity in the course of which the substance may be released; d) the manner in which and conditions under which the substance may be released into the environment, either alone or in combination with any other substance;...

This subsection requires that the regulations be preceded, subject to s.34(3)[102], by recommendation of the Ministers of the Environment and Health and after the federal-provincial advisory committee has been given an opportunity to give its advice under s.6. Federal-provincial cooperation is, therefore, required for the control of toxic substances.

Part VI of CEPA deals with the protection of the ocean from dumping. While this does not directly touch on groundwater protection, it keeps away toxic substances which could contaminate coastal groundwater through sea water intrusion. CEPA also prohibits the use of certain substances.[103] To ensure effective control of toxic substances not prohibited, it requires their registration.[104]

To the extent that regulations made under s.34 control the release of toxic substances into the environment, groundwater is protected.

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[102] The regulation shall not relate to substances or part thereof which in the opinion of the Governor in Council is regulated under other Acts of Parliament: for example, pesticides under the Pest Control Products Act R.S.C. 1985, c.P-9.

[103] See Part 1, Schedule II.

[104] Registration Regulation SOR/90-582: adds more toxic substances to the List of Toxic Substances in Shedule I to CEPA.

iv) Pest Control Products Act (PCPA)[105]

Pesticides pose a serious danger to water where they are carried by runoff or percolate into groundwater system. The federal agricultural power under s.95 of the Constitution gives it a dominant role in regulating pesticides and fertilizers.[106] The purpose of the PCPA as stated in the preamble is to "regulate products used for the control of pests and the organic functions of plants and animals". The Act prohibits the manufacturing, storing, displaying, distributing or using of control products under unsafe conditions.[107]

It is estimated that 500 types of pesticide compounds are registered in Canada for use in over 5,000 commercial formulations[108]. Control of pesticides is,

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[105] R.S.C. 1985 c.P-9.

[106] See supra, Chapter Two for a discussion of federal and provincial powers under the Constitution. Provinces also have power over agricultural activities but where provincial and federal exercise of power conflict, the federal power prevails: Multiple Access v. McCutcheon (1982) 2 S.C.R. 161.

[107] PCPA supra note 105, s.4(1), s.4(2) prohibits misleading labelling, advertising or packaging respecting the character, composition or safety of pest control products. Section 2 defines "control product" as "any product, device, organism, substance or thing that is manufactured, represented, sold or used as a means of directly or indirectly controlling, preventing, destroying, mitigating, attracting or repelling any pest, and includes a) any compound or substance that enhances or modifies or is intended to enhance or modify the physical or chemical characteristics of a control product to which it is added; and b) any active ingredient used for the manufacture of a control product."

[108] Government of Canada, supra, note 99, at 3.20.

therefore, important to groundwater protection.

Registration is a powerful tool for the control of pesticides. Section 6 of the Pest Control Product Regulation (PCPR)[109] requires, subject to section 5, the registration of pesticides sold, used, manufactured or imported into Canada. Under s.9 the Minister of Agriculture is empowered to specify and demand scientific information from an applicant seeking registration of a pesticide to enable the minister to assess the risks presented by the pesticide to human health, plants, animals and the environment. To be registered a pesticide must not

> lead to an unacceptable risk of harm to i) things on or in relation to which the control product is intended to be used, or ii) public health, plants, animals or the environment...[110]

The definition of "unacceptable risk" is neither provided in the PCPA nor in the PCPR. Agriculture Canada, however, adopts risk-benefit or cost-benefit analysis as a basis for determining what is "unacceptable risk".[111] This definition leans more towards economic than environmental considerations.

Pesticides are registered for a period of 5 years. Registration may, however,

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[109] C.R.C. 1978, vol.13, c.1253 as amended inter alia by SOR/88-89; SOR/88-109; SOR/88-289; SOR/88-416.

[110] Ibid s.18(d)(i)(ii).

[111] S.W. Ormrod (Director, Pesticides Division, Food Production and Inspection Branch, Agriculture Canada) "Perspective On Pesticides Evaluation" Address at the CCREM Workshop on Pesticides Use in Canada Proceedings (Toronto: CCREM, March, 1982) at 74.

be renewed.[112] Re-evaluation of registered pesticides is required from time to time to determine their toxicity and ensure that they do not present an "unacceptable risk" to plants, animals and the environment.[113] Some pesticides have been registered based on falsified or insufficient data submitted by registrants unknown to the government,[114] and the re-evaluation process is said to be very slow[115]. Consequently, registered persistent pesticide like aldicarb (Temlik) has, for example, been found in approximately 25% of groundwater samples in Prince Edward Island.[116]

A shift from heavy dependence on pesticide will be to the benefit of groundwater protection. The government has established Integrated Pest Management (IPM) program. IPM is defined as the

> combined use of chemical, biological, cultural and generic methods for effective and economical pest control with a minimum effect on target

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[112] PCPR supra, note 109, s.14.

[113] Ibid s.19

[114] J.F. Castrilli and T. Vigod, Pesticides in Canada: An Examination of Federal Law and Policy (Protection of Life Series. A Study Paper Prepared for the Law Reform Commission of Canada) (hereinafter Pesticides in Canada) (Ottawa: Law Reform Commission of Canada, 1987 reprinted 1989) at 52: lack of standard laboratory procedure also contributes to the registration of pesticides which otherwise should be denied registration.

[115] Ibid at 67-73.

[116] Ibid n.298.

organism and the environment.[117]

IPM is still at the developmental stage and does not as yet totally eliminate the use of pesticides[118]. Agriculture Canada concedes that pesticides would continue to play an important role in the IPM program.[119] The program only reduces "the exclusive dependence on chemical pesticides".[120] A major constraint to the use of IPM is the reluctance of farmers to use it. They prefer pesticides because of their proven effectiveness.[121] The farmers' preference is further justified by the fact that it is more costly to use IPM than to use pesticides.[122]

More research and studies are, therefore, needed to improve IPM so that it can out compete pesticides. A study prepared for the Law Reform Commission of Canada recommends that the PCPA be amended to require Agriculture Canada to

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[117] Pesticides in Canada supra, note 114, at 118.

[118] Agriculture Canada, Research Branch, Integrated Pest Management in Agricultural Crops in Canada (hereinafter, Integrated Pest Management) (Ottawa: Agriculture Canada, 1980) at 8.

[119] Ibid at 9.

[120] Agriculture Canada, Research Branch, Progress in Research: 1981 (Ottawa: Supply and Services Canada, 1982) at 42. See G.R.B. Webster, "Pesticides and Water Quality" in Allocative Conflict in Water Resources Management (Winnipeg: Agassiz Centre for Water Studies, University of Manitoba, 1974) at 339.

[121] Integrated Pest Management supra, note 119, at 29.

[122] Ibid at 7: According to Agriculture Canada in protecting pear and apple orchards from codling moths, for example, the use of IPM by way of sterile moth costs about $250 per hectare as against $100 per hectare it costs to use chemicals.

direct a substantial part of its pest control research budget to research into non-chemical alternatives to pest control such as IPM.[123]

As part of the efforts to minimize groundwater contamination from pesticides, two initial studies respecting pesticide applications and groundwater protection have been done under the auspices of the federal government. One of the studies identifies areas of southern Canada vulnerable to groundwater contamination by pesticides. Such areas were determined on the basis of soil charateristics and landscape.[124] The other study is a model for groundwater vulnerability to contamination with regard to soil texture and land use for an area of 30,000 km.Sq. in southwestern Manitoba and southeastern Saskatchewan.[125] These studies are useful guide for determining areas where monitoring and sampling wells can be sunk to determine whether groundwater contamination exists. Authorities could be guided by the studies

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[123] Pesticides in Canada supra, note 114, at 119.

[124] B. McRae, The Characterization and Identification of Potentially Leachable Pesticides and Areas Vulnerable to Groundwater Contamination by Pesticides in Canada (Ottawa: Pesticides Directorate, 1989, reprinted 1991) at 9-19, 27: "in general a vulnerable area can be characterized by the following factors: sandy or sandy loam soil texture in a homogenous soil profile, low organic matter and clay content, low soil temperature, low microbial activity in the soil, high soil permeability, high precipitation or irrigation and low evapotranspiration (high recharge), flat topography, and shallow unconfined aquifers".

[125] A.M. Turner, In press The Mapping of Relative Vulnerability of Groundwater Due to Contamination from Agricultural Pesticide: A GIS Approach Contract Report for National Hydrology Research Institute, Saskatoon (Ottawa: Environment Canada, date omitted).

to know areas where pesticides application is to be prohibited or restricted. And to restrict or prohibit, in order of risks posed, the use of pesticides identified to be leachable. The studies are however, only experimental.[126]

v) Fertilizers Act:

Like pesticides, fertilizers used in growing crops are a serious source of groundwater contamination. The Fertilizers Act prohibits the sale or import of any fertilizer or supplement thereof into Canada unless it conforms to prescribed registration, standards, packaging and labelling, and harmless to plants[127].

Unfortunately, the only relevance the Act has to groundwater protection is that it regards fertilizer-pesticides registered under the Act as registered under the PCPA so that the "unacceptable risk" test for registering pesticides applies to them.[128]

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[126] Government of Canada supra, note 99, at 3.10.

[127] R.S.C. 1985 c.F-10 as amended 1985 R.S.C. (Ist Supp.) c.31, s.9, s.3, s.4; Fertilizers Regulations C.R.C. 1978, vol.6, c.666 as amended by SOR/78-863; SOR/79-365; SOR/85-543; SOR/85-558; SOR/85-688; SOR/85-543; SOR/91-441, s.3.1(3)(c) exempts certain fertilizers and supplement from registration for example, "supplements sold only for correction of soil acidity or alkalinity"; ss.4 and 5 provide for registration and the procedural requirements.

[128] Fertilizers Act supra, note 127, ss.8(1), 9.

vi) General Comments on CEPA, PCPA and the Fertilizers Act

The slow process of toxicity assessment under CEPA and the Pest Control Products Act means that toxic substances the toxicity of which is yet to be assessed would remain in use until they are assessed and regulated accordingly. Given the delayed effect of groundwater contamination, this poses a more precarious situation for groundwater protection. Providing a time limit within which registrants are to re-evaluate their products and submit the data to the government would help to speed up the process particularly were the government is geared to suspend or cancel a registration for failure to meet the dead line.

Evidence of harm traceable to a particular substance is scientifically difficult to obtain especially when several years have elapsed between the use of a substance and its effect.[129] This is even worse in the case of groundwater because of the delayed effect of substances. Therefore, the cost-benefit or risk-benefit analysis approach adopted by Agriculture Canada in determining "unacceptable risk" under PCPR for purposes of registering pesticides, is an improper tool for assessing the risk posed to groundwater by any particular pesticide. The delayed effect is unknown and unknowable and cannot, therefore, be extrapolated into a cost-benefit or risk-benefit

[129] R.T. Franson et al, Canadian Law and the Control of Exposure to Hazards Background Study No.39 (Ottawa: Science Council of Canada, 1977) at 55-56.

analysis[130].

Determining "unacceptable risk" purely upon the nature and degree of the risk presented would promote groundwater protection because it would warrant denial or cancellation of registration of pesticides which cause serious groundwater contamination. Because government has not taken this position, the result is that groundwater protection is not a factor directly taken into account in deciding whether or not substances should gain either initial or renewed registration. This partly explains the registration of persistent pesticides like aldicarb which cause serious groundwater contamination. It is, therefore, recommended that

> the Pest Control Products Act or the Pest Control Product Regulations should be amended to require consideration of groundwater contamination potential when pesticides are proposed for registration or re-evaluation[131].

Unfortunately, this recommendation is yet to be reflected in any of the amendments to the PCPR. The recommendation is also good for registration of fertilizers under the Fertilizers Act and regulations made thereunder and for registration of toxic substances under the Registration Regulation made under CEPA. This proposition will pass constitutional test. The "pith and substance" of the entire regulation proposed to be amended by this proposition is the regulation of toxic substances. The reference to groundwater contamination is only collateral to the main

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[130] See supra, Chapter Two under sub-heading "Economic Approach to Environmental Protection" for a more detail discussion on this point.

[131] Pesticides in Canada supra, note 114, at 53.

object of the regulation and this, as stated earlier[132], cannot void the regulation.

vii) Regulation of Underground Storage Tanks:

Another major source of groundwater contamination is the escape of petroleum and associated products from underground storage tanks (USTs). There are about 200,000 USTs in Canada most of which were installed in the 1950s and 1960s and were made of non-corrosion resistant materials[133] which were the "state of the art" at the time. Given that the life span of such USTs is between 20 and 25 years, they were supposed to have been replaced by the end of the 1980s. However, the location of some abandoned USTs is not well documented and some have even been forgotten.[134] Consequently, it is estimated that about 10% of existing USTs are leaking.[135] This is of great concern because a litre of petroleum or associated

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[132] See supra, Chapter Two, note 94.

[133] D.A. Doyle, "Storage Tank Regulation" in The Canadian Institute Second Annual Western Canadian Management and Environmental Liability: Management Operational and Risk Prevention Techniques for Underground Storage Tanks (hereinafter The Canadian Institute) (Toronto: The Institute, 1990) 1.

[134] P.C. Wilson "Regulation of Storage Tanks in British Columbia" in The Canadian Institute supra, note 133, at 6 of its own section in the publication.

[135] Doyle supra, note 133.

products can contaminate several thousand litres of groundwater.[136]

There is no comprehensive federal legislation or regulation on USTs at present. There is, however, a Federal Underground Storage Tanks Regulations in the making.[137] There are also regulations on the storage of specific chemicals or substances in areas of federal jurisdiction. These regulations prescribe design and construction standards for tanks used in storing these substances aimed at preventing leaks which otherwise may contaminate groundwater. They, however, protect groundwater incidentally.

The Flammable Liquids Bulk Storage Regulations control the release of flammable liquids from stationary bulk storage facilities located in places under the control of the Canadian Transport Commission by requiring such storage facilities to be made of non-corrosive materials.[138] It also requires the storage facilities to be buried in places located away from pressures which might cause explosion.[139]

Under the Ammonium Nitrate Storage Facilities Regulations only storage facilities containing more than 3,000 pounds of ammonium nitrate or ammonium

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[136] The Association of Professional Engineers in the Province of British Columbia, Control of Leaking Underground Storage Tanks A Brief to the British Columbia Government (Vancouver: The Association, September 1989) 1.

[137] (1991) 8:2 The Environmental Compliance Report, 3.

[138] C.R.C. 1978 vol.12, c.1148, s.3, 27(1).

[139] Ibid s.20(4)(6).

nitrate mixed with fertilizers are controlled.[140] The facilities are required to be constructed in such a way as to prevent the ingress of rain and groundwater.[141] These regulations are narrow in their application in terms of areas and specific chemical substances.

Underground storage tanks containing flammable combustible liquids are required under the National Fire Code of Canada 1990 to be constructed of non-corrosive materials[142] and tested for leakage before installation.[143] The liquid levels of USTs and the water levels at the bottom are generally measured in a certain way.[144] When the level of water at the bottom of a UST increases in excess of 50mm or the records show a loss of the liquid content of a UST and a gain of water, then leak is detected and immediate corrective action is required and the authority concerned is notified within 24 hours.[145] Section 4.10 deals with procedures for abandoning and removal of tanks to avoid leakage.

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[140] C.R.C. 1978, vol.12, c.1145, s.4

[141] Ibid s.20.

[142] National Research Council of Canada, National Fire Code of Canada 1990 (Ottawa: The Council, 1990): this updates the National Fire Code of Canada 1985, ss.4.3.8, 4.3.9: the standard construction material is Canadian Standard: CAN4-S603.1.

[143] Ibid s.4.3.16, Under s.4.3.16.3 a tank discovered to be leaking must be replaced and the contaminated soil treated in accordance with ss.4.1.9.1, 4.3.8.8.

[144] Ibid s.4.3.17.

[145] Ibid s.4.3.17(4).

The two regulations previously examined and the National Fire Code are primarily concerned with preventing the outbreak of fire from flammable combustible liquids stored in USTs. They protect groundwater marginally: only to the extent that they prevent leaks from USTs.

It came as no surprise, therefore, when the Canadian Council of Resource and Environment Ministers (CCREM) established the National Task Force on Leaking Storage Tanks to examine environmental problems posed by leaking USTs and to find a solution to them. The Task Force developed a code containing minimum requirements for the design, construction, siting, installation, operation and maintenace of USTs designed primarily to protect groundwater against petroleum contaminants from USTs.[146] The Environmental Code is specifically designed to protect groundwater and is, therefore, discussed in more detail.

Under s.1.1.2 of the Code all categories of petroleum USTs are regulated. There is no exception. This is sound given the serious contamination potential of petroleum. Section 2.2.1 requires the owners of existing USTs to register them in a prescribed manner within a given time frame.[147] Owners of new USTs are required

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[146] Environmental Code of Practice for Underground Storage Tank Systems Containing Petroleum Products 1988 (Revised Edition) (hereinafter Environmental Code) at vi.

[147] Ibid s.2.2.5: the obligation on the part of a new owner to notify the authorities of change of ownership of a UST within 30 days.

to register them prior to their construction, installation or operation.[148] To ensure compliance with this, supply of petroleum products to UST systems not duly registered is prohibited under s.2.4.1.

Proposed or existing sites for UST installations are to be assessed by the appropriate authority and classified as Class A, B or C depending on their sensitivity to the environment or human health.[149] Under s.3.3.1(2) Class A sites are the most sensitive while Class C sites are the least sensitive. Section 3.3.3(1) provides that

> in classifying a site, the authority having jurisdiction may consider factors including but not limited to a) the quality and quantity of groundwater resource that could be affected by a leak, b) the density and proximity of wells, c) the local geology, d) the proximity of bodies of water,...g) the presence in the area of geological, hydrogeological or environmental conditions... that necessitates the taking of unusual precautions to prevent the pollution of the environment.

Owners of existing or proposed USTs may be required to submit to site sensitivity assessments.[150] Construction or installation of USTs requires the prior approval of the appropriate authority under s.4.2.1. Installation of tanks must be done in a certain way and by an approved installer.[151] More sophisticated non-corrosive

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[148] Ibid s.2.3.1.

[149] Ibid ss.3.2.1, 3.2.2, 3.3.1(1); s.3.3.2: a site not specifically assessed and classified is assumed to be a Class A site.

[150] Ibid s.3.3.4(1)(2)(3), s.3.3.5.

[151] Ibid ss.4.4.1, 4.4.2(1)(2), 4.4.3, 4.4.5.

materials[152] particularly in terms of prevention of leak, leak detection and leak containment are required for the construction and installation of USTs in Class A sites[153] because groundwater is more vulnerable in such sites. Leak testing by approved methods is required for new USTs at the time of installation before backfilling and after installation before operation.[154] Leak detection test in form of measuring the level of liquid in a UST and the level of water at the bottom of it as under the National Fire Code, and comparing the results to determine liquid loss or water gain is required under s.6.4.1. There are also standards for monitoring corrosion protection provided under s.6.3.1 and s.6.3.2. Where monitoring detects inadequate corrosion protection, immediate corrective action is required under s.6.3.3.

Groundwater is chiefly threatened by contamination from existing USTs since these were not designed, constructed or installed according to current standards. Therefore, the Environmental Code provides for their upgrading and prohibits the alteration of such USTs without prior approval.[155] Unprotected tanks 25 years old

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[152] Ibid s.4.3.1(1), s.4.3.2(1): generally the construction materials for USTs' walls must meet the CAN4-S603M standard for steel underground tanks for flammable and combustible liquids, or CAN4-S615M standard for reinforced plastic underground tanks for petroleum products. See also s.4.3.2(2).

[153] Ibid s.4.2.2(1): than in Class B sites see s.4.2.3(1), and s.4.2.4(1) for Class C sites.

[154] Ibid s.4.4.7(1)(2).

[155] Ibid s.5.2, 5.3.1, 5.3.2: for upgrading of USTs in sites A, B and C.

or above are to be replaced and not upgraded[156]. These are primarily the tanks that contaminate groundwater.

Section 5.3.7 requires all existing USTs in Class A and Class B sites to be installed with acceptable leak detection systems. Furthermore, all USTs in Class A or Class B site upgraded with the addition of acceptable leak protection devices are required to have overfill or spill protection systems in the form of either "a) a catchment basin (spill protection device), or b) an overfill protection device".[157]

There are operational and maintenance requirements for USTs to ensure that they remain in good conditions and thereby minimize threat to the environment. Part 7 regulates the withdrawal from service and the removal of USTs from the ground in a manner that does not endanger the environment.

The Environmental Code is a major step towards the protection of groundwater from USTs. However, it does not require financial security on the part of owners or operators of USTs against groundwater contamination. The greatest weakness of the Code is that it is not a legislation, not even in areas under federal jurisdiction. It is noted, however, that the proposed Underground Storage Tank regulation is essentially based on the Environmental Code and is to be promulgated

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[156] Ibid Table 5.3.1 and Table 5.3.2; s.5.3.4: provides for the removal of existing single wall steel tanks not cathodically protected and which are 25 years or more.

[157] Ibid s.5.7.1.

under s.54(1)(2) of CEPA.[158]

viii) Regulation of Dangerous Goods and Hazardous Wastes:

The federal role in the transportation of dangerous goods implicates groundwater protection indirectly. Section 4 of the Transportation of Dangerous Goods Act [159] prohibits the handling or transportation of dangerous goods unless applicable safety requirements have been met and the packaging, containers and means of transport comply with applicable safety standards.[160] Thus dangerous goods are not to be transported in a way that causes them to spill and endanger the environment. For example, under s.15(1) "... emission of ionizing radiation exceeding levels or quantities prescribed pursuant to the Atomic Energy Control Act Act" from any container or packaging may be stopped by inspectors apponited to enforce the Act. Details of safety standards for the transportation of dangerous goods are set out

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[158] D. Tingley and F. Work, Underground Storage Tanks: A Legal Review 2nd ed. (Edmonton: Environmental Law Centre, 1991) at 1.1-1.2.

[159] R.S.C. 1985, c.T-19. The Act does not apply to certain dangerous goods, for example, those under the command of the Minister of Defence: s.3(3).

[160] Ibid s.2 defines dangerous goods. The schedule to the Act contains 9 classes of dangerous goods. To realize the goal of environmental protection, s.19(1) requires transporters of dangerous goods to take out insurance policy.

in the regulations made thereunder.[161]

Federal involvement in waste management is not prominent. There are, however, proposals for PCB Waste Storage Regulations and Hazardous Waste Management Regulations at Federal Facilities.[162] These would help to prevent such wastes from contaminating groundwater. Until these regulations come into force, the possibility of groundwater contamination by such wastes in areas under federal jurisdiction remains. The federal government regulates waste disposal in Indian Reserves[163] and at National Parks.[164] In these areas wastes are discharged into mere dump sites and not into landfills with engineered facilities to protect

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[161] Transportation of Dangerous Goods Regulations SOR/85-77 as amended: SOR/85-314; SOR/85-585; SOR/85-609; SOR/86-526 SOR/87-186; SOR/87-335; SOR/88-635; SOR/89-294; SOR/89-39: Part III classifies dangerous goods and requires their handling and transportation to be done in accordance with the rules governing their respective classifications. Parts VI, VII and VIII provide rules for safety standards and requirements for each class of dangerous goods. Part IX provides, inter alia, for the registration of manufacturers of dangerous goods offered for transportation.

[162] (1991) 8:2 The Environmental Compliance Report, 3.

[163] Indian Reserve Waste Disposal Regulations C.R.C. 1978, vol. 10, c.960, s.3: "No person shall operate a garbage dump in a reserve, or b) use any land in a reserve for the disposal or storage of waste, except under the authority of a permit issued pursuant to paragraph 5(a) or (b) and in the manner specified in the permit."

[164] National Parks Garbage Regulations C.R.C. 1978 vol.11, c.1123, s.6; See National Parks Water and Sewer Regulations C.R.C. 1978 vol.11 c.1134, s.9. Waste disposal in the Northwest Territories and the Yukon Territory is governed by the regulations made by their respective governments. This is discussed together with the provinces.

groundwater from leachate infiltration.

ix) Environmental Assessment:

The requirement of environmental impact assessment for projects could help to discover potential damage to groundwater and to avoid it. The federal Environmental Assessment and Review Process Guidelines Order demands environmental assessment for any project that a) is to be undertaken by a federal department, b) may have an environmental effect in areas of federal responsibility, c) for which the federal government is financially committed, or d) that is to be located on lands administered by the federal government.[165] A fortiori, any of the aforementioned projects that would lead to groundwater contamination may be discontinued or be required to to be handled in a way that would protect groundwater.

b) GENERAL COMMENTS ON CONTAMINANT-FOCUSED LAWS:

Owing to the constitutional division of powers which vests the ownership of

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[165] Environmental Assessment and Review Guidelines Order SOR/84-467, s.6; see also, ss.10, 11, 12, 20. See also, Bill C-13, An Act to Establish a Federal Environmental Assessment Process, 3rd Sess., 34th Parlaiment, 1991 which has now passed but yet to be in force.

groundwater resource including its environmental concerns in the provinces, the federal laws above examined make only a marginal and often indirect contribution to groundwater protection. The laws are fragmented and sectoral in approach. For example, the Fisheries Act deals only with contaminants which negatively affect fish or fish habitat. This is also true of the Navigable Waters Protection Act, the PCPA, the Fertilizers Act and the various flammable liquid storage regulations. The CEPA which seems to be more comprehensive is not specifically directed to groundwater protection. It has also been demonstrated that the Canada Water Act which purports to be comprehensive is not so afterall. The federal delimma is that it has no legal power to do more than this.

Furthermore, some of these laws are particularly concerned with surface water, and not even in areas of federal jurisdiction, do they directly protect groundwater. It is misguided for federal laws to focus on one aspect of the hydrologic cycle, namely: surface water as if it is hydrologically unconnected with groundwater.

Even where the laws are made more comprehensive, they will, at best, engage federal efforts directly in the protection of groundwater only in the areas of federal jurisdiction. They cannot lead to direct federal role in protecting groundwater in the provinces. The constitutional division of powers would not permit this. A non-binding cooperative way must, therefore, be adopted to achieve what, on purely legal basis, is impossible. Federal cooperative efforts with the provinces to address groundwater

contamination problems are articulated in its policy discussed below.

II. FEDERAL POLICY ON GROUNDWATER:

In recognition of its limited role to groundwater protection, the federal government has attempted to take a guiding role by way of certain policy tools. Federal policy on groundwater protection is, in large part, resource-focused. This will be demonstrated from the following discussion of federal water policy and strategy.

a) RESOURCE-FOCUSED APPROACH:

i) Policy Goals and Progress:

The Guidelines for Canadian Drinking Water Quality 1987 set the maximum acceptable concentration (MAC) of chemicals in drinking water.[166] The Guidelines apply to all drinking water supplies including groundwater, public or private. They are, however, generally not legally enforceable.[167] The aim of the Guidelines is to set surface and groundwater drinking water quality standards in areas of federal

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[166] Federal-Provincial Subcommittee on Drinking Water, Guidelines for Canadian Drinking Water Quality (Ottawa: National Health and Welfare, 1987) at 11-15.

[167] Ibid at 7.

jurisdiction and to serve as a model which the provinces may adopt. The absence of federal legislation on safe drinking water compels the need for such guidelines. A federal government report states:

> Canada is one of the few developed nations that does not have national drinking water legislation. NHW is examining the legislative options for drinking water, and plans are in place to introduce legislation for a Canada Drinking Water Safety Act, although no date has been set.[168]

So far, only Quebec and Alberta have adopted the Guidelines as provincial legislation.[169] The other jurisdictions use the Guidelines to control municipal drinking water quality, but not as enforceable rules.[170]

Until the 1987 Federal Water Policy, there was no federal groundwater policy and little attention was paid to groundwater quantity and quality management. Federal attention has always been focused on surface water.[171] The 1987 Federal

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[168] Interdepartmental Committee on Water Federal Water Policy. A Progress Report (hereinafter Progress Report) (Ottawa: The Committee, March 1990) at 34.

[169] Government of Canada supra, note 99, at 3.24: a similar legislation is pending in Ontario.

[170] Ibid.

[171] The Canada Water Act supra Chapter Two, notes 25-27 and the accompanying text. See also, CELRF supra, Chapter Three, note 55, at 138: Pursuant to the Canada Water Act, the Water Survey Canada collects, stores, interpretes and distributes data on river and stream discharges, flow, depth, width and lake levels. Data are stored at the national water data bank, HYDAT. Research on water quantity and quality is undertaken by the National Hydrology Research Institute. It is evident that the emphasis on rivers suggests greater attention to surface water.

Water Policy acknowledges federal neglect of groundwater protection in relation to surface water protection. It recognizes the inter-connection between surface and groundwater and the fact that the contamination of one could lead to the contamination of the other.[172] The policy emphasizes the need for federal and provincial cooperation and the need for an adequate groundwater data base as crucial for addressing groundwater contamination problems. The federal government sums up its goals as follows:

> (to) develop with provincial governments and other interested parties, appropriate strategies, national guidelines and policies for groundwater assessment and protection; conduct research and undertake technological development and demonstration projects in response to groundwater problems; develop examplary groundwater management practices involving federal lands, responsibilities, facilities and federally funded projects; develop measures to achieve appropriate groundwater quality in transboundary waters; and provide information and advice on groundwater issues of federal and national interest.[173]

In pursuit of these policy goals, the Department of the Environment (DOE) has been consulting other federal government departments, provinces and the university community with a view to fashioning appropriate strategies. It has become clear that groundwater contamination should be dealt with as an integral part of the overall groundwater management.[174] The DOE, in cooperation with other federal

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[172] Environment Canada, Federal Water Policy (Ottawa: Environment Canada, 1987) at 19.

[173] Ibid at 19.

[174] Progress Report supra, note 168, at 28.

departments like the Department of Agriculture (DOA) and the Department of Energy and Mineral Resources (EMR), has been improving its data base on regional and national groundwater contamination. It is also involved in joint projects with the provinces and territories mainly on pesticides management and research studies which would be used for the development of guidelines for deep well disposal and the prevention of contamination of groundwater well.[175]

Research and studies on groundwater contamination are being carried out, and it is reported that some modern equipment for groundwater monitoring and sampling has been developed.[176] Progress on developing examplary groundwater management practices at the federal level is reported as follows:

> Existing groundwater management practices focus on the environmental assessment of proposed developments (mines, pipelines and impoundments, etc.) and the investigation of adverse impacts of existing groundwater contamination (chemical waste disposal sites, spills etc.). A preliminary feasibility study of groundwater assessment at federal facilities was conducted at the Atlantic Region.[177]

Agencies such as the Prairie Provinces Water Board (PPWB) Committee on Groundwater are handling the monitoring of interprovincial groundwater quality. But owing to lack of resource plans, the establishment of networks for monitoring groundwater quality affected by long-range transport of airborne pollutants are yet

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[175] Ibid.

[176] Ibid at 28-29.

[177] Ibid at 29.

to be implemented.[178] A more significant progress has been recorded in respect of federal provision of information and advice to the provinces and the general public on groundwater contamination and remediation.[179]

ii) DOE's Approach To Groundwater Protection Problems:[180]

In spite of the progress made thus far, on a national basis, the DOE has identified some areas where groundwater management suffers significant deficiencies. The provinces share the deficiences in varying degrees in the areas of

> 1) resource evaluation - i.e. aquifer identification and assessment; 2) aquifer management - planning and operations; ...conjunctive surface and groundwater planning and operations, e.g. planning and development of artificial recharge projects.[181]

These are crucial elements of groundwater protection. It is impossible, for example, "to protect an aquifer from contamination if it has not been delineated and its characteristics determined".[182]

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[178] Ibid.

[179] Ibid.

[180] The only authoritative information on this is contained in DOE Groundwater Strategy supra, Chapter One, note 77. Therefore, this segment of this chapter relies primarily on this source.

[181] Ibid at 18.

[182] Ibid.

However, national guidelines, objectives and standards have been proposed for various aspects of groundwater protection including but not limited to

> standard procedures for groundwater sampling and chemical analysis; national standards for exchange of hydrogeological data; minimal national standards for aquifer protection; hydrogeological guidelines and standards for landfill siting, construction and operation...[183]

The provinces can improve their groundwater protection by adopting these guidelines as they suit their hydrogeological environment. When the guidelines are finalized, they will represent a major federal contribution to groundwater protection. Information, research and studies upon which such guidelines are based demand great expense which the provinces might not be able to afford without failing to meet the legitimate financial needs of other areas of their responsibilities.

The DOE's strategy for groundwater management which includes groundwater protection is summed up as follows:

> simultaneously encompass both quantity and quality concerns; emphasize prevention of future groundwater contamination in addition to solving existing problems...; provide for close, cooperative arrangements with the provinces and the private sector; recognize the interconnectedness of all parts of the hydrologic cycle and of the ecosystems in which water plays a vital role....[184] (emphasis added).

Clearly, the strategies emphasize not only the need for a unified federal and provincial efforts but also the propriety of adopting a "holistic" approach which

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[183] Ibid at 23.

[184] Environment Canada, DOE Groundwater Strategy A Management Approach to Groundwater Issue (Ottawa: Environment Canada, 1990) (being a summary version of DOE Grounwater Strategy supra, note 180) at 8.

embraces the various interconnected components of the hydrologic cycle including the ecosystems. Furthermore, both contaminant-focused and resource-focused elements of groundwater protection are present in the strategies.

Crucial to the implementation of the strategies is 1) a cost-sharing federal-provincial cooperation in developing compatible groundwater management systems encompassing guidelines for various aspects of groundwater problems, data banks, management strategies such as the use of economic incentive and other management tools, to be in place within 5 years; 2) also required is the appointment of a chairperson to coordinate the DOE's and other federal departments' groundwater activities and to serve as a contact with the provinces.[185] Other implementation processes include 3) developing federal groundwater management plans, assessing and upgrading the capabilities of appropriate federal departments especially in the areas of data collection, technology transfer and technical training; and 4) initiating, improving and coordinating research and demonstration projects in areas that are hitherto neglected[186]

As of December 1990, the implementation periods of various aspects of the strategies ranged from immediate to five years.[187]

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[185] Ibid at 10-13.

[186] Ibid.

[187] Ibid at 15-17.

b) GENERAL COMMENTS ON RESOURCE-FOCUSED APPROACH:

Although the Federal Water Policy recognizes the problem presented by protecting surface water separately from groundwater, it seems an integrated protection approach for the hydrologic cycle has yet to be put into practice. As John Gilliland, Special Advisor (federal) Groundwater Section put it,

> while we all pay lip service to the concept that each component of the hydrologic cycle is intimately related to the others, all too often we insist on dealing with these components as if they were completely isolated.[188]

Adequate funding is necessary both to deal with the hydrologic cycle in an integrated fashion and to meet other policy goals. Regrettably, because the federal government has always understood its role in groundwater protection as limited[189], its funding involvement has been accordingly limited. There is no specific federal funding for the implementation of the Federal Water Policy as it relates to groundwater. According to one scholar,

> Since 1987, federal funds directed at groundwater issues have declined. The number of groundwater researchers in Environment Canada has gone from more than 20 in 1984 to less than ten today. Federal funding for water research in universities which was considerable in the 1970's,

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[188] "Groundwater Contamination and the Hydrologic Cycle" (1990) 15 (No.1) Canadian Water Resources J. at 2.

[189] A.J. Roman and D. Ferris, "Regulation of Groundwater Contamination in Canada" (1989) 65 Chicago-Kent Law Rev. 519 at 525.

> diminished to almost nothing by the mid 1980's and did not increase as a result of the 1987 (federal water) policy.[190]

The DOE itself complains that it is underfunded by the federal government and that this may affect its activities to meet the groundwater protection goals set out in the Federal Water Policy[191]

One important way of demonstrating its commitment to groundwater protection would be for the federal government to provide adequate funding for groundwater programs contemplated in its policy. And beyond this, the government should use economic incentives to promote groundwater protection in both areas of federal and provincial jurisdictions. This can be done by financially supporting groundwater protection projects or programs and practices. Providing subsidies, loans or tax incentives for the aquisition of technology which minimizes groundwater contamination should also help. The same is true of not promoting developments in areas vulnerable to groundwater contamination.[192]

If groundwater protection programs directed to the provinces proceed on the basis of federal-provincial cooperation and are backed by federal funding, provinces would be encouraged to a greater commitment to groundwater protection. Such

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[190] J.A. Cherry, "Groundwater Protection The Lack of Government Action in Canada" (Nov./Dec. 1989) Hazardous Materials Magazine, at 20.

[191] DOE Groundwater Strategy supra, note 180 at 50-53.

[192] Ibid at 21-22.

federal measures are important since the provinces, as we shall see,[193] do not have comprehensive or strong legislation to protect groundwater from contamination. Most still rely on often vague general environmental legislation to protect groundwater. Apart from the inadequacy of such legislation to deal with groundwater concern, their enforcement is often loose.[194] Some writers have observed that general environmental legislation is left weak or its enforcement is not strictly executed because governments do not want to scare away industries which boost their economies.[195]

The Federal Water Policy and the Progress Report[196] indicate clearly that groundwater protection is, at best, at the developmental stage. The policy goals and the strategies developed by the DOE can be offered to the provinces to improve their groundwater protection programs. However, these policy goals and strategies need to be developed further if the challenges posed by groundwater contamination are

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[193] See infra, Chapter Five.

[194] "Groundwater protection The Lack of Government Action in Canada" supra, note 190 at 18, 21; J.A. Vonhof Ground Water Issues: An Overview Inquiry on Federal Water Policy Research Paper #14 (Available at Inland Water Directorate, Ottawa, May, 1985) at 75.

[195] R. Northey, "Conflicting Principles of Canadian Environmental Reform: Tubeck and Habermas v. Law and Economics and the Law Reform Commission" (1987-88) 11 Dalhousie L.J. 639 at 646-649. See Law Reform Commission of Canada Crime Against the Environment Protection of Life Series Working Paper 44. (Ottawa: Law Reform Commission of Canada, 1985) at 23-26: analyzes the social utility of pollution but regets an absolute or blanket use of it to decide pollution tolerance.

[196] See supra note 168.

to be met. Recommendations on the appropriate improvements will be made after the American position has been considered.[197]

It should be emphasized that a combined application of contaminant-focused and resource-focused approaches by federal and provincial governments in a unified fashion would serve groundwater protection better than the fragmented traditional approach which emphasizes only the contaminant-focused approach. This will become evident from a discussion of the American experience.

C. THE ROLE OF THE FEDERAL GOVERNMENT IN GROUNDWATER PROTECTION-UNITED STATES

As was demonstrated[198], judicial interpretations of the powers of Congress have given Congress elaborate powers to make laws with far-reaching effect on groundwater protection. State laws often adopt federal regulations and, where appropriate, are tailored to suit local circumstances.

The contaminant-focused and resource-focused approaches to groundwater protection are more advanced in the United States. A combined application of these approaches under a unified effort of the federal and state governments is significantly helping groundwater protection in this country. This is evident from the following

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[197] Infra, notes 233 et seq. and accompanying text.

[198] See supra, Chapter Two.

discussion.

I. LEGAL FRAMEWORK:

There is no single comprehensive federal law addressing groundwater concerns. Rather, as is the case in Canada, provisions on groundwater protection are scattered over different federal environmental protection laws dealing with different sources of groundwater contamination.[199] The following is a review of major legislation which ~~are~~ is relevant to groundwater protection. Since this writer seeks to argue that the U.S. approach may serve as a model solution to Canadian problems, this review attempts to provide a clearer understanding of the American approach and to lay the foundation for its application to Canadian problems. As the U.S. approach is both contaminant and resource-focused, it is more responsive to and conscious of groundwater concerns.

The relevant legislation protects groundwater in a rather technical way. This is due to the subterranean location of the resource so that in the discussion that follows, some technical provisions are given.

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[199] E.I. Selig, "An Overview of Laws Dealing with Groundwater" in Groundwater Quality Symposium supra, Chapter One, note 105, at 3-4.

a) CONTAMINANT-FOCUSED LAWS:

i) Resource Conservation and Recovery Act (RCRA):[200]

This Act applies only to solid wastes as defined under s.1004(27) and to hazardous wastes as defined under s.1004(5).

The objective of the Act includes but is not limited to: converting existing open dumps to facilities which do not pose danger to human health and the environment and prohibiting future open dumping on land; ensuring proper management of hazardous and solid waste in a manner that protects the environment and to ensure federal-state parnership in carrying out the purposes of the Act[201]

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[200] 42 U.S.C. SS.6901 et seq., Pub. L. No.94-580, approved Oct. 21, 1976; as amended by Pub. L. 99-499, (1984 Hazardous and Solid Waste Amendment) approved October 17, 1986. The sections used here are those of the Act itself and not the corresponding sections under the USC. Subtitle "C" of the Act deals with industrial waste management; Subtitle "D" deals with municipal waste management and Subtitle "I" deals with leaking underground storage tanks.

[201] Ibid s.1003.

1) Industrial Hazardous Wastes:

Hazardous wastes are regulated by permit system[202] from "cradle to grave", that is, from their generation to final disposal. Waste is monitored by means of a manifest system at each stage of disposal involving the generators and transporters of it.[203]

Of great importance to groundwater protection under the Act is s.3004. Section 3004(a) requires the US Environmental Protection Agency (EPA) to establish by federal regulation strict standards for design, construction, location, and operation of hazardous waste treatment, storage and disposal (TSD) facilities that are necessary to protect the environment and human health. Such standards are to include requirements respecting monitoring well to detect groundwater contamination, contingency plan to minimize unanticipated damage caused by the facilities, corrective measures and financial responsibility guarantees on the part of the owners or operators of the facilities.[204]

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[202] Ibid s.3005.

[203] Ibid ss.3002, 3003. Manifest system is discussed infra Chapter Five, notes 51-53.

[204] Ibid s.3004(a); s.3004(b)(c)(d)(e)(f) generally prohibit the disposal of certain liquid hazardous wastes in landfills and prohibits underground injection of waste practices. There are, however, few exceptions which the EPA Administrator is required to administer. But the prohibitions would become absolute ten years after

Operating standards have been established by regulation for existing and new disposal facilities and these are incorporated into permits issued thereunder[205]. Landfills under ss.264.300-264.317 and surface impoundments under ss.264.220-264.249 of the regulations are required to have double liners and a leachate collection and removal system in between the liners and above them to prevent the migration of waste to groundwater. The subsections also require groundwater monitoring. To ensure that the standards of groundwater quality prescribed by the EPA under s.264.94 are maintained monitoring wells are required to be placed downgradient and upgradient of the facilities. Where the standards are exceeded, a compliance monitoring program is required to be put in place and where the violations continue, corrective actions are required to be taken.[206]

Performance requirements for TSD facilities vary depending on the nature of such facilities. Some of these requirements are crucial to groundwater protection. For example, under s. 265.253 of the regulations owners and operators of such facilities are required to show that hazardous wastes treated at their facilities were rendered harmless. Or where, for example, waste pile approach is followed, the wastes are required to be placed in or on liners that protect them from precipitation or runoff and consequently prevent leachate production.

Under s.3006 of the Act, States would get EPA authorization to administer

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[205] 40 Code of Federal Regulations C.F.R. Parts 264 and 265.

[206] Ibid s.264.97-264.101.

hazardous waste programs where their programs are equivalent to and consistent with those of the EPA and with adequate enforcement mechanism in place. The incorporation into the EPA permitting standards of groundwater monitoring and response program and of "liquids management strategy" intended to minimize and remove leachate production promotes groundwater protection.[207]

2) Solid Waste Disposal:

Solid wastes which do not fall under the definition of hazardous waste under the Act are primarily left to the States to manage. But under ss.1008(a)(2)(B) and 4010(c) of the Act, the EPA Administrator has the mandate, after studies and consultation with states and municpalities, to establish guidelines for solid waste management facilities and appropriate methods for the "protection of the quality of groundwaters and surface waters from leachates."

Also, s.4004(a) requires the EPA to establish guidelines setting out criteria for classifying solid waste management facilities as "sanitary landfill" or "open dumps". At the minimum, a facility is classified "sanitary landfill" and not "open dump" where wastes disposed in it do not pose reasonable probability of adverse effect on health or the environment.

Once the EPA has provided criteria under s.1008(3) for States to use to

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[207] Patrick et al, supra Chapter One, note 121, at 379.

classify waste sites as "sanitary landfills" or "open dumps", States are required under s.4005(a) to close down waste disposal facilities or sites which fall under "open dumps" classification. To assist States in such classification, the EPA Administrator is required under s.4005(b) to publish inventory of all disposal facilities or sites in the U.S. which are "open dumps".

States are required to submit waste disposal management plans stating the information required under s.4003. In its plan under this section, a State must, inter alia, prohibit the establishment of new "open dumps" as required under s.4004(b) and must close or upgrade existing ones as required under s.4005. It should also provide adequate implementation and enforcement mechanisms. Where such plans are approved under s.4007 by the EPA, the State is entitled to federal technical and financial assistance in managing the wastes. Section 4006 requires States to promulgate regulations conforming to the EPA guidelines for waste management once such guidelines have been promulgated.

Pursuant to the Act, the EPA has established some guidelines.[208] The guidelines provide that a waste disposal facility or site is an "open dump" if it contaminates groundwater serving as a source of drinking water or containing less than 10,000 mg/L total dissolved solids. Contamination is deemed to have occurred where contaminant levels exceed the MCLs under the Safe Drinking Water Act (SDWA). In the case of groundwater already contaminated beyond the MCLs, any

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[208] (1987) 40 C.F.R. s.257.3

additional or increase of the contaminants is deemed contamination. Such "open dumps" are required to be closed under s.4005.

3) Leaking Underground Storage Tanks:

The Act applies to USTs[209] containing not only petroleum but also regulated substances as defined under s.101(14) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).[210]

Owners of existing USTs are, under s.9002, given specified period of time to notify the authorities of the location, age, size, type and uses. Section 9003(a) mandates the EPA Administrator to promulgate regulations for USTs release detection, prevention and correction as may be necessary to protect the environment

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[209] RCRA supra, note 200: Section 9001(1) defines UST as "any combination of tanks...which is used to contain an accumulation of regulated substances and the volume of which...is 10 per centum or more beneath the surface of the ground". This definition does not include types of USTs specified in s.9001(1)(A)-(B) which, for example, include farm or residential tank of 1,100 gallons or less capacity used for storing motor fuel for non-commercial purposes. The exemptions, if not regulated, may pose serious danger to groundwater because a litre of such substances can contaminate several thousands litres of groundwater. For this reason s.9009(d) requires the EPA Administrator to "conduct a study regarding the tanks referred to in section 9001(1)(A) and (B). Such study shall include estimates of the number and location of such tanks and an analysis of the extent to which there may be releases or threatened releases from such tanks into the environment" Section 9001(e) provides that the result of the study and recommendation of the Administrator would determine whether or not the exemptions would be lifted as to apply the appropriate provisions of the Act to such tanks.

[210] Ibid s.9001(2).

and human health. In promulgating such regulations, the Administrator may, under s.9003(b), take into account among others, the location and use of the tanks and the soil characteristics, hydrogeology and water table. The regulations are to incorporate, among others, requirements for maintaining leak detection and inventory control systems; maintaining records of groundwater monitoring, leak detection, tank testing or inventory control system; reporting of releases and corrective action taken; taking a corrective action in response to releases; closing of tanks to prevent future releases; and maintaining financial responsibility guarantee for taking corrective actions and for compensating third parties injured from releases.[211]

Such regulations have been promulgated.[212] Design and construction of new tanks are required to be done in accordance with acceptable national standard and their installation in accordance with the manufacturer's instruction. Certificate of compliance with such installation standards are required of the owners.[213]

Section 280.21 requires all existing tanks to be upgraded to current standards within ten years which began in 1988. Owners and operators of new and existing tanks are required to follow operating requirements pertaining to spill and overfill control and containment, maintenance of corrosion protection systems, storage,

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[211] Ibid s.9003(c).

[212] (Sept. 23, 1988) 53 Fed. Reg. 37,082 codified at 40 C.F.R. s.280; s.280.10 provides some exceptions.

[213] Ibid s.280.20.

appropriate repairs, and reporting and record keeping.[214] By s.280.40-45 only leak detection systems that meet the recommended leak detection performance standards are to be used.

A regulation has also been promulgated with respect to financial responsibilities of owners and operators of tanks containing petroleum products in the event of releases and damage to third parties.[215]

States are required under s.9004(a) of the Act to submit an underground storage tank release detection, prevention and correction program to the EPA for review and approval. In order to be approved, such a plan must contain adequate enforcement mechanisms and the requirements identical with, and no less stringent than those which the EPA Administrator is required to include in the regulation under s.9003(c). Where a State program is approved and the State is not enforcing

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[214] Ibid s.280.30-34. Release reporting requirements are contained in s.280.50-52; corrective action requirements are contained in s.280.61-67: where for example, there is evidence that groundwater wells have been contaminated or that contaminated soil may come in contact with groundwater, the owners and operators of the tanks are required to conduct investigation to determine the full extent of the soil or groundwater contamination and submit the result to the appropriate authority. The authority may require the owners and operators to submit corrective action plans and to implement such plans upon approval by the authority. Closure of tanks requirements are contained in s.280.71.

[215] (Oct.1988) 53 Fed. Reg. 43,322 codified at 40 C.F.R. Part 280, s.280.93(a)(1): owners or operators of tanks at facilities engaged in petroleum production or whose monthly throughput is more than 10,000 gallons are to maintain financial guarantee in the amount of $1 million per occurrence. Other categories of owners or operators are to maintain guarantee of at least $500,000 per occurrence: s.280.93(a)(2). See also, s.280.93b(1)(2).

the program as authorized under this Act, the EPA is required to notify the State of this failure. Where the State does not comply with the enforcement standard within 120 days of such notification, the EPA is reqiuired to withdraw its approval of the State program and to reestablish the federal program in that State.[216]

To help States carry out their EPA approved UST programs, s.9010 and s.2007(f)(2) provided $25 million "for each of the fiscal years 1985 through 1988 to be used to make grants to the States...". Overall, it has been stated that "the statutory provisions...envision a fairly comprehensive, potentially very effective, program to protect the nation's groundwater from leaking underground storage tanks".[217]

ii) Clean Water Act of 1977[218]

The main goal of this Act as stated under s.101 is to maintain physical, chemical and biological integrity of U.S. waters by controlling the discharge of contaminants from point and non-point sources into the water.[219] The Act is

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[216] RCRA 9004(e).

[217] G. Commons, "Plugging the Leak in Underground Storage Tanks: The 1984 RCRA Amendments" (1986) 11 Vermont L. Rev. 267 at 288.

[218] 33 U.S.C. 1251 et seq., Pub. L. No.95-217 as amended by Act of Jan. 30, 1987, Pub. L. No.100-4. The sections of the Act are followed.

[219] Ibid s.304: requires EPA to set effluent limitation guidelines for contaminant dischargers and to set water quality standards to be met by such limitation. Section 402 provides for permit for the discharge of pollutants and empowers the EPA or the

primarily concerned with the protection of surface water. Research, investigation, training and information on water quality and for its improvement under s.104 and water quality standards and implementation plans under s.303 have only a marginal effect on groundwater protection.

Nonetheless, the Act contains some specific provisions on groundwater protection. Under s.319(b) each State is required to submit for EPA approval a management program for non-point source pollution which must identify best management practices and measures which will be used to reduce pollution taking into account the effect of such practices and measures on groundwater quality. Where such a program is approved, s.319(i)(3) mandates the federal government to bear 50% of the cost of "assisting a State in carrying out groundwater protection activities..." subject to a limit of $150,000 for any one fiscal year. Section 106 also provides for federal grants to States to plan, develop and implement pollution control programs for both surface and ground water protection.

Section 208 requires each State to publish a guideline identifying areas with significant water quality control problems due to industrial, municipal or agricultural activites and to establish a plan or program for identifying and implementing the type of treatment facilities necessary to handle wastes generated by such activities. Although the implementation of programs under s.208 has been minimal, it has

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National Pollution Discharge Elimination System (NPDES) to enforce the effluent limitation standard.

nevertheless reduced the use of septic tanks which cause groundwater contamination[220].

iii) Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)[221]

Section 3(a) generally prohibits the sale, distribution use or delivery of pesticides except they are registered.[222] Under s.3(c)(5)(C) only pesticides which do not present "unreasonable adverse effects on the environment" are registered.[223] Section 6(a) requires the review of registration every 5 years or where additional data shows that a registered pesticide does not meet the standard of not posing "unreasonable adverse effects on the environment". Under s.6(b), the EPA may after holding a hearing, cancel a pesticide registration or change the classification where the pesticide poses "unreasonable adverse effect" to the

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[220] Patrick et al, supra, note 207, at 387.

[221] 7 USC S.136 et seq., Pub. L. No.92-516 as amended by Pub. L. 98-620 of 1984 and by Pub. L. No. 100-532, 102 Stat. 2654. The sections of the Act itself are followed here and not the sections of the USC.

[222] Ibid s.3(c)(2)(A): requires the EPA to publish registration guidelines and to provide information needed for registration. Economic factors are taken into consideration in developing such guidelines.

[223] Ibid s.3(d): pesticides are classified as "general use" and "restricted use". Unlike the latter, the former does not pose "unreasonable adverse effect" to the environment. Under s.4 only the EPA certified applicators may use pesticides of "restricted" class.

environment. In cancelling a registration under this subsection, the effect of the cancellation on the agricultural economy must be taken into account. Where a pesticide presents an imminent hazard, pending cancellation or change of classification under s.6(b), the EPA may suspend the registration.[224]

In determining what constitutes "unreasonable adverse effects on the environment", s.2(bb) requires taking into account the social, economic and environmental costs and benefits of the use of any particular pesticide. Thus cost-benefit analysis is an overriding element in determining whether or not a pesticide is to be registered.[225] One writer observes that the cost-benefit provision of FIFRA departs from the requirements of the other U.S. environmental protection legislation which employs risk based standard limited only by the availability of control technologies.[226]

The 1988 amendment to FIFRA did not alter the considerations, particularly economic considerations, which the EPA has to take into account before cancelling or changing the registration of a pesticide. Thus, "in so doing, Congress missed the opportunity to make FIFRA an effective regulatory mechanism for controlling

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[224] Ibid s.6(c).

[225] (1988) 40 C.F.R. s.154.1.

[226] R.J. Slater, "EPA's Pesticides-in-Groundwater Strategy: Agency Action in the Face of Congressional Inaction" (1990) 17 Ecology Law Q. 143 at 146: refers to MCL standard under the SDWA limited only by the feasibility of control technologies (see SDWA s.1412(b)(4) codified at 42 USC Section 300g-1(b)(4)(Supp.V. 1987)).

pesticide contamination of groundwater."[227] Nevertheless, the EPA review process has resulted in the cancellation of aldrin, diedrin, kepone, chlordane, heptachlor and DDT.[228] .

As with Canadian authorities, the EPA is saddled with screening pesticides some of which were registered based on falsified safety data, or were registered before proper methods of testing them were developed. FIFRA is yet to be amended to allow EPA suspend or cancel the registration of pesticides obtained on falsified safety data.[229]

b) RESOURCE-FOCUSED APPROACH:

The programs discussed below are resource-focused. They put some strategies in place for the protection of groundwater which serves as the primary drinking water supply for a community. The discussion is detailed to give a clearer understanding of these important programs.

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[227] Ibid at 148.

[228] R.D. Findley and D.A. Farber, Environmental Law in a Nutshell (St. Paul, Minnesota: West Publishing Co., 1988) at 149-150.

[229] Ibid at 150.

i) Safe Drinking Water Act (SDWA) of 1974:[230]

Section 1412 of the SDWA empowers the EPA Administrator to establish drinking water standards for every source of public water supply in the United States. The section also authorizes the EPA to specify the MCL for each contaminant that might be found in such drinking water and to adopt criteria to ensure compliance. This forms the basis of different groundwater protection programs established under the Act.

1) State Underground Injection Control Program:

Section 1421(a) of the Act mandates the EPA Administrator to promulgate regulations for State underground injection control (UIC) program. The regulations must "contain minimum requirements for effective programs to prevent underground injection which endangers drinking water sources within the meaning of subsection (d)(2)." To this end, such regulations must require State UIC program to be approved by EPA under s.1422 on the conditions that it: (A) prohibits underground injection in that State unless with a permit issued by the State; (B) ensures that an applicant for a permit to inject waste underground satisfies the State that such

[230] 42 USC S.300f-300j-11; Pub. L. No.93-523 as amended by Act of June 19, 1986, Pub. L. No.99-339. Followed are the sections of the Act and not the corresponding sections in the USC.

injection will not endanger drinking water sources...; (C) includes requirements for monitoring, inspection and record keeping; and (D) applies to underground injection by federal agencies as prescribed under s.1447(b) and by any other person whether on federal land or not.[231]

The regulations are required to take into consideration the geologic, hydrological or historical conditions of different States and different areas within a State.[232] Where, under s.1422(a)(b)(1), the EPA determines that it is appropriate for a State to adopt a UIC program, that State must adopt and submit for the EPA approval a program which conforms to the regulation made under s.1421. An approved program gives the State primary enforcement responsibility until such a time the Administrator determines that the State does no longer implement and enforce the program as required or does no longer keep record and report its activities under the program to the Administrator.[233] The failure of a State to discharge its duties under the program would trigger the re-establishment of federal program in that State.[234]

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[231] Ibid s.1421(b)(1).

[232] Ibid s.1421(b)(2)(3).

[233] Ibid s.1422(b)(3).

[234] Ibid s.1422(c); s.1423: in the event of a violation of the regulations made to protect drinking water from underground injection, the EPA has the power of direct enforcement where the State in charge fails to enforce the regulation.

2) Sole Source Aquifer (SSA) Program:

Section 1424(e) provides that

> if the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated would create a significant hazard to public health, he shall publish notice of that determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer.

Within areas designated as sole or principal source aquifers under s.1424(e), a "critical aquifer protection area" may be delineated. Section 1427 provides procedure for developing, implementing and assessing demonstration programs designed to protect such areas.[235] Section 1427(d) requires the Administrator to establish criteria for identifying critical aquifer protection areas. Such criteria are

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[235] "Critical aquifer protection area" is defined under s.1427(b) as "1) all or part of an area located within an area for which an application or designation as a sole or principal source aquifer pursuant to section 1424(e), has been submitted and approved by the Administrator not later than 24 months after the enactment of the Safe Drinking Water Act Amendments of 1986 and which satisfies the criteria established by the Administrator under subsection (d). 2) all or part of an area which is within an aquifer designated as a sole source aquifer as of the enactment of the Safe Drinking Water Act Amendments of 1986 and for which an areawide groundwater quality protection plan has been approved under s.208 of the Clean Water Act prior to such enactment."

required to take into account

> 1) the vulnerability of the aquifer to contamination due to hydrogeologic characteristics; 2) the number of persons or the proportion of population using the groundwater as a drinking water source; 3) the economic, social, and environmental benefits that would result to the area from maintenance of groundwater of high quality; (and) 4) the economic, social and environmental costs that would result from degradation of the quality of the groundwater.

An application submitted under s.1427(c) to the EPA for the establishment of a demonstration program to protect critical aquifers must include proposed boundaries for the critical aquifer protection area, a hydrogeologic assessment of ground and surface water within the proposed area and a comprehensive management plan for the area.[236] The objective of the comprehensive management plan is to maintain the quality of groundwater in the area, and to this end, the plan is required to contain the following elements:

> A) A map showing the detailed boundary of the critical protection area. B) An identification of existing and potential point and non-point sources of groundwater degradation. C) An assessment of the relationship between activities on the land surface and groundwater quality. D) Specific actions and management practices to be implemented in the critical protection area to prevent adverse impact on groundwater quality. E) Identification of authority adequate to implement the plan, estimates of program costs, and sources of State

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[236] Ibid s.1427(e): the application shall also include a planning entity to develop a comprehensive management plan for the critical protection area; procedures for public participation in the development, review and adoption, and implementation of the comprehensive management plan; and the measures and schedule proposed for the implementation of such plan.

matching fund.[237]

Where a plan is approved, the Administrator is required to enter into a cooperative agreement with the successful state, municipal or local applicant, and to provide, on a marching basis, 50% of the total cost of implementing the demonstration program.[238]

Section 1427(l) required states to submit to the Administrator by December 31, 1989, a report of assessment of the impact of the program on groundwater quality, identifying those measures that have proved effective in protecting groundwater. The Administrator, in turn, is required to submit a report on the accomplishments of the program to Congress identifying methods that have proved most effective and making appropriate recommendations for the application of those methods to protect groundwater when and where necessary. Under s.1427(n) $17.5 million were earmarked for appropriation to implement the program for the 1991 fiscal year.

3) Wellhead Protection (WHP) Areas:

Subsection 1428(e) of the Act defines "wellhead protection area" as

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[237] Ibid s.1427(f)(1); s.1427(f)(2) provides optional elements to be included in such plans.

[238] Ibid s.1427(i)(j): However, such grant shall not exceed $4 million for one aquifer in any one fiscal year.

> the surface and subsurface area surrounding a water well and wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield...

Under this subsection, the extent of a wellhead area is to be determined by the states. But the EPA Administrator is to publish a technical guidance to help States in making such determination. Such guidance should reflect

> the radius of influence around a well or wellfield, the depth of drawdown of the water table by such well or wellfield at any given point, the time or rate of travel of various contaminants in various hydrologic conditions, distance from the well or wellfield, or other factors affecting the likelihood of contaminants reaching the well or wellfield, taking into account... the geology of the formation in which the well or wellfield is located.

Each State was required by 1989 to submit for the EPA approval a program for the protection of wellhead area from contaminants which may have any adverse effect on human health. Such program was required to contain a determination of the protection area for each wellhead based on the hydrogeological information on groundwater flow, recharge and discharge and other relevant data. The program was also to identify the potential sources of contaminants in each wellhead protection area; and to describe needed financial and technical assistance; and the implementation of control measures, demonstration projects, training and education for the protection of the water supply in each area.[239]

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[239] Ibid s.1428(a): other requirements include defining the duties of State and Local government entities in developing and implementing the program; contingency plans for the location and provision of alternate drinking water supplies to each public water system in the event of contamination of the existing well or wellfield;

Where a state wellhead program is approved, the EPA makes a grant of not less than 50% and not more than 90% of the cost of developing and implementing the program. For the 1991 fiscal year, for example, $35 million was earmarked for appropriation.[240]

Under s.1428(h) federal agencies having jurisdiction over a potential source of contaminants within wellhead protection areas are required to comply with States' requirements and rules for the protection of water supply in such areas. Section 1428(g) requires States to be diligent in implementing the programs and to submit biennial reports to the EPA regarding progress on the implementation.

4) Aquifer Recharge Area Protection Programs:

Although not specifically required under the SDWA, some states have Aquifer Recharge Area Protection Programs. Usually an aquifer recharge area is geographically larger than a wellhead area encompassing groundwater recharge areas vulnerable to contamination due to heavy infiltration. For example, the town of Acton, Massachussetts has proposed an aquifer recharge area which it divided into

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and consideration of all the potential sources of contaminants which would affect new public water supply wells within the proposed wellhead area.

[240] Ibid s.1428(k).

three segments in the order of protection priority.[241] The highest priority goes to the well buffer areas comprising the areas of influence of existing and future wells. The second priority is the areas directly recharging existing and potential well areas. The remaining areas underlain by sand and gravel formations, otherwise known as the aquifer protection areas, take the third priority.[242] Some activities are prohibited, while others are restricted in the aquifer recharge areas.[243]

The foregoing is a review of major laws which bear relevance to groundwater protection. There is, however, other laws of more narrow or general nature which impact on groundwater.[244]

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[241] D. Neufeld, Groundwater: Its Management and Protection in Ontario (Legislative Research Service, 1987 Current Issue Paper # 58 ISSN 07 15-9587)(available at Ontario Legislative Library) at 19: citing some local U.S. programs.

[242] Ibid.

[243] Ibid at 20: In well buffer areas storage of hazardous waste, and road salt, fertilizer and pesticide applications are prohibited. In addition, earth removal and site clearing must meet certain performance standards, Industrial operations, solid waste disposal, mining, animal feedlot, and storage of road salt are prohibited. Fertilizer and pesticide application is regulated by permit. In the aquifer protection areas, hazardous materials and solid waste disposal are prohibited. Every other activity must have its impact hydrogeologically assessed and regulated by permits and performance standards.

[244] Toxic Substances Control Act Act of 1976 15 USC 2601 et seq., Pub L. No.94-469 National Environmental Policy Act of 1969 42 USC 4321 et seq., Pub. L. No.91-190; Surface Mining and Reclamation Act of 1977 30 USC 1201 et seq., Pub. L. No.95-87, s.1265(10). The CERCLA is not discussed as it mainly deals with remediation of groundwater contamination.

c) GENERAL COMMENTS ON CONTAMINANT-FOCUSED AND RESOURCE-FOCUSED APPROACHES:

It is important to note that each piece of legislation examined above provides for state roles. Thus federal-state cooperation has a legal basis. Also, with the exception of FIFRA, each piece of legislation has provisions directly bearing on groundwater protection. Even the Clean Water Act which is focused on surface water, nevertheless provides specifically for groundwater protection. Thus the need to simultaneously address surface and groundwater concerns is legally taken into account.

Furthermore, the SDWA focuses mainly on resource-oriented programs. Each state is required to develop and submit sole source aquifer and wellhead protection program plans for EPA approval. The programs specifically protect groundwater as a resource and not by any incidental or indirect way. To ensure implementation, a certain amount of funding is available for each of these programs. The American approach is thus a combination of contaminant-focused and resource-focused strategies. Both constitute a powerful weapon to protecting groundwater. This "weapon" is given to the EPA to administer.

II. EPA GROUNDWATER PROTECTION STRATEGY:

In administering the contaminant-focused and resource-focused programs under federal environmental legislation as it relates to groundwater protection, the EPA has developed a strategy[245] which is based upon a number of objectives:

a) Strengthen EPA Internal Groundwater Organization:

Pursuant to this objective the EPA has established an office of groundwater protection to supervise the implementation of the EPA activities regarding groundwater. The EPA regional offices have also established groundwater units which coordinate EPA groundwater programs at the regional level, and assist states with financial and technical assistance to enhance their capabilities for groundwater management.[246]

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[245] US EPA Groundwater Protection Strategy (Washington D.C.: Office of Groundwater Protection, 1984) 56 et seq.

[246] See US EPA Protecting the Nation's Grounddwater: EPA's Strategy for the 1990,s The Final Report of the EPA Ground-Water Task Force (Washington, D.C.: Office of the Administrator, 1991) 23-29.

b) Address Contamination Problems of National Concern:

States play prominent regulatory role where: a) there are numerous localized activities of groundwater concern; b) the risk presented by an activity is nationally low; c) land use is a principal groundwater protection approach; or d) technologies needed are easily obtained and relatively inexpensive.[247] However, the EPA would assume the primary regulatory role when: a) there is a need to establish regulatory consistency among States; b) State by State efforts (fragmented approach) would be inefficient ; c) the problem is of the scope that demands national resources; or d) national security is threatened, for example, in the case of disposal of hazardous wastes (emphasis added).[248] Thus, from time to time, the EPA reviews groundwater contamination sources to determine their seriousness. For example, such reviews identified USTs as a serious threat to groundwater quality. Consequently, in 1984 the RCRA was amended to deal with USTs[249]

Pesticide use is also identified as a major threat to groundwater. We have seen that FIFRA[250] makes no express reference to groundwater contamination as a factor to be taken into account in registering or cancelling registration of a

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[247] Ibid at 11.

[248] Ibid.

[249] Patrick et al, supra, note 207 at 296-297.

[250] See supra, notes 225 and 227 and the accompanying text.

pesticide. To fill this gap, the EPA has developed a pesticide strategy.[251] The strategy is designed to protect current and potential sources of drinking water as well as groundwater which supports fragile ecological values.[252] Under the strategy, MCL standards determined pursuant to the SDWA is used to determine allowable pesticide concentration in groundwater. Where a particular pesticide reaches its MCL, the strategy presumes, albeit rebuttably, that the risk posed by the pesticide outweighs its benefit, and this may trigger review of the pesticide under FIFRA.[253] The EPA also imposes national baseline restrictions for pesticides which are determined to present a "serious widespread groundwater threat".[254] More stringent measures, for example, the cancellation of registration can follow where groundwater is at a high risk of contamination.[255]

The pesticide strategy requires states to adopt, subject to the EPA's approval, adequate management plans for pesticides. Where a State fails to adopt such a plan, the EPA could cancel the registration of pesticides found to pose serious danger to

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[251] US EPA EPA Agricultural Chemicals in Groundwater: Proposed Pesticides Strategy (hereinafter the EPA Pesticide Strategy) (Washington, D.C.: Office of Pesticides and Toxic Substances, 1987).

[252] Ibid at 75.

[253] Ibid at 82.

[254] Ibid at 102-103: the restriction is designed to prevent pesticides in aquifer reaching or exceeding their MCLs. The restrictions may involve method, quantity and use of pesticides and even requiring application only by EPA certified applicators.

[255] Ibid at 103-104.

groundwater in that State.[256] The EPA has effected a nationwide preliminary cancellation of the registration of the pesticide Aldicarb because of serious groundwater contamination risks posed by it.[257] This is a major step taken to ensure that groundwater contamination is a factor taken into consideration in the registration of a pesticide. Finally, a management plan may be required for a specific high risk pesticide and each management plan involves groundwater monitoring, public education, technical assistance, enforcement and response programs.[258]

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[256] Ibid at 105-106: developing a State management plan entails determining areas where pesticides which contaminate groundwater are likely to be used, identifying groundwaters which are particularly vulnerable to contamination by these pesticides, and determining the uses of the groundwaters- whether for drinking water or ecosystems support purposes. Management practices are then tailored to protect these uses.

[257] Preliminary Determination to Cancel Registration of Aldicarb Products and Availability of Technical Support Document Notice (hereinafter Aldicarb Decision.) (1988) 53 Fed. Reg.24,630. EPA however, allows aldicarb to be used under a State management plan where soil characteristics and depth of the water table do not make groundwater vulnerable: Ibid at 24,635. All States must ensure that aldicarb label instructions specify that it is a restricted pesticide and should not be used within 300 feet of any drinking water source: Ibid 24,631. Registrants of aldicarbs are required to conduct groundwater monitoring in areas designated by EPA as having at least a "medium" vulnerability to aldicarb contamination: Ibid 24,636. For States having high vulnerability to aldicarb groundwater contamination, registration of aldicarb in those States is made conditional upon having in place an EPA approved Management plan: Ibid 24,630.

[258] EPA Pesticide Strategy supra note 251, 108, 109, 111-114, 121-127: More stringent management measures are imposed where monitoring shows increasing presence of pesticides in groundwater.

c) Create a Policy Framework for Guiding the EPA Groundwater Programs:

Under this objective, the EPA recognizes that all groundwater resources are not of equal value and should, therefore, not enjoy the same protection (the concept of differential protection). This is a sound policy given the regulatory burden imposed on industries generating contaminants and the great expense involved in protecting groundwater. But care must be taken not to give the impression that pollution of less valued groundwater is legitimized. Where pollution of such a class of groundwater gets out of hand, the long term adverse effect on other aspects of the environment may be far-reaching. Therefore, in a strict sense, "...the ability to degrade groundwater is not granted by the assignment of groundwater to a class."[259]

Pursuant to this objective the EPA has developed guidelines for classifying groundwater according to value, use, and vulnerability to contamination.[260] The guidelines provide for three classes of groundwater, namely:

i) Class I: Special Groundwater:

These are either highly vulnerable groundwater resources serving as sources

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[259] Seig supra, note 199, at 9.

[260] US EPA, Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy (Washington D.C.: Office of Groundwater Protection, 1986) 137et seq. See also, EPA's Strategy for the 1990s supra, note 246, at 11.

of irreplaceable drinking water to a large population for which there are no reasonable alternatives; or groundwater which is ecologically vital in that it supplies the baseflow for particular sensitive ecological systems that its pollution would lead to the destruction of a unique habitat. Level of protection for this class of groundwater is extremely high. Protection measures are targeted to achieve MCL standards under the SDWA.

ii) Class II: Current and Potential Sources of Drinking Water and Water Having Other Beneficial Uses:

These are groundwater resources serving as current or potential sources of drinking water or which are capable of other beneficial uses which do not meet Class I criteria. The level of protection of this class of groundwater ranges from moderate to high, at least to protect human health.

It has been argued that the criteria for distinguishing between Class I and Class II groundwater are vague and do not really eliminate the policy of non-degradation[261] which, arguably, is supposed to be achieved by classification.

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[261] P.D. Frohart, "EPA's Groundwater Protection Strategy: Much Ado About Nothing?" (1985) 1 Natural Resources. & the Environment at 61; 71: complains that the Strategy falls short of establishing new federal groundwater protection program.

iii) Class III: Groundwater Not Considered A Potential Source of Drinking Water and of Limited Beneficial Use:

This category of groundwater is saline or contaminated to a level that does not permit drinking or other beneficial uses. Groundwater resources in this class are subclassed according to their interconnection with adjacent groundwater or surface water of high quality. Thus, Class IIIA is groundwater with intermediate to high inteconnection with yield that is insufficient to meet the needs of an average sized family. Class IIIB is groundwater with low interconnection naturally isolated from other sources of water resulting in low potential risk or adverse effect to the environment or human health.[262] A fortiori, a high yield, heavily contaminated groundwater resource which interconnects with high quality groundwater would be given a clean-up or treatment priority in order to avoid contamination of the adjacent groundwater.

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[262] See Patrick et al, supra, note 207 at 298-300: Groundwater classification begins by delineating a two mile radius area from the boundary of activity or facility causing the contamination. This delineated area is called the Classification Review Area (CRA). A preliminary inventory is taken within a CRA of public water supply wells, wetlands, surface water and populated area not served by public water supply. This is followed by applying the classification criteria as in Classes I, II and III to determine into which class groundwater in the area falls.

d) Strengthen State Groundwater Programs:

The EPA is committed to ensuring that states have in place groundwater protection programs that provide a comprehensive protection. It recognizes, however, that because of variability in hydrogeological factors among states, elements of such programs may vary from state to state. Nonetheless, all states are required to include in their "State Ground-Water Protection Programs" (SGWPPs) certain "Common Elements of 'Mature' Ground-Water Protection Programs".[263]

These "common elements" include setting goals and documenting their progress; and characterizing the resource and setting priorities for actions, for example, assessing the aquifer systems, their recharge and discharge zones. Also included is a classification of groundwater according to its use, value, vulnerability to contamination, yield, and quality. Other elements include developing and implementing prevention and control programs such as the wellhead and aquifer recharge protection, and programs aimed at eliminating or reducing pollution at the source. Another element is defining State roles and their relationship to federal programs.[264]

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[263] EPA's Strategy for the 1990,s supra note 246, at 11-14.

[264] Ibid at 15-21: see these pages for more details about the content of each of the "common elements". See National Research Council Committee on Groundwater Quality Protection, Groundwater Quality Protection: State and Local Strategies (Washington, D.C.: National Academy Press, 1986) for a model groundwater protection strategy. Some highlights of the model strategies are: setting groundwater

In pursuit of the objective of strengthening the States' Groundwater Programs,

> since 1985 EPA has provided funding (approximately $35 million as at 1990) under s.106 of the Clean Water Act to develop groundwater protection strategies based on each State's individual problems and needs. The strategies provide an overall policy and planning framework to protect groundwater for its highest beneficial use, and address such topics as public education, groundwater data management, legislative and regulatory development, resource assessment, groundwater classification, and point and nonpoint source contaminant controls.[265]

Consequently, all States have developed groundwater strategies and thirty-three of the States have incorporated into their laws either elements of the strategies or the entire strategies.[266] This means that the strategies are enforceable laws and not mere administrative guidelines. The EPA groundwater classification guide helps States to classify their groundwater, set protection priority for each class and make appropriate regulatory decisions to protect each class. In response to it, twenty-two

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protection goals and objectives; obtaining groundwater management information, for example, characteristics of groundwater and the location of actual and potential contaminant sources; technical knowledge of groundwater process and hydrologic principles; and eliminating or controlling toxic substances and groundwater contamination activities by the use of permit, land use control and providing incentives for the use of technologies that cuts down on generation of wastes which contaminate groundwater. Other elements include improving intergovernment and interagency cooperation and coordination; adequate legal authority for groundwater programs, funding and training of personnel; emphasizing prevention of groundwater contamination in the light of economic, social, environmental and political factors and incorporating public participation in groundwater protection programs.

[265] US EPA Progress in Groundwater Protection and Restoration (Washington D.C.: Office of Groundwater Protection) February 1990 at 8: the assessment of State groundwater protection strategies by the Urban Institute was supported by the EPA.

[266] Ibid.

States have developed their own groundwater classification systems while eleven States have informal classification systems.[267]

In pursuit of the wellhead protection (WHP) program, the EPA has developed guidelines to help States develop WHP programs and delineat WHP areas.[268] Given the importance of local governments in ensuring the success of the program through, for example, land use control, the EPA has developed a guide to help them choose and apply appropriate protection measures for wellhead areas.[269] Guidelines for funding WHP[270] and for contingency planning to provide alternative source of groundwater supplies as required under s.1428e of the SDWA where a well or wellfield is contaminated, have also been developed by the EPA for States and Local governments.[271]

By January 1990, the EPA received 29 State WHP programs for review and

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[267] Ibid.

[268] US EPA Developing A State Wellhead Protection Program A User's Guide to Assist State Agencies Under the Safe Drinking Water Act (Washington, D.C.: Office of Groundwater Protection, 1990); US EPA Guidelines for Delineation of Wellhead Protection Areas (Washington, D.C.: Office of Groundwater Protection, 1987).

[269] US EPA Wellhead Protection Program: Tools or Local Governments (Washington, D.C.: Office of Groundwater Protection, 1989).

[270] US EPA Local Financing for Wellhead Protection (Washington, D.C.: Office of Groundwater Protection, 1989).

[271] US EPA Guide to Ground Water Supply Contingency Planning for Local and State Governments Technical Assistance Documents (Washington, D.C.: Office of Groundwater Protection, 1990).

approval, conducted 12 training courses for States and Local representatives on how to delineat WHP areas and how to develop local management tools for WHP. It also included in its drinking water regulation a recognition of the interrelationship between WHP areas and "areal assessments around public water wells, focusing on the common need to remove these sources of contamination."[272] It is estimated that approximately 90% of the US public underground drinking water will be protected under the WHP program.[273]

Accomplishments under the Sole Source Aquifer (SSA) Program have been impressive. According to a report, EPA has since 1974 designated 52 SSAs serving over 22 million people; and has reviewed federally assisted projects in designated SSAs.[274] The EPA has also prepared and distributed SSA petitioner guidance describing the hydrogeologic and drinking water data needed to make a SSA determination.[275] It has also prepared a guide for the Office of Groundwater

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[272] Progress in Groundwater Protection and Restoration supra note 265, at 9.

[273] Ibid.

[274] Ibid at 10: specific funding is however, yet to be provided for development, assessment and implementation of demonstration programs designed under s.1427 of the SDWA to protect critical aquifer areas within designated SSAs. But regulations respecting grants for identifying critical aquifer areas have been issued.

[275] US EPA Sole Source Aquifer Designation Petitioner Guidance (Washington, D.C.: Office of Groundwater Protection, 1987).

Protection in administering the SSA Program.[276]

Progress has also been made regarding pesticide and toxic chemical controls. For example, EPA sponsors a National Survey of Pesticides in Drinking Water and requires groundwater monitoring data in support of pesticide registrations.[277] Also, varying degrees of progress have been made regarding hazardous waste management and disposal, solid waste disposal, USTs, and underground injection control activities under the EPA.[278]

Recently the EPA initiated a pollution prevention program aimed at eliminating or reducing pollution at the source. Several pilot projects are being funded in pursuit of this program. Out of $12 million earmarked for the projects for 1991 and 1992, $2 million is to be channelled directly to groundwater protection pilot projects each year.[279] Preventing pollution at the source would no doubt help prevent groundwater contamination.

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[276] US EPA Sole Source Aquifer Background Study: Cross-Program Analysis (Washington, D.C.: Office of Groundwater Protection, 1987).

[277] Progress in Groundwater Protection and Restoration supra, note 265 at 18-20: the EPA has "developed techniques for hazard assessment of chemicals based on Structure Activity Relationships (SARs) which can be used when data on the chemical is lacking".

[278] Ibid at 21-31.

[279] Ibid at 43: about $4 million in grants was made to States for developing or supporting pollution prevention programs. This was increased to $6 million for the 1990 fiscal year.

e) Comments and Concluding Remarks on the EPA Groundwater Protection Strategy:

In conclusion, it is no exaggeration that the EPA holds a considerable sway over groundwater protection particularly where State by State (fragmented) approach will be inefficient. Its pesticides strategy has succeeded in introducing groundwater contamination as a factor to be taken into consideration in registering pesticides. The EPA classification criteria which some States have already adopted help to focus priority and resources on more valuable groundwater. In recognition of the unity of the environment, both the pesticide strategy and the classification strategy superimpose the protection of sensitive ecological environment side by side with groundwater protection. Its "common elements" requirement in State Ground-Water Protection Programs is an addition which strengthens groundwater protection. The highlights of the progress of both contaminant-focused and resource-focused groundwater protection programs at the Federal and State levels show that the EPA strategy is not unworkable, but is indeed helping considerably to protect groundwater.

The contaminant-focused and resource-focused approaches are applied simultaneously. The involvement of states and the over-riding authority of the EPA provide the desired unified approach or institutional integration. The provisions of the Clean Water Act indicate the integrated management of the two basic

components of the hydrologic cycle, namely, surface and ground water. To this extent, there are thus both institutional and resource integration approaches to the management of United States' water resources.

D. CANADA AND THE U.S. FEDERAL POSITIONS ON GROUNDWATER PROTECTION IN A COMPARATIVE PERSPECTIVE: FILLING THE CANADIAN GAPS

The American Constitution has made it possible for Congress to pass legislation which directly protects groundwater at the state levels. Congress has adopted umbrella legislation and coerced states to adopt implementing regulations consistent with and no less stringent than federal laws. Both contaminant-focused and resource-focused groundwater protection programs are enshrined in federal legislation. They are not mere guidelines. They are laws and the states cannot decline to follow them. Also, funding and technical assistance are made available to states through the EPA for the implementation of these programs.

Unfortunately, the Constitution of Canada would not permit the federal government to adopt the American approach in a binding way. Therefore, it is recommended that Canada adopts with certain modifications, through cooperative agreements with provinces, the American approach.

There should be a joint federal and provincial management of serious sources

of groundwater contamination such as industrial and municipal hazardous wastes, escape of petroleum and other hazardous substances from USTs and pesticides. Federal environmental protection policy should provide umbrella guidelines which focus on groundwater protection for the management of these sources of contamination. The guidelines could also serve as a model legislation for the provinces to adopt. The Environmental Code for controling USTs containing petroleum products is a good example of model guidelines at the disposal of the provinces. The Code was developed under the CCREM, and thus, represents a joint federal and provincial effort. British Columbia's proposed UST law, for example, is modelled upon the Code.[280]

Legislation such as the U.S. RCRA has been criticized as being too detailed in technical particulars and generally insisting on a standard application of such details in all situations. This is said to overlook site-specific problems which may need to be addressed differently.[281] This will not be the case in Canada because the suggested guidelines for controlling contaminants are not law. They are to be adopted with flexibility by bureaucrats to suit local circumstances.

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[280] Wilson, supra, note 134, at 24-30.

[281] R. Allen Freeze and J.A. Cherry, "What Has Gone Wrong" (1989) 27 No.4 Ground Water at 460: for example, "some state regulations that require monitoring to protect the 'upper most aquifer' have led to meaningless interpretations at sites that do not have layer-cake stratigraphy. Strict adherence to the regulations can be counterproductive in that it may lead to monitoring networks that do not offer early warning of the most likely modes of leakage" Such regulations were made in response to the umbrella provisions of the RCRA

The federal government should also offer financial and technical assistance to provinces which adopt such guidelines. The construction of hazardous waste disposal facilities, for example, is a project of great financial demand. In addition, the federal government should embark on providing to the provinces, precautionary measures against factors which negatively impact on groundwater supply and protection.

Furthermore, under a scheme of federal-provincial cooperation, registrants of pesticides such as pesticide Aldicarb can be required to undertake groundwater monitoring and response programs in areas where such pesticides are used or in areas where studies[282] show groundwater vulnerability to such pesticides. Under such a cooperation scheme, the provinces will be required to develop management plans[283] for dangerous pesticides as a precondition for their use in the provinces, particularly provinces where groundwater is highly vulnerable to such pesticides.

The DOE groundwater strategies developed pursuant to Federal Water Policy should be further developed or expanded to include groundwater classification criteria, and programs such as the wellhead protection, sole source aquifer and aquifer recharge area programs used by the U.S. EPA. It has been said that these U.S. programs are as yet not "sufficiently well developed to warrant attempts at

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[282] For example of such studies, see McRae, supra, note 124 and Turner, supra note 125.

[283] For the components of the pesticides management plan, see, supra, notes 256 and 258 and accompanying text.

specific duplication in Canada".[284] Under the programs U.S. states are given some flexibility to adopt certain measures due to variability in their hydrogeological environment. Canada can have the same flexibility in adopting the programs.

An exact duplication of every detail of the programs is certainly not appropriate as it would disregard local circumstances. Canada should, however, adopt the programs in principle and tailor them to suit local needs. For example, the programs would be extremely important in PEI where groundwater constitutes about 100% of the potable water supply. However, they may not be needed in the Northwest Territories where less than 1% of groundwater is used due to the difficult access to the resource.[285]

There is as yet no drinking water legislation at the federal level, only the Guidelines for Canadian Drinking Water Quality. Although the Federal Water Policy may be geared towards ensuring groundwater quality prescribed in the Guidelines, there is no legal obligation attached. Furthermore, an attempt to use legislation at the federal level to establish programs similar to the sole source aquifer and wellhead protection programs will, to the extent that the provinces are affected, not pass the

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[284] Groundwater Protection The Lack of Government Action in Canada, supra note 190, at 20.

[285] Personal Communication with Brian Lantham, Head Water Management and Planning, Water Resources Division Indian and Northern Affairs dated March 27, 1992, see Appendix.

constitutional test.[286] Rather than wait until such legislation can be constitutionally supported on the ground of national concern, timely federal-provincial cooperation to make drinking water safe across Canada is essential. Already Quebec and Alberta have adopted the Guidelines for Canadian Drinking Water Quality as legislation. This suggests that provinces are likely to adopt programs like the sole source aquifer, wellhead protection and aquifer recharge area protection programs should the federal government offer them with the appropriate incentives.

These resource-focused programs are important not only for groundwater serving drinking purposes but also for the protection of groundwater which supports sensitive ecological environment. This should also be incorporated into the DOE's groundwater protection strategy. A knowledge of the hydrcgeology of different regions, boundaries of aquifer, their quality and yields, and actual and potential sources of contaminants is important in order to have these programs. Therefore, along with offering these programs to the provinces, the federal government should provide technical and financial assistance needed to implement them. Lack of financial and technical resources have impeded the efforts of some provinces to determine the quality and safe yields of their aquifers.[287].

By taking these steps, the federal government will be involved in both

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[286] See supra, Chapter Two.

[287] See for example, Personal Communication with the authorities of Newfoundland, New Brunswick, Manitoba and Saskatchewan in the Appendix.

contaminant-focused and resource-focused groundwater protection programs across Canada. The urgency to have a concerted effort to protecting groundwater in this way will become more obvious as population, agricultural and industrial activities expand to increase water demand as well as groundwater contamination. The adoption of a combination of contaminant-focused and resource-focused approaches under integrated federal and provincial efforts (institutional) and integrated management of the hydrologic cycle - surface and ground water and the ecosystem they support (resource integration) will yield the most efficient management and protection of Canada's water resources. Sound management demands that these measures be taken now in order to avert contamination crisis in the future. This will be consistent with the sustainable development goal of managing water resources in a way that meets both present and future needs.

CHAPTER FIVE

THE ROLE OF THE PROVINCIAL GOVERNMENTS IN GROUNDWATER PROTECTION

The contaminant-focused and resource-focused approaches to protecting groundwater are also present at the provincial level and will be examined herein.

CONTAMINANT-FOCUSED LAWS

There is no provincial legislation specifically directed at groundwater protection. There are, however, general environmental laws in each province which protect groundwater to the extent that these laws govern sources of contaminants.[1]

I. General Environmental Protection Laws:

Canadian jurisdictions generally prohibit the discharge of contaminants into the environment.[2] The discharge of contaminants into water is prohibited except

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[1] Because of the numerous sources of groundwater contamination, only the major sources of contamination, namely: industrial and municipal waste, sewage from septic tanks, underground strorage tanks, and pesticides use in agricultural activities are addressed in this Chapter.

[2] (Ontario) Environmental Protection Act (hereinafter Ont. EPA) R.S.O. 1980 as amended Stat. of Ontario 1981, 1983, 1986, 1988, 1989, 1990, ss. 5(1), 23(2); (Alberta) Environmental Protection and Enhancement Act (hereinafter Alta. EPEA) S.A. 1991 (Bill 53); (Saskatchewan) The Environmental Management and Protection

pursuant to a permit issued under appropriate regulations.[3] Thus the law does not impose an absolute prohibition but regulates the amount or concentration of permissible discharges.[4] Furthermore, a certificate of approval is required for the construction of a facility from which contaminants are to be discharged into water.[5]

All jurisdictions take a restrictive approach to contaminants release into the environment. For example, in Ontario there is an absolute prohibition of the discharge of contaminants which might have an adverse effect on the environment. Section 13(1) of the Ont. EPA states:

> nothwithstanding any other provision of this Act or the regulations, no person shall discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment that causes or is likely

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Act (hereinafter Sask EMPA) S.S.1983-1984, c.E-10.2; (NewBrunswick) Clean Environment Act (hereinafter N.B. CEA) R.S.N.B. 1973 c.6 as amended 1978 and 1990, s.5.3; (Quebec) Environmental Quality Act (hereinafter Que. EQA) R.S.Q. 1977, c.Q-2; (Prince Edward Island) Environmental Protection Act (hereinafter PEI. EPA) R.S. PEI. 1988 as amended 1991 (Bill No.23); (Newfoundland) The Department of Environment and Lands Act (hereinafter Nfld. DELA) R.S. Nfld. 1989, c.21; (Manitoba) The Environment Act (hereinafter Man. EA) S.M. 1987, c.26; (British Columbia) Waste Management Act (hereinafter B.C. WMA) S.B.C. 1982, c.41 as amended 1990 (Bill 68); (Nova Scotia) Environmental Protection Act (hereinafter Nova. EPA) R.S.N.S. 1989, c.150; (Northwest Territories) Environmental Protection Act (hereinafter NWTs. EPA) R.S.NWT. 1974 as amended 1985, c.E-7.

[3] Ont. EPA s.23(2), Ontario Water Resources Act (OWRA) R.S.O. 1980, c.361, s.16(1)(2); Alta. EPEA s.161; (Nova Scotia) Water Regulations N.S. Reg. 1964 as amended 1967, s.16; Sask. EMPA, s.17(a); Que. EQA, s.20; (New Brunswick) Water Quality Regulation-Clean Environmental Act N.B. Reg. 82-126, Aug. 1982; (New Brunswick) Clean Water Act S.N.B. 1989, c.6.1 as amended 1989 and 1990, s.12(1); Nfld. DELA, s.25; B.C. WMA s.3; PEI. EPA s.20. Except otherwise stated, water as used in these statutes means both surface and ground water.

[4] See for example, Alta. EPEA ss.96, 97; Ont. EPA s.5(1); Que. EQA s.20.

[5] See for example, Ont. EPA s.8; Nova. EPA s.23(1); Que. EQA s.22.

to cause an adverse effect.[6]

Arguably, a permittee is prohibited from discharging such contaminants even when he has not exceeded the amount, concentration or level prescribed in the regulation or in a permit. Section 1(1)(a) outlines eight categories of injuries which qualify as adverse effects. These include the "impairment of the quality of the natural environment for any use that can be made of it." Natural environment includes water.[7]

Any case of groundwater contamination is a contravention of these provisions as that would necessarily impair the groundwater quality for any use that can be made of it. Strictly speaking, this interpretation may have the effect of prohibiting most industrial and agricultural activities which have a negative effect on groundwater quality. This can hardly be the intention of the legislature.

Alberta and the Northwest Territories prohibit discharges that have adverse effects on the environment but condone them where they are in accordance with any law applicable in the jurisdictions.[8] At least in theory, Ontario's and Quebec's positions are to be preferred as they offer greater protection to groundwater.

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[6] The only exception is the disposal of animal wastes in accordance with normal farming practice under s.13(2).

[7] Ont. EPA s. 1(1)(k)(q). See also, Ontario Water Resources Act R.S.O. 1980, c.361, ss.14 and 15(3). Quebec has similar provisions: see Que. EQA s.20

[8] Alta. EPEA s.104; NWTs. EPA s.5(1)(2).

II. Groundwater Protection through Specific Regulations:

The discussion that follows focuses on specific regulations that deal with sources of environmental contamination. The bulk of these regulations concerns groundwater protection only in a technical and practical way due to the subterranean location of the resource. Therefore, some technical provisions are given where appropriate to elucidate how these regulations protect groundwater. There is no comprehensive approach to groundwater protection. The regulations discussed below are fragmented. Typically, the regulations protect groundwater from contamination from lanfills, USTs, and sewage septic tanks by controlling the location, construction materials, construction, installation, monitoring and supervision of the systems.

a) Industrial and Municipal Wastes Disposal in Landfills:[9]

As municipal and industrial wastes are a major source of groundwater contamination, the regulation of their disposal is important to groundwater

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[9] Industrial and municipal solid wastes are considered together for the following reason: Landfills designed to receive domestic wastes, also receive a considerable amount of industrial wastes and household hazardous wastes such as shampoo, batteries, solvents, cleaners and metals etc.: per J.A. Vonholf, supra Chapter Four, note 194, at 60-61. It is said that in northern Canada all kinds of wastes, industrial chemicals and untreated sewage are dumped in a single waste disposal site usually on top of ice or sand: per Government of Canada supra, Chapter Four, note 99, at 25.11. Therefore, since industrial and municipal wastes are sometimes disposed in a single landfill or in separate cells in a landfill, rather than classify wastes into industrial and municipal, landfills type-approach is adopted. Landfills are classified into engineered and non engineered facilities landfills.

protection. Generally, a permit is required to dispose of wastes into waste disposal facilities[10] and the disposal of wastes in any place other than the place authorized is prohibited.[11] Some jurisdictions require a certificate of approval before the construction, alteration or operation of a waste management facility or a waste disposal site.[12]

Until recently, the waste disposal pattern did not respect environmental protection because wastes were indiscriminately disposed in landfills which could not prevent their escape into groundwater zone.[13] Wastes dumped in this way are exposed to precipitation. As precipitation seeps through the decomposing wastes, they produce leachate which seeps through the soil to contaminate groundwater.[14] Therefore, safe standards of landfills are crucial to groundwater protection. Examples of these standards are discussed in the following pages:

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[10] See for example, B.C. WMA ss.3(3), 8, 12, 13, 14; (British Columbia) Special Waste Regulation (hereinafter B.C. SWR) B.C. Reg. 63/88 s.4; Ont. EPA, Part V; Alta. EPEA, Part 9 s.161; (Saskatchewan) The Municipal Refuge Management Regulations (hereinafter Sask MRMR) R.Reg.4/86, s.6(3)(4).

[11] See for example, Ont. EPA ss.39, 40; Que. EQA s.66.

[12] See for example, Ont. EPA ss.26, 27; B.C. WMA ss.4(1), 15; (Alberta) Waste Management Regulation (hereinafter Alta WMR) Reg. 250/85, ss.6(1), 7(1), 11; Que. EQA ss.54, 55; Nova. EPA s.24; (Nova Scotia) Dangerous Goods and Hazardous Waste Management Act R.S.N.S. 1989, c.118, s.6(1)(2); PEI EPA s.13; (Newfoundland) Waste Material Disposal Act 1973, S. Nfld. No.82, s.19(1); Sask MRMR s.5.

[13] Vonhof supra, note 9, at 61-62. See supra Chapter One for some major cases of groundwater contamination in Canada.

[14] Department of Municipal Affairs and the Environment, Solid Waste Management in New Brunswick (Fredericton: The Department, current, date omitted, obtained from New Brunswick Waste Management Branch.) at 10.

There are two categories of landfills namely: landfills with engineered facilities and landfills without engineered facilities. Landfills with engineered facilities are those with liners (synthetic membrane or thick natural clay) and leachate collection and containment systems designed to prevent leachate seepage into groundwater zone.[15] In some jurisdictions such landfills have the capacity to receive certain hazardous wastes.[16] Landfills without engineered facilities fall short of the sophistication of those with engineered facilities.[17] Landfills with engineered facilities are discussed in more detail because they provide better protection to groundwater and serve as standards for upgrading landfills without engineered facilities.

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[15] See for example, B.C. SWR supra, note 10; Alberta Environment, Industrial Landfill Guidelines (Edmonton: Alberta Environment, 1987); (Ontario) Ministry of Environment, Engineered Facilities at Landfills that Receive Municipal and Non-Hazardous Wastes (hereinafter Engineered Facilities) (Toronto: The Ministry, 1988).

[16] For example, under the B.C. SWR supra note 10, s.1: "special waste" includes dangerous goods, waste oil, waste asbestos, waste pest control products and their containers and leachable wastes all of which are hazardous waste; (Alberta) Industrial Landfill Guidelines supra note 15. Class I landfills do not accept hazardous wastes which by regulation are prohibited from being disposed into landfills: para 4.2; Class II landfills may not accept liquid hazardous waste or hazardous waste containing free liquids which by regulation are prohibited from being disposed into landfills. In otherwords, Class I and Class II landfills may accept hazardous wastes which are not so prohibited.

[17] See for example, Ont. Reg.309 ss.10, 11; (Quebec) Regulation Respecting Solid Waste R.R.Q. Q-2 r.14 amended by O.C. 195/82, 1075/84, 1003/85, 1621/87, s.29; (Quebec) Regulation Respecting Pulp and Paper Mills R.R.Q. c.Q-2 r.12 as amended by O.C. 241/85, 1776/88, ss.33, 34, 36, 38; (Manitoba) Waste Disposal Ground Regulation Man. Reg.98/88R, ss.8, 12; Alta. WMR supra, note 12, ss.27, 51; (British Columbia) Ministry of the Environment, Pollution Control Objectives for Municipal Type Wastes Discharges in British Columbia (hereinafter Pollution Control Objectives) (Victoria: Queen's Printer, 1989) at 13 para. 3.4-5; Sask. MRMR, supra, note 10, s.6.

i) Landfills with Engineered Facilities:

1) The Location of the Landfills:

Generally, such landfills are sited on thick natural clay deposits (aquitards). This minimizes the seepage of leachate from the landfill into groundwater zone. However, jurisdictions differ as to the thickness and other parameters of earth materials required. For example, in Alberta, the bottom of the landfills are required to be of a certain thickness above the seasonal high water table.[18] Also the landfills are not to be "located over a buried channel aquifer unless it is demonstrated that the aquifer is protected by substantial thickness of low permeable geological materials."[19]

Aquifer yields, groundwater flow and depth of water table are important factors taken into consideration in determining the proper location of a landfill. For example, Alberta would allow a landfill in an area underlain by a surficial or bedrock aquifer where the apparent 20 year yield (Q20A) is less than 9 litres per minute (l/min) but not where the 20 year yield exceeds 45 l/min.[20] In British Columbia, the

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[18] Industrial Landfill Guidelines supra note 15, at para 5.3: the thickness is 1.5 meters.

[19] Ibid para. 5.4.

[20] Ibid Appendix 2: where the 20 year yield is between 9 and 45 l/min, a landfill may or may not be allowed depending on the combination of other hydrogeological factors. Landfills may be permitted in areas of aquifer discharge provided surface water is not affected by mobilized contaminants. But this may not be allowed in areas of groundwater recharge. These are general hydrogeological factors. Each landfill

landfills are to be sited and constructed entirely above the seasonally high water table and in an area separated by unsaturated rock materials of certain depth and permeability.[21] It is further provided that

> no person shall locate a secure landfill in a recharge area for an unconfined aquifer with one or more high capacity wells (greater than 100 litres/minute) or a significant number of lower capacity wells used for fish hatcheries, domestic, irrigation, industrial, municipal or livestock watering supply[22].

Ontario requires wastes in a landfilling site to be placed

> sufficiently above or isolated from the maximum water table at the site in such manner that impairment of groundwater in aquifers, is prevented, and sufficiently distant from sources of potable water supplies so as to prevent contamination of the water, unless adequate

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project is to be considered in the light of the hydrogeological factors present. Appendix 3 gives details of groundwater evaluation and details of construction of observation well for monitoring purposes. See also paras. 7.1, 7.2, 7.3, 7.4, and 7.5.

[21] B.C. SWR supra note 10, s.25(3)(a)(b).

[22] Ibid s.25(4): "significant number of lower capacity wells" is not defined; s.25(6) provides that "no person shall locate a secure landfill within 300 meters of any non-intermitent watercourse or any other permanent water body". Section 25(7) prohibits the location of secure landfills within specific watersheds. See (B.C) Ministry of the Environment, Pollution Control Objectives for Chemical and Petroleum Industries (Victoria: The Ministry, 1990) at 21-22; (B.C.) Department of Lands, Forests and Water Resources, Pollution Control Objectives for Food-Processing, Agriculturally Oriented, and Other Miscellaneous Industries (Victoria: The Department, reprinted Aug. 1989) at 189.0-190.0, paras 3.3-3.4: Selection of landfill site should be guided by "hydrogeology, soil conditions, surface run-off behaviour, proximity of surface water, location of domestic or irrigation wells, and availability of suitable cover materials" "Contamination of surface and ground waters as a result of the location or operation of the landfill must be avoided." "Surface run-off should be diverted around a landfill and adequate drainage from the site must be maintained". "The hydrogeologic and climatic factors are to be taken into consideration when determining the disposition of hazardous materials in the landfill in relation to groundwater levels".

provision is made for the collection and treatment of leachate.[23]

2). The Landfill Liners:

Furthermore, the landfills are required to have liners. For example, Ontario requires synthetic membrane liners,[24] Alberta requires two liners one of which must be of synthetic quality.[25] In British Columbia, s.27(2)(a)(b) of the B.C. SWR requires a landfill to be constructed of dual liner systems made of impervious materials of certain thickness. They are to be of a quality that can resist pressure or chemical reaction from contact with leachates or stress from climatic conditions, installation or operation of the landfill.[26] In New Brunswick, the liners are required to be impermeable enough to prevent the leachates from contaminating groundwater.[27] Generally the quality of the liners is such that they can prevent the

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[23] (Ontario) Waste Management (General) Regulation O. Reg. 309 R.R.O. 1980 as amended by O. Reg 175/83; 574/84; 322/85; 464/85; 460/88; 750/88; 138/90; 162/90; 520/90; ss.8(5), 12(4). Section 3 exempts certain types of wastes from the application of this Regulation, for example, agricultural waste, hauled sewage, dead animals under the Dead Animal Disposal Act, inert fill, rock fill or mill tailings from mine and recyclable materials. Section 5 exempts certain waste disposal sites from the application of this Regulation and Part V of the Ont. EPA. But this does not include landfills and dumps. The regulation applies to all categories of wastes and landfills.

[24] Engineered Facilities supra, note 15, at 4.

[25] Industrial Landfill Guidelines supra, note 15, at paras. 4.1, 4.2.

[26] B.C. SWR supra, note 10, s.27(2)(c).

[27] Department of Municipal Affairs and the Environment, Design Guidelines for Sanitary Landfill Sites (Fredericton: The Department, 1988) at 20-22.

seepage of waste into groundwater.

3) Other Engineered Facilities:

The landfills are required to have leachate collection, containment and removal system and leak detection system.[28] Ontario goes further to require engineered facilities to be monitored to ensure that they meet the prescribed performance standards. It also requires the monitoring system to be such that warns of failure in advance in order to afford time for contingency measures to be taken.[29] Engineered facilities are usually required to be maintained through out the contaminating life of the landfills or for as long as it is necessary to protect the environment.[30] To ensure that this is done, Ontario for example, requires specific details of the performance standard of the facilities, financial and technical support for the maintenance and operation of the facilities as long as the landfill would last.[31]

The sophistication of landfills with engineered facilities varies from case to

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[28] See for example, Industrial Landfill Guidelines supra, note 15, para 4.1 for Class I landfills; B.C. SWR supra, note 10, s.27(3): provides standards for design, construction, installation and maintenance of leachate detection, collection and removal system; Engineered Facilities supra, note 15, at 4; Ontario Reg. 309 supra note 23, s.8(7); Design Guidelines for Sanitary Landfills supra, note 27, at 20, 34-35.

[29] Engineered Facilities supra note 15, at 3.

[30] See for example, ibid at 3; B.C. SWR supra, note 10, s.27(2)(b).

[31] Engineered Facilities supra note 15, at 3.

case depending on environmental conditions as well as the present and future uses of the relevant groundwater determined under the Ontario's "reasonable use" policy.[32] This policy allows the degradation of groundwater in some cases. The quality of engineered facilities thus required is tailored to allow contaminants release to the level of determined degradation of a particular groundwater.

Accordingly, one who applies for approval to construct a landfill is required to assess and estimate present and possible future uses of groundwater in terms of quantity and quality in the proposed landfilling site. The Ministry of Environment needs such assessments to determine the maximum contaminant level allowed to be released into the groundwater from the proposed landfill.[33]

4) Groundwater Monitoring and Supervisory Duties:

Generally, groundwater quality sampling and monitoring are required in such landfills and monitoring wells are usually spread across upgradient and downgradient locations so as to get a representative sampling of groundwater quality.[34] Inspection,

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[32] Ibid at 2. The "reasonable use concept" is discussed more fully infra, notes 172-180.

[33] Ontario Ministry of the Environment, Advice to Applicants and to Consultants in Preparing Hydrogeologic Reports for Proposed Landfill Sites (Toronto: The Ministry, 1984) at 2-4: Similar assessment is made of the surface water in the area to ascertain expected groundwater contamination from the surface water should the latter be contaminated. The impacts of the landfill on surface and groundwater uses on and off site are also required to be assessed.

[34] See for example, B.C. SWR supra, note 10, s.26(2); Industrial Landfill Guidelines supra, note 15, paras. 4.1, 4.2: for both Class I and Class II landfills.

supervisory and reporting duties are imposed on the operators or owners of the landfills. In British Columbia, for example, during and after construction of a landfill, the owner is required to inspect the synthetic or clay liners, the drainage system, the leak detection system and the leachate collection systems to ensure that they are in order, and to repair or correct any defects.[35] Where groundwater monitoring indicates that groundwater quality standard has been derogated from (non compliance), the owner of the landfill is required to report it to the appropriate authority within a given time.[36]

5) Financial Assistance:

A great financial commitment on the part of both municipalities and industries is involved in meeting prescribed standards for landfills. Some provinces give financial assistance to municipalities for the construction of landfills and for waste management demonstration projects.[37] To the extent that environmental problems would arise

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[35] B.C. SWR supra note 10, s.26(1).

[36] Ibid s.26(5). By s.27(4) "a secure landfill is in a non compliance situation, with regard to groundwater quality, when analytical data from upgradient and downgradient groundwater monitoring wells for any parametres or chemical constituents are significantly different using approved statistical methods."

[37] See for example, (Ontario) Ministry of the Environment, Waste Management Improvement Program (Toronto: The Ministry, date omitted) 1-2; Ontario Ministry of the Environment, Financial Assistance Program (Toronto: The Ministry, date omitted) at 1-2; (Nova Scotia) Regional Municipality Solid Waste Financial Assistance Regulations N.S. Reg. 297/90 (Nov. 1990), ss.4, 5; N.B. CEA supra, note 2; Manitoba Environment, Fact Sheet Nov.7, 1989 at 2.

if municipalities are not assisted in this way, such assistance promotes groundwater protection and is recommended for other jurisdictions that do not have similar provisions.

ii) Disposal of Highly Hazardous Waste:

Only Alberta, Ontario and Quebec have specialized hazardous waste treatment facilities.[38] Quebec's facilities are the Stablex disposal facilities and the Tricil incineration facilities.[39] Both facilities, however, cannot receive certain types of hazardous waste.[40] This constraint may lead to illegal dumping of such wastes in landfills not designed for them and may result in serious groundwater pollution.

Owing to limited disposal facilities, hazardous wastes are often stored until they can be disposed in the right facilities. Storage facilities are required to be made of impervious materials and to be located on impervious floor so that the wastes do not contaminate ground and surface water in the event of leaks.[41] Quebec has a

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[38] Government of Canada supra note 9, at 14.13; Vonhof supra note 9, at 63.

[39] Commision D'Enquete Sur les Dechets Dangereux, Hazardous Waste in Quebec Issues and Question Information and Consultation Document Summary (1989) at 10.

[40] Ibid at 27: "...Tricil cannot deal with organo-halogenated wastes, especially PCBs, and its incinerator cannot burn condensers or transformers contaminated by PCBs." Stablex "... cannot treat explosives, pesticides and residues containing more than 30% oil and grease, neither can it eliminate PCB contaminated residues".

[41] See for example, B.C. SWR supra note 10, ss.16-17.1; (B.C.) Antisaptain Chemical Waste Control Regulation B.C. Reg. 300/90 as amended O.C. 1289/90, ss.6, 7; (Saskatchewan) Hazardous Waste Substances Regulation R.R.S. 3/88, ss.3, 10, 11,

typical storage standard for hazardous waste. A storage site is required to be a certain distance from the sea, watercourse or well.[42] It must have an impermeable floor surrounded by a holding basin made of impermeable materials compatible with the chemical composition of the waste.[43] The holding basin is required to always be in a condition to contain and recover all emissions, leaks or overflows from the storage containers[44].

The storage of hazardous waste in a lagoon where an accidental spill may endanger the quality of drinking water is prohibited.[45] Where a lagoon is used to store such waste, it "must be equipped with a dual protection system to contain wastes and prevent any migration of contaminants to adjacent soil and underground

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13, 15; (Sask.) The PCB Waste Storage Regulation Sask. Reg. 6/89, ss.4, 5(2)(h-u); (Newfoundland) Storage of PCB Waste Regulation Nfld. Reg. 230/88, ss.3-7; (Alberta) Hazardous Waste Regulation Alta. Reg 505/87, s.13(a)(c); (Manitoba) PCB Storage Site Regulation Man. Reg. 474/88, s.5(1)(2); (Nova Scotia) Dangerous Goods Storage Regulations N.S. Reg. 97/89, s.7(1). (Quebec) Hazardous Waste Regulation O.C. 1000/85 as amended O.C. 1314/88, ss.9, 26(5).

[42] Hazardous Waste Regulation supra note 41, s.26(5).

[43] Government of Quebec, Guide for the Storage of Hazardous Wastes and Management of Use Oil (Quebec City: Ministere de l' Environnement, 1985)at 5.

[44] Ibid. See pages 7-8 for storage of hazardous waste in piles the requirements of which are similar in essential particulars to storage in containers discussed above. In addition, the waste piles are to be covered with impermeable materials to keep away rain and infiltration.

[45] Ibid at 8. It was such lagoons that contaminated drinking groundwater at Mercier, Quebec: see supra, Chapter One, note 83 and accompanying text.

and surface water".[46] It is also required that the lagoon be surrounded with a diversion structure made of impermeable materials compatible with the wastes and which must always be in a condition to contain and recover emissions, leaks and overflows of the wastes from the lagoon.[47] Furthermore,

> the operator of the storage site must install at least two observation and sampling wells, particularly one upstream and one downstream from the storage area in relation to the flow of underground water. Samples must be taken from the wells at least once a year.[48]

This is intended to monitor groundwater quality so as to prevent contamination or take remedial action when appropriate.

iii) Tracking Hazardous Waste:

Waste is usually transported from the place of generation or storage to the place of final disposal. Given that hazardous waste can cause serious groundwater contamination if dumped in facilities which are not designed to receive it, tracking it from the place of generation or storage to the final disposal facilities is of crucial importance to groundwater protection. There are two important elements of waste tracking: waste registration and a manifest system.

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[46] Ibid: "the installation must make it possible to detect and to recover, between the two systems, any fluid originating from a break or possible leak of the first system in contact with the hazardous waste".

[47] Ibid at 9.

[48] Ibid at 10.

Most jurisdictions have legislation imposing the registration of such waste[49] and the use of a manifest system on the generators, carriers and receivers.[50] The registration is intended to make the government know the generators of the waste, the duration of waste generation and the character of the waste. The manifest system, on the other hand, is designed to help government know who is in custody of the waste from the time it leaves the site of generation or storage until it is finally disposed of. In Ontario, for example, a manifest form is given to an approved waste carrier who, at different stages of transport, must fill out the appropriate portion, sign it and have both the generator and the receiver of the waste complete and sign their own portions[51] The parties exchange copies and send the appropriate copies to the Ministry of the Environment within a given period of time.[52] The Ontario Ministry of the Environment operates a computerized tracking system using the data on the manifest. Information from the copies of the manifest form received from both the

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[49] See for example, Ont. Regulation 309, s.15; B.C. SWR, s.43; (Man.) The Dangerous Goods Handling and Transportation Act S.M. 1984-85 c.7D.12, s.9(1)(2); (Manitoba) Generators Registration and Carrier Licensing Regulation Man. Reg. 175/87 as amended by Man. Reg. 140/88, ss.3, 4; (Nova Scotia) Dangerous Good and Hazardous Waste Management Act R.S.N.S. 1989 c.118, s.5: not really registration but notification to the minister of the place of generation, the quantity and the place of disposal of such wastes.

[50] See for example, Ontario Regulation 309 ss. 16-26; (Alberta) Hazardous Waste Regulation Alta Reg. 505/87, ss.5, 7, 9, 10; (B.C.) SWR ss.45, 46, 47; (Manitoba) The Dangerous Goods Handling and Transportation Act s.12; (Manitoba) Manifest Regulation Man. Reg. 139/88, ss.4, 5, 6; (Quebec) Hazardous Waste Regulation ss.67, 70-87.

[51] Ontario Regulation 309 ss.17, 18(1), 20(1)(2)(5), 21.

[52] Ibid ss.16(1)(a), 18(1), 20(2)(b)(ii), 22(7)(e). See also (Ontario) Ministry of the Environment, "Environment Info" (Summer, 1990) at-4.

generator and the receiver of the waste are compared with the computer profiles maintained for every hazardous and industrial waste generator, receiver and carrier registered in the province.[53] Where the comparison shows inconsistencies, they are investigated and dealt with.[54]

iv) Criticisms, Comments and Recommendation on General Environmental Protection and Waste Disposal Laws:

> Overall, it has been observed that
>
> > under current environmental legislation in the various provinces, new landfill sites and industrial waste disposal areas require a definition of the hydrogeological environment, monitoring programs, and, where necessary intallation of impermeable membranes or clay layers and drainage system.[55]
>
> Yet some criticisms and recommendations are appropriate.

General environmental protection laws do not provide adequate protection to groundwater because they overlook rather than address the particularities of groundwater. The often vague provisions of such regulations make enforcement difficult. There should be legislation specifically directed to groundwater protection. Alternatively, regulations made pursuant to general environmental protection legislation should provide for mandatory groundwater protection strategies and

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[53] "Environment Info" supra note 52, at 4.

[54] Ibid.

[55] Vonhof supra, note 9, at 62: "all provinces have embarked on waste-site identification programs and risk assessment of the sites of old waste disposal locations and landfills".

programs.[56]

Provisions such as s.13(1) of the Ont. EPA which prohibit discharge of contaminants that would adversely affect the environment would be helpful if strictly enforced. Strict enforcement of such provisions would help to compensate for the inadequacies of present waste disposal facilities particularly, landfills without engineered facilities. Such inadequacies have, for example, been acknowledged by a British Columbia report which concluded that "a number of landfills are currently discharging leachates whose concentrations of pollutants exceed those considered acceptable", and urged the upgrading of such landfills so as to meet the receiving water quality standard.[57]

Referring to the (Alberta) Waste Management Regulation which control landfills without engineered facilities, one writer concluded that the regulation was designed to deal with immediate health problems posed by wastes disposal but not with the long-term groundwater pollution associated with it.[58]

There are about 10,000 landfills in Canada most of which are mere dump sites or landfills without engineered facilities.[59] For example, New Brusnwick has about

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[56] See infra under sub-heading "Proposed Elements of a Model Provincial Comprehensive Groundwater Protection Legislation" for a discussion of groundwater protection strategies.

[57] Pollution Control Objective supra note 17, at 12 para 3.2.2: the receiving water quality standard is stated in Table 5-3.

[58] D. Percy, The Regulation of Groundwater in Alberta (Edmonton: Environmental Law Centre, 1987) at 40-42.

[59] Government of Canada, supra, note 9, at 25.1, 25.9.

225 dump sites which were generally not well planned, sited or operated and as a result have caused water pollution.[60] The province is, however, in the process of replacing these dump sites with a number of sanitary disposal sites[61] A waste management task force has advised Manitoba to consolidate its 450 waste disposal grounds into a few large and upgraded landfills.[62] Ontario is also making efforts to phase out dump sites. For example, s.11(1) of the Ont. Reg 309 prohibits, with few exceptions, the establishment of dump sites. Section 10 provides the standards for location, maintenance and operation of such sites.

Upgrading dump sites to the standards that can take waste without endangering groundwater or replacing them with landfills with engineered facilities which can safely handle all categories of waste will greatly serve groundwater protection. Presently landfills with engineered facilities are few in Canada.[63] These

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[60] Department of Municipal Affairs and the Environment, Solid Waste Management in New Brunswick (Fredericton: The Dept. date omitted, but the most current publication) at 3-4

[61] Ibid; see New Brunswick General Regulation-Health Act N.B. Reg. 88/200, ss.15(1)(2), 15.2(1)(2) for solid waste disposal.

[62] Manitoba Environment, Action Plan A Waste Minimization Strategy for Manitoba in the 1990's Final Report of the Manitoba Recycling Action Committee (Winnipeg: Manitoba Environment, 1990) at 44-45.

[63] Government of Canada supra, note 9, at 25.9. For example, New Brunswick has only one such landfill serving the Fredericton region, which is, however, not designed to handle highly hazardous waste, see Solid Waste Management in New Brunswick supra note 14, at 12; British Columbia which has a law on "special waste" (hazardous waste) disposal does not have a "secure landfill", that is, landfill with engineered facilities for the disposal of such waste: see W.D. Gaherty, "Storage and Disposal of Toxic Substances" in Insight, Toxic Substances and Environmental Legislation (Insight, 1989) at 6 (of its own section of the publication).

landfills are expensive to build and it is recommended that the federal government should give financial and technical assistance to provincial governments in this regard. With an adequate number of such facilities in place in all jurisdictions, groundwater contamination from landfills could be greatly reduced.

b) Sewage Disposal: Septic Tanks:

Municipal sewage is usually treated and discharged into watercourses.[64] Some jurisdictions make financial arrangements to assist municipalities to provide sewer systems and treatment plants.[65] Municipal sewage controlled in this way does not pose a great danger to groundwater. A greater danger to groundwater is presented by private on-site sewage systems involving the use of septic tanks.

Generally, a permit or approval is required to establish or operate a sewage disposal system.[66] A permit is usually not issued where sewage would be disposed

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[64] See for example, OWRA supra, note 3, s.51; (Manitoba) Waterworks, Sewage and Sewage Disposal Regulation (hereinafter Man. SD.Reg) Man. Reg. 331/88R s.8.

[65] See for example, (New Brunswick) Municipal Sewage Treatment Assistance Regulation-Clean Environment N.B. Reg. 83/124, s.3; Que EQA s.40.

[66] See for example, (PEI) Sewage Disposal Regulations (hereinafter PEI SD Reg.) EC/542/87 (updated to June 1990), s.2(2); (B.C.) Sewage Disposal Regulation (hereinafter B.C. SD Reg.) B.C. Reg. 411/85 O.C. 2398/85 as amended by 199/86, 105/88, 128/91, s.3(1), 4(1); (Ontario) Sewage Systems Regulation (hereinafter Ont. Sewage Reg.) Ont. Reg. 374/81 as amended by 842/81, 139/82, 515/82, 290/83, 130/84, 71/85, 546/85, s.14; Ont. EPA s.64(b); Ont. s.24(1)(3); (Quebec) Regulation Respecting Water Works and Sewer Services (hereinafter Que. Sewer Services) c.Q-2, r.7, s.49; (New Brunswick) General Regulation- Health Act (N.B. Gen. Reg.) N.B. Reg. 88/200, s.274; (Yukon) Private Sewage Disposal Systems Regulations (hereinafter Yuk. Sewage Reg.) R.O.Y.T. 1974-75 c.P-8, s.13; (Nova Scotia) On-Site

in such a way that it could contaminate water supply.[67] Examples of standards for sewage systems are given below.

i) Location of the System:

In PEI and the Yukon, septic tanks are required to be located a certain distance away from any source of potable water[68]. Sewer lines running from the building being served to the septic tanks are also to be a certain distance from a potable water source in PEI.[69] Absorption fields are required to be located in areas where the groundwater table, watercourse or bedrock is of a certain depth below the surface.[70] The absorption field is required to be of a certain distance

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Disposal Systems Regulations (hereinafter N.S. On-Site Reg.) N.S. Reg. 73/78 as amended by 112/80, 168/83, s.2(1); (NWTs) Public Sewerage Systems Regulations (hereinafter NWTs. Sewerage) Reg. No.221, 1980 (RRNWTs); Man. SD.Reg.331/88R ss.6, 7; (Manitoba) Private Sewage Disposal Systems and Privies (hereinafter Man. Private Sewage) Man.Reg. 95/88R as amended by 418/88, s.3(2), s2: applies to private sewage disposal sys[illegible] with sewage flow of less than 14,000 litres of sewage a day.

[67] See for example, NWTs. Sewerage s.7(1)(3); Man. Private Sewage.Reg s.8; N.S. On-Site ss.4(2), 11(b); Yuk. Sewage Reg. s.13(c); PEI SD. Reg. s.2(6).

[68] PEI SD Reg. s.6(1); Yuk. Sewage s.25(c): in both jurisdiction the distance is fifty feet.

[69] PEI SD Reg s.6(15): the distance is ten feet.

[70] Ibid s.7(1)(a); Yuk. Sewage s.29: in both jurisdictions, not less than four feet.

from a potable water source or natural water body in PEI[71] and Yukon.[72] British Columbia limits the use of septic tanks to lots with an impervious layer of soil or bedrock, or groundwater table greater than a certain depth below the ground surface.[73] There are also variable depths and distances for the location of tanks above water tables and from potable water sources in other jurisdictions.[74]

Pursuant to s.43 of the Environment Act,[75] Manitoba has, by regulation, designated certain sensitive areas for the control of sewage disposal systems.[76] Under s.3 of the regulation, septic tank absorption fields and sewage ejectors are prohibited on the lands referred to in s.1 unless prior authorization is obtained from the local government officer. With such precautions, groundwater contamination from sewage disposal systems in sensitive areas is avoided or minimized.

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[71] PEI SD Reg s.7(1)(h)(i): fifty feet.

[72] Yuk. Sewage s.35: a hundred feet.

[73] B.C. SD Reg. schedule 2, s.1: 1.2 meters or four feet.

[74] See for example, N.B. Gen. Reg. ss.240(a)(b)(c), 257; Ont. Sewage Reg. Table 1, ss.7(1), 8(1); Man. Private Sewage s.13(3).

[75] S.M. 1987 c.26.

[76] Sensitive Areas Regulation Man. Reg. 126/88R, s.1(a)-(p): (footnote to the subsections) "the lands described in s.1 were originally designated as sensitive due to the possibility of contamination of groundwater and surface water by the installation of sewage disposal systems..."

ii) Soil and Percolation Tests and Lot Size:

Some jurisdictions require site investigation, and soil and percolation tests to be conducted on a proposed site where a sewage system is to be constructed and operated.[77] Such tests help to determine the sensitivity (suitability) of the site for such systems. The sensitivity tests usually consider the distance between the groundwater table and the ground surface of the lot where a sewage system is to be installed and this is taken into account in issuing or refusing permit.[78] Comparatively, on this point, Nova Scotia, for example, has a more stringent requirement than New Brunswick.[79]

iii) Construction Standard and Construction Materials:

In most jurisdictions any tanks used in a sewage disposal system must meet standards which are essentially those of the Canadian Standard Association.[80] For

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[77] See for example, N.S. On-Site s.2(3)(4); B.C. SD Reg. s.3(3); Ont. s.24(3); N.B. Gen. Reg. s.237.

[78] See for example, N.B. Gen. Reg. ss. 237, 238; N.S. On-Site ss.8, 10, 11: the closer the water table to ground surface, the larger the lot size required.

[79] Ibid.

[80] See for example, Ont. Sewage Reg. s.6; B.C. SD Reg. ss.6, 7; PEI. SD Reg. ss.6, 7(2)-(11); Yuk. Sewage ss.14-25; N.S. On-Site Reg. s.13(4)-(22); N.B. Gen. Reg. ss. 230, 242-256, 259-267; Man. Private Sewage ss.8, 9, 12.

example, PEI requires that

> the sewer line from the building or structure to be served by a sewage disposal system to the septic tank a)...be constructed of straight non perforated rigid, smooth bore, water-tight CSA (Canadian Standard Association) certified sewer pipe with sealed joints.[81]

Nova Scotia requires septic tanks to be constructed of "non porous concrete fibreglass, reinforced plastic or other approved non corrodible material".[82] The province prohibits the use of metal tanks, or metal tanks with protective coatings or concrete blocks.[83] It also requires that the design (and construction) of an on-site sewage disposal system consisting of a septic tank with a disposal field, take into account the location of well, other domestic water supply sources, topography, groundwater table elevation, bedrock elevation and soil characteristics.[84] Other jurisdictions have general provisions directly or indirectly preventing sewage contamination of groundwater.[85]

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[81] PEI SD Reg. s.6(15)(a).

[82] N.S. On-Site Reg. s.13(2).

[83] Ibid.

[84] Ibid s.13(3).

[85] See for example, Ontario Sewage Reg. s.4(2) para.2; N.B. Gen.Reg. s.229(a); Yuk. Sewage ss.4, 13; B.C. SD Reg. ss.6, 7.

c) Underground Storage Tanks (USTs):

i) Analysis of UST Regulations:

Most jurisdictions have responded to groundwater contamination from USTs. Some jurisdictions have more stringent regulations than others as demonstrated below.

1) Registration of Tanks and Permit Regime:

A knowledge of how many tanks there are, their locations and capacity is important to effectively regulate petroleum USTs in any jurisdiction. Some jurisdictions require the registration of existing and new tanks,[86] and prohibit the

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[86] (PEI) Petroleum Storage Tanks Regulations (hereinafter PEI tank) EC/187/90, s.2(1); (N.B.) Petroleum Product Storage and Handling Regulation-Clean Environment Act (hereinafter N.B. tank) N.B. Reg. 87/97 as amended by 90/139, ss.6, 23; (N.S.) Petroleum Storage Regulations (hereinafter N.S. tank) Reg 33/88 as amended by 180/88, s.13(1): registration is for USTs of 2000 litres or more capacity; (Nfld) Storage and Handling of Gasoline and Associated Products Regulations (hereinafter Nfld. tank) Nfld. Reg. 258/82 as amended by 271/86, ss.14, 15; (Man.) Storage and Handling of Gasoline and Associated Products (hereinafter Man. tank) 97/88R. s.13; (Ontario) Gasoline Handling Act (hereinafter Ont. Gasoline) R.S.O. 1980 as amended by Ont. Stat. 1988, c.49 and 1989 c.72, s.51(2) owners and operators of USTs are required to inform the Director of the Fuel Safety Branch of the existence of such tanks and to provide evidence that they are protected from external corrosion as required by this subsection. Persons who supplied gasoline or associated product to USTs in 1987 or 1988 are required to furnish the Director with the names and addresses of the purhasers: s.6a(6)(7). The use of or supply of gasoline to USTs

supply of petroleum products to unregistered tanks.[87]

A permit is required for the construction and/or installation of a UST, and environmental protection is generally taken into account in issuing or denying it.[88] Some jurisdictions licence or certify UST builders and installers.[89] Quebec and New Brunswick go further to require dealers on petroleum products contained in USTs, and the builders and installers of the USTs to maintain a public liability insurance

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at private outlet is prohibited after January 1, 1991 unless the Director had been given the information under s.6a(5). In Alberta, regulations requiring the registration of USTs are being drafted: D. Tingley and F. Work, Underground Storage Tanks: A Legal Review 2nd ed. (Edmonton: Environmental Law Centre, 1991) at 2.1. B.C. Uderground Storage Tanks Regulation (Draft) would require the registration of existing and new USTs: see Underground Storage Tanks: A Legal Review at 3.1-3.2.

[87] See for example, PEI tank s.2(6); N.S. tank s.13(4); Ont. Gasoline s.6a(5)(b); Yukon Gasoline Handling Act R.S.Y. 1986, c.79, s.3.

[88] PEI tank s.3(1)(a), s.3(2), s.3(4)(a)(b)(c): for USTs of less than 9000 litres except those at retail outlets and bulk petroleum sales outlet; s.4(1)(2)(4)(a)(b)(c): for all USTs at retail outlets and bulk petroleum sales outlets and those connected to heating appliances having capacity of 9000 litres or greater; N.B. tank s.6: for USTs with capacity of 2000 litres or greater, see ss.18, 23, 24; Man. tank s.13; N.S. tank ss.14, 15: the same litre capacity as in PEI.; Nfld. tank s.14, s.4: subject to ss.9 and 10, which prohibit water pollution, the regulation does not apply to USTs of 2,500 litres or less capacity connected to a heating appliance; Ontario Gasoline s.6(1); (Quebec) The Petroleum Products Utilization Act R.S.Q. c.U-1.1 s.36; (Quebec) Petroleum Product Regulation (hereinafter Quebec tank) C.c-31 r.1, s.98: the capacity of a UST is limited to 100,000 litres; Sask. Hazardous Reg. supra, note 41, s.9; (Yukon) Gasoline Handling Regulations (hereinafter Yukon tank) Yuk.Reg. 1972/137 as amended by 1975/300, s.8(3); (Yukon) Gasoline Handling Act R.S.Y. 1986, c.79, s.4; (B.C). Fire Code Regulation (hereinafter B.C. Fire Code) B.C. Reg. 15/87 as amended by B.C. Reg.131/89, s.4.12. Generally, non compliance with the terms and conditions of a licence or permit is a ground for the cancellation or suspension of same.

[89] See for example, Quebec tank s. 34; N.B. tank ss.35, 36(4).

coverage against pollution and other damages caused to third parties.[90] New Brunswick will cancel an installer's permit upon the cancellation or termination of the insurance coverage.[91]

In comparison with other jurisdictions, New Brunswick has more stringent provisions on locating USTs. Potential USTs owners or operators are subject to strict environmental approval process. For example, the province requires an approval of a proposed UST site first. In order to determine the sensitivity or suitability of such sites, it requires a potential owner or operator to submit an application for approval accompanied by a map showing, inter alia, the location of any well or water bodies within 1000 metres of the site.[92] The inspector assessing the site is required to take into account

> a) the density and proximity of wells; b) the proximity of surface water bodies; ...d) the presence in the area of geological, hydrogeological or environmental conditions, structures or animal, bird, aquatic or plant life that necessitate the taking of unusual precautions to prevent pollution of the environment.[93]

The Minister is empowered, before granting or refusing a site approval application, to demand from the applicant further information regarding geological and hydrogeological test results, contingency plans and pollution control equipment

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[90] Quebec tank ss.27, 30, 32, 35, 37; N.B. tank ss.7(1)(2), 36(2).

[91] N.B. tank s.40(1)(2)(3).

[92] N.B. tank s.24(3).

[93] Ibid s.25(2). Nova Scotia has similar provisions: N.S. tank ss. 14, 15, 16.

among others.[94] It is only when a site application has been approved that the successful applicant can proceed to apply for environmental approval as directed by the Minister.[95] The Minister may grant the application with terms and conditions prescribed under s.30(2) regarding having a safe tank.

An environmental approval entitles the successful applicant to go ahead with the construction or installation of the USTs[96]. However, the applicant may be required to be licensed in accordance with Part II of the regulation or to obtain registration under the Water Quality Regulation[97] which prohibits the construction or modification of any contaminant source without approval.

The site and environmental approval requirements do not, however, apply to USTs of less than 2,000 litres capacity or a marina UST of less than 200 litres.[98]

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[94] N.B. tank s.26(1)(a)-(n); N.S. tank s.14(3).

[95] N.B. tank s.30(1).

[96] Ibid ss.28, 30(6); s.35: the construction and installation of USTs must be done by an authorized person; s.32(a)(b)(c): before commencing the operation of a UST, an environmental approval holder must satisfy the conditions of the approval and the applicable regulations.

[97] Ibid ss.30(2)(g), 33(1).

[98] Ibid s.23

2) Construction and Installation of Tanks:

Certain materials are required to be used in the construction of USTs. There are variations in the quality of the materials depending on the chemical composition of the intended content. Construction materials must be generally compatible with the intended content and must be resistant to corrosion in order to avoid leaks. Generally, the construction and installation standards of the National Standard of Canada (Underwriters Laboratories of Canada -ULC) are followed by most jurisdictions.

For example, steel USTs intended to contain flammable or combustible liquids are required to be of ULC S603 or S603.1 standard.[99] Fibreglass USTs would be required to be of ULC S615 standard latest edition.[100] There are also installation requirements. In Ontario, for example, in a location where high water level is

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[99] Alberta Fire Code Alta. Reg. 151/84 as amended by 135/86, s.166(2)(3); N.B. tank ss.53, 54, 108(1); PEI tank s.5(1); N.S. tank s.17(1); Nfld. tank ss. 5, 29; Man. tank s.3, schedule A s.1; Sask. Hazardous Reg. s.15(a)(b)(c); (Sask.) Regulations Governing the Storage and Handling of Inflammable Liquids (hereinafter Sask. tank) Sask Reg. 258/67 as amended by Sask. Reg. 235/71, 278/74, 81/85, 135/87, s.8; (Ontario) Gasoline Handling Regulation (Code) (hereinafter Ont. Code) R.R.O. 1980, c.439 as amended by O. Reg. 568/88, 620/88, 67/89, 458/89, s.7(5)(6).Quebec tank s.97; Yukon tank s.8(5)(6). (NWTs) Fire Prevention Regulations (hereinafter NWTs. tank) N.W.T. Reg. R-036-81 as amended R-153-82, R-021-83, R-001-88, R-024-89: adopted the Environmental Code's construction and installation standards, s.3(1); (B.C.) Fire Code Regulation B.C. Reg 15/87: adopts the provisions of the National Fire Code of Canada 1985, N.S tank s.17(1).

[100] Quebec tank s.96; Ontario Code s.7(10); Man. tank s.3; Nfld. tank s.29; N.S. tank s.17(1)-(10); Sask Hazardous Reg. s.15; PEI tank s.5(3); N.B. tank ss.54, 108(2).

expected, USTs are required to be installed with impermeable materials such as concrete slabs at a certain elevation to avoid contact with water table.[101] Alberta, Quebec and New Brunswick have similar provisions[102]. Quebec further requires all new USTs to be equipped with observation wells[103]

USTs located in Quebec's Class A sites - sites of certain proximity to water supplies or underground structures are required to have double shells and piping;[104] and tanks in Class B sites - sites within certain proximity to floodplains, public water supplies, underground structures and watercourses are to be equipped with automatic leak detection and inventory control systems.[105] In sensitive sites, in addition to meeting the latest edition of ULC standards for construction and corrosion protection, New Brunswick requires tanks to be of double wall monitored continually.[106] Jurisdictions such as British Columbia, Prince Edward Island,

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[101] Ont.Code s.7(39) sub-clauses. (1)(g)(h) and (2)(g)(h).

[102] N.B. tank s.106(1)(2); Alberta Fire Code s.197; Quebec tank ss.109, 112-118.

[103] Quebec tank ss.124-125, See also ss.106-107.

[104] Ibid s.99.

[105] Ibid s.100.

[106] Department of Municipal Affairs and the Environment, Construction Standards for Installation and Removal of Petroleum Storage Systems (hereinafter N.B. Construction Standard) (Fredericton: The Dept. Operation Branch, Industrial Program, April 1991) at 6, 7: "in lieu of double wall tanks and/or supply lines, single wall tanks and/or supply lines may be completely enclosed by a flexible liner system that is designed to contain any spill or leak that may stem from the system. A liner systems shall be complete with a top cover supplied by the manufacturer. The system

Saskatchewan and the territories do not have such provisions.

3) Monitoring, Leak Detection and Response Action:

Monitoring the content of USTs to determine when leak has occurred so as to take corrective measures is important to groundwater protection. Although there are some variations in monitoring and leak detection systems in the jurisdictions, the systems are essentially the same. For example, measurement, inventory and record keeping of the liquid contents of USTs are made and reconcilled with the receipts and withdrawal records on a daily or weekly basis.[107] Any inconsistency in the records is evidence of a leak which must be reported to the appropriate authorities and in respect of which an appropriate response action must be taken.

Leak detection can also proceed, for example, as provided under New Brunswick's law which states that

> where a loss of liquid or a gain of water of five millimetres or greater is indicated by the reconciliation made under the subsection (5) or (6) or where the level of water at the bottom of the underground storage

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to be used for this shall be approved by the Department prior to installation."

[107] Quebec tank ss.282-287; Alberta Fire Code s.219(1)-(4); B.C. Fire Code the same as s.4.3.17 of the National Fire Code supra, Chapter Four, note 144 and accompanying text; Man. tank ss.17, 18; Nfld. tank s.25; NWTs tank same as Environment Code supra Chapter Four, note 146, s.6.2.1, s.6.2.2, s.6.2.3.; N.S. tank s.20: only for USTs of 4000 litres or greater capacity; Ontario Code s.8(34); PEI tank ss.11, 12, 13; Yukon tank s.9(33); N.B. tank s.65; (N.B.) Water Quality Regulation N.B. Reg. 82-126 as amended by N.B. Reg. 86-85, s.17.

> tank exceeds 50 millimetres the owner or operator of the system shall immediately take corrective action in accordance with section 44.[108]

Some jurisdictions require the installation of leak detection systems.[109] Leak detection tests may be required during installation and before backfilling of tanks and/or from time to time during the operation of tanks.[110] Where a leak is detected, the tank is required to be removed and replaced or upgraded to meet required standards, and the leak is recovered and removed from the soil or groundwater.[111] Some jurisdictions do not allow the upgrading of existing tanks which are 25 years or more at the time of the coming into force of the UST regulations. Such tanks have exceeded their life span. They were not made with materials that meet current standards and therefore, are required to be totally

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[108] N.B. tank s.65(7).

[109] Ontario Code s.7(40)(41); Quebec tank s.100; See Sask. Hazardous Regulation s.15(d); N.B. Construction supra note 106, at 2, 4: requires the sampling and monitoring of groundwater at UST sites by means of sniffer tubes.

[110] Alberta Fire Code ss.215, 217, 218; B.C. Fire Code same as National Fire Code supra note 107, s.4.3.16; Man. tank ss.4, 5, 21; N.B. tank ss.60(1), 61, 63, 64, 108(1); Nfld. tank ss.25, 30; N.S. tank s.28; Ontario Code s.8(35)(a)(h); PEI. tank ss.4(a), 13(3)(4)(b)(c), s.16, s.17; Quebec tank ss.101-111; Yukon tank s.9(34).

[111] See for example, Alberta Fire Code ss.199(4)(k), 216; B.C. Fire Code same as National Fire Code ss.4.3.16.3, 4.1.9.1, 4.3.8.8; Man. tank s.23; N.B. tank s.62; Nfld. tank, s.26(a)(b)(c)(d). NWTs tank: same as in Environmental Code supra note 107; N.S. tank s.25, 10; Ontario Code s.8(35)(f), s.10(7)(a); Yukon tank ss.9(34)(e)(f); s.11(7)(a).

removed.[112]

Some jurisdictions specially regulate UST leaks in areas designated "critical" or "sensitive". In Manitoba and Newfoundland, for example, groundwater or surface water in such areas is vulnerable to contamination from USTs containing gasoline and associated products.[113] Where a tank is located in a "critical area", the owner or operator is required to conduct certain tests within a prescribed period and where the test shows leakage, to comply with certain removal and upgrading standards for the tanks.[114] Where no leak is detected, he is still required to comply with certain standard of upgrading of the tank and to, within a given time, notify the appropriate authorities of the methods of upgrading used.[115] Essentially the same requirements apply to tanks located in "sensitive areas".[116] In both "critical" and "sensitive" areas all reconciliation records regarding leak detection must be submitted to the

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[112] PEI tank s.15(1), s.15(2): requires the removal or upgrading of USTs which are under 25 years before they reach 15 years; N.S. tank s.25(1)(2); Sask. Hazardous Regulation s.15(e) Ontario Code s.7(49): does not approve steel USTs installed prior to 1974 which are not protected from corrosion by wrapping, coating, galvanizing or cathodic protection; NWTs tank: as in Table 5.3.1, 5.3.2. of the Environmental Code supra note 107.

[113] (Man) Critical Areas Regulation Man. 125/88R, ss.1, 2, 3; (Man) Sensitive Areas Regulation Man. Reg. 126/88R, ss.1, 2. Nfld. tank s.2(k), s.2(aa).

[114] Man. tank s.4(a)(i)(ii); Nfld. tank s.6(2)(a)(b).

[115] Man. tank s.4(b)(i)(ii); Nfld. tank s.6(2)(c)

[116] Man. tank s.5; Nfld. tank s.7.

appropriate authorities every three months.[117]

A more general approach for preventing leaks from USTs is to provide that no owner or operator of storage tanks or any other person is permitted to directly or indirectly cause the contamination of soil, undergroundwater or surface water by spillage, leakage or release of gasoline or associated products from such tanks.[118]

4) Abandonment and Removal of Tanks:

Abandoned USTs are not usually given maintenance attention such as carryiing out leak detection tests. Such USTs pose danger to the environment. Therefore, they are usually removed from the ground. The laws of different jurisdictions define what constitutes abandonment and the procedures for safe removal and disposal of such tanks and associated piping from the ground without endangering the environment.[119] Where USTs have been so removed from the ground, they cannot be reused except they are recertified as meeting current

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[117] Man. tank s.17(1)(f); Nfld. tank s.20(1)(f).

[118] Man. tank ss.7, 8, 9; Nfld. tank ss.9(1), 10; N.S. tank s.7.

[119] Alberta Fire Code ss.395, 396, 397, 401; B.C. Fire Code s.4.10.3.1: same as in National Fire Code supra note.....s.4.10; Man. tank ss.1(a), 24; N.B. tank ss.230, 231, 232, 233, 238(2), 239, 242, 243; schedule B: requires the disposal of all "undesirable" tanks by June 30, 1993; Nfld. tank ss.2(a), 27; NWTs tank as in Environmental Code supra note....Part 7; N.S. tank ss. 29, 30(1)(2), 31; Ontario Code ss.9(17)(1-3), 9(18)(21); PEI tank ss.19, 21; Quebec tank ss.129, 130, 131, 172; Sask. tank Part V, Sask. Hazardous Regulation s.17; Yukon tank ss.10(10)(1-2), 10(11).

applicable standards.[120]

ii) Comments, Criticisms and Recommendations on UST Regulations:

Like the National Fire Code, both the Alberta Fire Code and the B.C. Fire Code are primarily designed to prevent fire outbreak as a result of leaks from USTs. They protect groundwater incidentally, that is, to the extent that they prevent leaks. Thus the location of USTs under these laws do not, for example, address hydrogeological conditions which are crucial to groundwater protection. This, for example, suggests an urgent need to make the proposed B.C. Underground Storage Tanks Regulation a law.[121]

The Alberta Fire Code and its mother legislation, the Fire Prevention Act[122], come under the authority of the Minister of Labour. Alberta Environment gets involved only when a leak occurs from a UST.[123] Its role is, therefore, remedial rather than preventive, a strong indication that environmental protection is

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[120] See for example, Alberta Fire Code s.400; N.B. tank ss.237, 241, 247, 248, 249; Nfld. tank s.31(3); N.S. tank ss.30(3), 32(1)(a); PEI tank s.20(1)(2); Quebec tank ss.133, 106, 127.

[121] Wilson, supra, Chapter Four, note 280; Underground Storage Tanks: A Legal Review supra note 86.

[122] R.S.A. 1980, c.F-10.1 : to be replaced by a proposed Uniform Safety Act, see Underground Storage Tank: A Legal Review supra, note 86.

[123] Environmental Protection and Enhancement Act Bill 53, ss.94 et seq.

not the primary purpose of both laws. This is so notwithstanding that Alberta Environment and the Labour Department are undertaking a five year Management of Underground Storage Tanks (M.U.S.T.) Program which began in 1988.[124]

Activities under M.U.S.T. include the assessment of the potential of groundwater pollution and fire risk, an inventory of all existing and abandoned tanks, the recommendation of requirements for tank installation, the operation and abandonment of tanks and the recommendation of schedules for upgrading and replacing tanks.[125] Alberta should promulgate a regulation for USTs primarily designed to protect groundwater. The Environmental Code[126] offers a model for Alberta and other provinces with less stringent and less comprehensive provisions except for want of financial responsibility guarantee or liability insurance on the part of owners or operators of USTs under the Code.

With the exception of Quebec and New Brunswick, none of the provinces have provisions for liability insurance on the part of owners, operators or installers of USTs against pollution damage caused to third parties. The importance of a liability insurance requirement cannot be overemphasized. Apart from compensating injured third parties, it promotes extra care on the part of owners, builders and installers of USTs to ensure that leak is avoided. This enhances groundwater protection.

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[124] Underground Storage Tanks: A Legal Review supra note 86, at 2.1.

[125] Ibid.

[126] Supra Chapter Four, note 146 et seq. and the accompanying text.

New Brunswick's stringent environmental approval process for USTs ensures that only a diligent and environmentally minded applicant would be given approval. The linking of this process to the (N.B) Water Quality Regulation makes water pollution prevention a key element of its USTs regulation. However, the exemption of tanks of less than 2000 litres capacity and marina system with capacity of less than 200 litres from the process could be dangerous given that a litre of gasoline can contaminate several thousand litres of water. Even more dangerous is the exemption from licensing regime of the same category of USTs.[127] It is submitted that all USTs regardless of their capacity should be subject to licensing regime as under the Environmental Code. Other than the aforementioned flaw, other jurisdictions should adopt New Brunswick's environmental approval approach.

d) Agricultural Use of Pesticides and Associated Substances:

i) Analysis of Pesticide Regulations:

In all jurisdictions the sale, use or application of pesticides generally requires

[127] N.B. tank s.6(1): only owners or operators of USTs with capacity of 2000 litres or more and a marina system with a capacity of 200 litres or more are required to be licensed.

a licence, permit or certificate of approval.[128] In some jurisdictions, certain pesticides are classified as restricted and permits for their use are subject to stringent conditions.[129] A licence or permit applicant is required to obtain public liability insurance coverage.[130]

Generally, the application of pesticides into natural water bodies is prohibited

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[128] (B.C.) Pesticide Control Act (hereinafter B.C. Pesticide) R.S.B.C. 1979 c.322, ss.4, 5, 6; (Nfld.) The Pesticides Control Act (hereinafter Nfld. Pesticide) S.Nfld. 1983, s.4(1)(2); (N.B.) Pesticide Control Act (hereinafter N.B. Pesticide) S.N.B. 1989, c.P-8 as amended by an Act of 1990 c.61, ss.14, 15, 16(1)(2); (Alta) Environmental Protection and Enhancement Act (hereinafter Alta. EPEA) 1991, Bill 53, s.178(1); (Alta.) Pesticide Applicator Licensing Regulation (hereinafter Alta. Pesticide) Alta. Reg. 214/80 as amended by Alta. Reg. 219/84; (PEI) Pesticides Control Act (hereinafter PEI. Pesticide) S.PEI 1988, c.P-4 as amended by an Act of 1991 c.28, s.8; (Sask.) Pest Control Product Act (hereinafter Sask. Pesticide) S.S. 1979-80 c.P-8 as amended by S.S. 1979-80 c.92, 1980-81, c.77, 1983-84 c.16, 1988 c.42, s.10; (Sask.) Pest Control Products Regulations (hereinafter Sask. Pest Reg.) R.R.S. 1985 c.P-8 Reg.2, s.11; (NWTs.) Pesticide Act R.S.N.W.T. 1974 c.P4, s.6; (Yukon) Pesticide Control Act (hereinafter Yuk. Pesticide) S.Y.T. 1989-90 c.20, s.8; (Man.) The Pesticides and Fertilizers Control Act (hereinafter Man. Pesticide) R.S.M. 1987 c.P-40, s.2(2)(3); (Ont.) Pesticide Act R.S.O. 1980 c.376 as amended by Ont.Stat. 1986 c.68, 1988 c.54 Part III, ss.5, 6; (Que) Pesticide Act S.Q. 1987 c.29, s.34; (N.S.) Pest Control Act R.S.N.S. 1989 c.341, ss.12(1), 13(1), 13(2): exempts casual or domestic users from the permit system.

[129] B.C. Pesticide Reg. s.4(1)(f)(g): Annex 1 schedules; Newfoundland Regulation 86/84, s.8; Que Pesticide Reg. s.14, schedule III; N.B. Pesticide Reg. s.11; PEI Pesticide Reg. s.10; Sask. Pesticide Prohibition Reg. ss.2, 3, 4; Man. Pesticide Reg. s.4(1); Alta. EPEA s.180(b).

[130] See for example, (B.C.) Pesticide Control Act Regulation (hereinafter B.C. Pesticide Reg.) B.C. Reg.319/81 as amended by Reg.439/90, s.24(1); N.S Pest Control Act s.14(3); Nfld. Pesticide s.5(1); (N.B.) General Regulation-Pesticides Control Act (hereinafter N.B. Pesticide Reg.) N.B. Reg.83-57, s.13(b); Ont. Pesticide Act s.9; Man. Pesticide s.2(4); (Que.) Regulation Respecting Pesticides (hereinafter Que. Pesticide Reg.) O.C. 874/88 (Que. Official Gazette June 22, 1988 vol.120, No.26); (NWTs Pesticide Regulation) NWT.Reg. 026/85, s.4.

except one holds a permit for that purpose.[131] Whether groundwater is protected by this prohibition is a matter of interpretation of the individual laws. For example, New Brunswick and Newfoundland refer to "body of water" but define it as including groundwater.[132] Manitoba and British Columbia refer to "body of water" but do not define it as including groundwater.[133] Prince Edward Island, the Yukon territory and the Northwest Territories refer to "open body of water"[134]. The word "open" clearly suggests that these laws do not contemplate groundwater protection.

However, Prince Edward Island and the Yukon prohibit the use of pesticides by any person including licensees in a way that causes injury in excess of injury, if any, which would normally result from the proper application of such pesticides.[135] Ontario has similar provisions.[136] Alberta and British Columbia prohibit the use of pesticides where that would result in unreasonable adverse consequences to the

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[131] B.C. Pesticide Reg. s.10(1)(c); N.S. Pest Control Act s.14(a); (N.S.) Pest Control Products Act Regulations N.S.Reg. 80/89, s.17; Yuk. Pesticide s.7(1); NWTs Pesticide Act s.2; Sask. Pesticide s.5; (Alta.) Pesticides Sales, Use and Handling Regulations (hereinafter Alta. Pesticide Use) Alta. Reg.213/80 as amended by 142/90, s.3; PEI Pesticide s.7; Que. Pesticide Reg. s.14; Ont.Pesticide s.7(2); N.B. Pesticide s.16; Man.Pesticide Reg. s.3(1).

[132] N.B. Pesticide s.1; Nfld. Pesticide s.1(b).

[133] Man. Pesticide Reg. s.3(1); B.C. Pesticide Reg. s.10.

[134] PEI Pesticide s.7; (PEI) Pesticide Control Act Regulations EC543/84 (updated to June 1990) s.12(1); Yuk. Pesticide s.7(1)(2) NWTs Pesticide Act s.2.

[135] PEI Pesticide s.3; Yuk. Pesticide s.3(2)(3).

[136] Ont. Pesticide s.4.

natural environment.[137] Nova Scotia has general provisions prohibiting contamination by pesticides.[138] Most jurisdictions prohibit the direct withdrawal of water from a water source with equipment used in applying pesticides except such equipment is fitted with a device that prevents back-flow of water.[139] Again, only Newfoundland and New Brunswick provisions contemplate groundwater protection in this regard.[140] In disposing of pesticides and their containers by burying,[141] only Ontario, New Brunswick, Nova Scotia and British Columbia specifically provide that it should not contaminate groundwater.[142]

Of great importance for groundwater protection is the power of the authorities in some jurisdictions to restrict or prohibit the sale, storage or use/application of

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[137] B.C. Pesticide Regulation s.2(2); Alta Pesticide Use supra, note 131, s.2(2).

[138] N.S.Pest Control Act ss.6(1)(2), 14(1), 16.

[139] B.C. Pesticide s.7(2); N.S. Pest Control Act s.17(b)(c); Nfld. Pesticide s.12; N.B. Pesticide s.43; N.B. Pesticide Reg. ss.45, 46; Ontario Regulation 751/80; as amended by 562/85, ss.22, 23, 36; PEI Pesticide Reg. s.17(1)(2); Sask Pesticide Reg. s.6; NWTs. Pesticide Act s.5; Alta. EPEA s.180(j).

[140] Nfld. Pesticide s.12; N.B. Pesticide s.43; N.B. Pesticide Reg. ss.45, 46.

[141] B.C. Pesticide Reg. s.41; Nfld. Pesticide s.11; N.B. Pesticide ss.24, 24.1; N.B. Pesticide Reg. s.43; PEI. Pesticide s.6; PEI Pesticide Reg. s.13; Sask. Pesticide Reg. s.10; Sask. Pesticide Prohibition Regulation 86/80, s.4; NWTs Pesticide Act s.4; Yuk. Pesticide s.6; Alta. EPEA s.180(n).

[142] Ontario Regulation ss.41(1); 83(1)(b): but only for water exterminators; N.B. Pesticide Reg. s.41: only for the burial of pesticide containers; N.S. Pest Contol Reg. s.19; R.W. Adams, Handbook for Pesticide Applicators and Dispensers (hereinafter Handbook for Pesticide) 5th ed. (Victoria: B.C. Environment, 1990) at 212.

certain pesticides where there has been contamination or danger of contamination of the environment or, generally, where it is in the public interest.[143] Thus toxic pesticides that can cause serious groundwater contamination can be restricted or prohibited under such provisions. However, it is one thing to restrict pesticide use generally and another to design a restriction specifically for groundwater protection. In Prince Edward Island, for example, aldicarb (Temlik) is not to be applied 1) where the depth of groundwater table is less than 5 metres, 2) within 150 metres of any well, and 3) where the average slope of a field is above 10% or the field is prone to uncontrolled erosion or run-off.[144] Other restrictions include not applying it 4) more than once in 3 years in a given field, 5) within 20 metres of any open ditch, stream or areas prone to run-off, and 6) at a rate beyond 11.0-22.4 Kg/ha.[145] Newfoundland has prohibited the use of certain pesticides.[146] However, the prohibition is not necessarily with groundwater protection in mind though it serves that purpose.

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[143] N.S. Pest Control Act s.22; B.C. Pesticide s.16; Nfld. Pesticide s.14; N.B. Pesticide ss.8(1), 9; Man. Pesticide s.4(5); Alta EPEA s.181(a); PEI Pesticide Reg. s.15(1).

[144] PEI Department of Agriculture, Guidelines for the Use of Aldicarb (Temlik) in PEI (Charlottetown: The Dept., 1987) 1 et seq.

[145] Ibid.

[146] Newfoundland Regulation 188/85: prohibits the sale, distribution or use in the province of pesticides containing ethylene oxide, metam sodium, methyl isothiocyanate.

To further control the use of pesticides, pesticide users in some jurisdictions are required to comply with certain practices.[147] Adopting appropriate method and timing for pesticide or fertilizer application helps to minimize run-off, leaching and seepage of pesticide into watercourses and groundwater.[148] There are guidelines to help farmers apply fertilizers or manure in a way that minimizes groundwater contamination.[149]

ii) Criticisms, Comments and Recommendations on Pesticide Regulations:

A regular analysis of soils to determine the right amount of fertilizer a particular crop would need to do well is important to avoid excessive fertilizer leaching into groundwater[150] following precipitation or irrigation. Demonstration

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[147] B.C. Pesticide Reg. s.12(1); Sask. Pesticide Reg. s.18; Man. Pesticide Reg. s7(2); N.B. Pesticide Reg. ss.19, 32; PEI Pesticide Reg. s.9; NWTs. Pesticide Reg s.3.

[148] For guidelines on pesticides use, see for example, Handbook on Pesticide supra note 142, at 211.

[149] See for example, Ministries of the Environment and Agricuture and Food, Agricultural Code of Practice for Ontario 1973 (hereinafter Agricultural Code) (Toronto: The Ministries). (reproduced in Ecolog vol.4); Livestock Manure and Waste management in New Brunswick Guidelines (reproduced in Ecolog vol.3). See also, R.A. Hedlin and C.M. Cho, "Fertilizer Use and Other Soil Management Practices in Relation to Contamination of Ground and Surface Water with Nitrogen and Phosphorous" in The Allocative Conflicts in Water Resources Management (Winnipeg: Agassiz Centre for Water Studies, University of Manitoba, 1974) at 306-307.

[150] Hedlin and Cho, supra, note 149, at 314, 318.

programs for farmers on the use of minimal quantity of fertilizers to avoid leaching into groundwater zone, and without diminishing crop yields is important. Such projects are largely lacking in most Canadian jurisdictions.[151] Manitoba has a "homestudy course entitled 'Agricultural Chemicals in the Nineties' sponsored by the Department of Agriculture.[152] This is a mediocre project as it is not practically done in the field by specialists.

In contrast, the State of Nebraska, has since 1978 established a 65 Sq.mile special water quality project area, an area in which nitrogen concentration in groundwater was found to exceed the maximum allowable concentration.[153] The area was established for purposes of applying the Best Management Practices (BMPs) in irrigating and applying fertilizer to crops in order to minimize nitrogen contamination of groundwater in the area due to leaching. The goal of the project which involved cost-sharing and participation by different interested government agencies was to demonstrate to farmers that "the financial benefits and environmental merits of BMPs through reduced fertilizer and irrigation costs could

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[151] See Personal Communications with the appropriate authorities of different jurisdictions, see Appendix: jurisdictions like British Columbia, New Brunswick, the Northwest Territories and Saskatchewan deny knowledge of such projects. Alberta and Newfoundland avoid specific comments on the projects.

[152] Personal Communication with Mark Goodwin, Weed Specialist, Soil and Crops Branch, Department of Agriculture, Manitoba, dated Feb. 19, 1992.

[153] J.S. Schepers, "Use of Agricultural BMPs to Control Groundwater Nitrogen" in Ground Water Quality Protection Symposium supra Chapter One note 105, at 85.

be realized while production was maintained or improved."[154]

In each of 1980, 1981 and 1982 nitrogen fertilizer applied under the project droped by 83lb per acre on 7,393 acres (representing 22% of the project area) with no reduction in crop yield. Concentration of nitrogen in groundwater is reduced in this way.[155] Yet it is reported that for fear of poor crop yield farmers still do not want to install the BMPs in their farms to reduce fertilizer application.[156]

Already some studies which could provide a basis for adopting similar programs in Canada have been done.[157] The promotion of integrated pest management, however, remains a more compelling need.[158]

In large part, groundwater is protected from pesticide and fertilizer only in a

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[154] Ibid at 86-87: recommended BMPs include " soil testing for improved fertilizer applications, use of resistance blocks and tension metres to determine when irrigation is required, installation of irrigation well flow meters to determine how much water is applied, construction of irrigation reused pits, ...and a variety of fertilizer time and form options to accommodate the producer while minimizing the potential for leaching."

[155] Ibid at 87.

[156] Ibid at 88.

[157] J.L. Buth et al, Groundwater Quality Assessment of the Assiniboine Delta Aquifer (Carman, Manitoba: Manitoba Agriculture, 1992) 1-2, 10; H. Maathuis et al, Study of Herbicides in Shallow Groundwater Beneath Three Irrigated Sites in Outlook Irrigation District, Saskatchewan Saskatchewan Research Council Pub. No.R-844-13-E-88, June, 1988 at 64-65.

[158] See for example, British Columbia Environment, British Columbia's Environment Planning for the Future New Directions in Pesticide Management (Victoria: B.C. Environment, 1991) at 5-6: the province is embarking on integrated pest management.

general, superficial fashion. Jurisdictions should note pesticides which are particularly dangerous to groundwater and prohibit or restrict their use. With the exception of PEI, no jurisdictions have restricted or prohibited the use of pesticides for reasons of groundwater protection. Furthermore, as earlier suggested, provinces should establish pesticides management plans designed specifically for groundwater protection.[159] Federal-provincial cooperation in pesticide research and monitoring programs relevant to groundwater protection which has already begun in some provinces is a positive step in this direction.[160]

Contaminant-focused regulations of states in the United States are not discussed as they essentially derive from the umbrella legislation of Congress and EPA's regulations discussed in Chapter Four.[161]

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[159] Supra, Chapter Four notes 256 and accompanying text. The EPA model may offer a good guide to the provinces.

[160] Environment Canada, Pesticides Research and Monitoring Annual Report 1988-1989 (Ottawa: Supply and Services Canada, 1990) at 12-14, 21, 35, 57, 60, 79-80.

[161] See supra, Chapter Four notes 200 et seq. It suffices to say that states generally require engineered facilities for landfills: see for example, 6 NYCRR (New York State) Part 360 Solid Waste Management Facilities (Dec. 31, 1988 revised May 28, 1991)Sub-part 360-2, ss.360-2.1-360.17; registration, construction, installation and leak detection standards for USTs: see for example, 6 NYCRR Part 612-614 (1985) ss.612.2, 613.2-613.9, 614.2-614.7. Pesticides use is also regulated: see for example, (Wisconsin) Wis Stat 1987 ss.94.69(9)(10).

B. RESOURCE-FOCUSED APPROACH

There is no doubt that laws dealing with sources of groundwater contamination are crucial to groundwater protection. The existence of these laws, however, does not per se constitute a groundwater protection strategy. "Groundwater protection strategy" refers to the various resource-focused techniques for the protection of the resource. A combination of contaminant-focused laws and resource-focused laws or programs constitutes a powerful groundwater protection tool. Unfortunately, the protection strategies in the provinces are as yet underdeveloped and suffer from a number of constraints.

A groundwater protection strategy should encompass: aquifer assessment-determining its recharge and discharge areas, yield, quality and existing and potential contamination sources, and classifying the aquifers accordingly. It should also include a comprehensive and systematic monitoring scheme and the control of land use practices which impact upon groundwater quality.

I. Aquifers Assessment and Characterization:

Where an aquifer is Known to have a high yield of potable water that could serve a large community, it is reasonable to prohibit in the recharge areas activities that can contaminate the groundwater. Therefore, knowledge of the aquifers'

boundaries, yields, qualities, recharge and discharge zones are important to protecting them from contamination.

Some jurisdictions have embarked on such projects. This is, however, subject to some qualifications. For example, Alberta keeps an on-going inventory of the quantity and quality of groundwater resources through the maintenance of a "province-wide groundwater database, a network of observation wells monitoring major aquifers and a program of systematic hydrogeologic mapping."[162] Groundwater database is maintained at Alberta's Groundwater Information Centre (GIC). This Centre collects, stores and disseminates hydrogeological information including aquifer characteristics, yields, water level, well depth, geophysical logs and other associated data some of which are computerized.[163] The identification and classification of groundwater recharge areas is seen as a continuous process which depends upon gathering and interpretation of hydrogeological data.[164]

In other jurisdictions certain aquifers are yet to be charted and assessed.[165]

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[162] Alberta Environment, Water Management in Alberta Challenges for the Future: Groundwater Background Paper vol.7 (Edmonton: Alberta Environment, 1991) at 2.

[163] Ibid.

[164] Alberta Environment, Water Management in Alberta Challenges for the Future: Alberta's Water Resources Background Paper vol.1 (Edmonton: Alberta Environment, 1991) at 5.

[165] See Appendix: Personal Communications with the authorities of British Columbia, Manitoba, Saskatchewan, New Brunswick, Newfoundland and the Northwest Territories.

Groundwater or aquifers are not classified according to yield, quality, use or/and vulnerability to contamination in any of these jurisdictions.[166]

In Ontario, a determination of the areal extent and potential yield of major aquifers was contained in the document on "Major Aquifers in Ontario Series" published between 1973 and 1978.[167] Since 1969, the Groundwater Probability Map Series has been periodically published to show where potential usable groundwater in the province was available.[168] Since 1979, the Ministry of Environment (MOE) has been publishing maps showing groundwater susceptibility to contamination in different locations in the province.[169] In one of such maps it was stated that:

> the importance of protecting major sources of groundwater, especially groundwater which is a sole source of (water) supply with no other practical alternatives is self evident. Areas known to have major aquifers potentially capable of being contaminated are considered to be generally sensitive, and those areas containing sole source aquifers are deemed to be more sensitive than areas in which alternative sources might be exploited.[170]

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[166] Ibid.

[167] Neufeld, supra Chapter Four, note 241, at 5: publication of the Ministry of the Environment.

[168] Ibid.

[169] Ibid: susceptibility is determined by "a) permeability of near surface materials, b) groundwater movement, c) presence of major shallow aquifers, and d) use of groundwater in an area".

[170] (Ontario) MOE, Susceptibility of Groundwater to Contamination Wallaceburg-St Clair Facts Sheet (Map) (Toronto: The Ministry, 1986) Scale 1:50,000.

Clearly, these are aquifers for which there should have been programs such as the U.S. "sole source aquifer" and "wellhead protection areas" programs.[171]

Of even more serious concern is Ontario's "reasonable use" policy which allows the degradation of certain groundwater. This policy establishes a basis for determining the reasonable use of groundwater on property adjacent to contaminant (waste) sources. Proponents of the policy argue that it facilitates the implementation of groundwater quality management policies and procedures designed to protect existing and potential reasonable use of water.[172] The MOE determines what constitutes "reasonable use" and "potential use" of groundwater on a case by case basis because "...the wide variation in the quality, quantity and availability of groundwater makes a fixed, standard approach impracticable."[173]

Reasonable use of groundwater in any particular location is determined on the basis of "a) the present use of the groundwater, b) its potential use, and c) the amount and quality of the groundwater that is available".[174] The "reasonable use"

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[171] Supra Chapter Four, notes 235-240 and accompanying text.

[172] MOE, Incorporation of the Reasonable Use Concept into Groundwater Management Activities (Toronto: the MOE, 1986) s. 1.0: The groundwater management policies and procedures are contained in the Water Management Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment 1978 revised 1984.

[173] Ibid s.2.2: "reasonable use and potential use must be established with respect to specific soil and water-bearing units in the subsurface and would apply to all of the ground lying beneath a particular property."

[174] Ibid s.2.2: explains how these are technically determined.

concept applies to the issuance of a Certificate of Approval for the establishment, operation and expansion of landfills, exfiltration lagoons and large subsurface sewage systems.[175] Discharge of contaminants from these sources must respect the quality of groundwater on adjacent property determined as acceptable under the reasonable use concept. For example, a change in the quality of groundwater by contaminants discharged from landfills is acceptable only where:

> (the) quality cannot be degraded by an amount in excess of 50% of the difference between background and the quality criteria for any designated reasonable use except drinking water. In the case of drinking water, the quality must not be degraded by an amount in excess of 50% of the difference between background and the Provincial Drinking Water Objectives for non-health related parameters and in excess of 25% of the difference between background and the Provincial Drinking Water Objectives for health-related parameters. Background is considered to be quality of the groundwater prior to any man made contamination.[176]

As a rule landfills are required to be upgraded or closed where contaminant levels exceed the above specified limits.[177] A high safety margin is incorporated into the estimates of contaminants to be discharged from landfills because technology is not available to accurately determine the quantity or concentration of contaminants

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[175] Ibid ss.1.0; 3.2(1).

[176] Ibid s.3.5.1.1: the MOE believes that increases in contamination levels so allowed will not impair groundwater use determined to be reasonable on adjacent property, see s.3.3.3(c).

[177] Ibid s.3.5.2: modification could take the form of installing a cover with low hydraulic conductivity to minimize water contact with the wastes which produce leachates.

that could be discharged from a landfill.[178] Also, the natural quality of groundwater, present quality and potential contamination from all sources are taking into consideration in assessing the level of allowable degradation. This is summed up in the following scenarios:

> Example 1- where the designated reasonable use of groundwater allows no change in quality, no change is acceptable. Example 2- where the designated reasonable use of the groundwater is drinking water and the groundwater quality is presently better than the Provincial Drinking Water Objectives, a lowering of water quality on the Adjacent Property will be acceptable in accordance with the formular stated above. Example 3- where groundwater quality is currently poorer than the Provincial Drinking Water Objectives, but the groundwater is nonetheless in use as a drinking water source, then no decrease in water quality will be acceptable.[179]

Furthermore, release of unregulated level or concentration of contaminants may be allowed in a contaminant attenuation zone subject to the attenuation capacity of such zones where: (1) there is an alternative source of water supply far superior to the groundwater associated with the contaminant attenaution zone; (2) only a small defined and hydrogeologically restricted subsurface unit which is not likely to be of a higher use will be degraded; 3) the groundwater is naturally of high iron or manganese quality (i.e hard water); and 4) the authorities determine that the most appropriate use of a particular environment is contamination attenuation zone.[180]

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[178] Ibid s.2.4(B).

[179] Ibid s.3.5.1.2: exceptions to examples 1 and 2 are contained in s.3.4 Part 3.

[180] Ibid s.3.4: Contaminant attenuation zone is a zone where contaminants can be attenuated by natural processes.

II. Monitoring:

Given the importance of groundwater monitoring for the early detection of contamination, it is unfortunate that a comprehensive, long-term monitoring program is lacking in most Canadian jurisdictions. For example, British Columbia maintains 145 observation wells to monitor groundwater levels and quality only in areas where groundwater serves drinking and irrigation purposes.[181] New Brunswick has about 23 groundwater stations for "both hydrometric and management purposes and for basic groundwater level data".[182]

According to one writer,

> all provinces have installed network of observation wells to monitor groundwater levels, but only in Saskatchewan and Alberta has there been a program to also monitor the long-term quality of groundwater in the major aquifers systems in a systematic way."[183]

Other provinces monitor groundwater quality on a site or contaminant specific

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[181] Water Management Branch, Ministry of Environment, Groundwater Program 1989 Exacutive Update (Victoria: The Branch, 1989) 1; B.C. Environment, B.C.'s Environment Planning for the Future Sustaining the Water Resources (hereinafter Sustaining the Water Resources) (Victoria: B.C. Environment, 1991) at 14: The province, however, plans to undertake a monitoring and water quality management program for certain pollution sources.

[182] Department of Municipal Affairs and the Environment, Annual Report 1987-88 (Fredericton: The Dept. 197-88) at 25.

[183] Vonhof supra note 9, at 74.

basis.[184] But even this is directed at a small fraction of potential contamination sources and not related to sites that are located on major aquifers or close to water supply wells.[185] Again "techniques and strategies for groundwater monitoring have received scant attention..."[186]

A systematic monitoring of at least the major aquifers gives a more comprehensive picture of the groundwater quality in a jurisdiction. This is helpful in framing protection strategies than a site or contaminant specific monitoring.

III. Land Use Control:

Where sole source aquifer areas, wellhead protection areas and aquifer recharge areas (sensitive areas) are delineated, prohibition of activities that cause contamination offers a good protection. For example, New York State wellhead areas have been delineated with each area having at least two zones, namely: a wellfield management area and a remedial action zone. Land use prohibitions are one of the management options for these zones.[187]

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[184] Ibid; Neufeld, supra note 167 at 22: criticizes the Ontario position.

[185] J.A. Cherry, "Groundwater Occurrence and Contamination in Canada" (1987) 215-217 Can. Bulletin of Fisheries and Aquatic Sciences 387 at 416.

[186] Ibid at 417.

[187] Department of Environmental Conservation, Proposed New York State Wellhead Protection Program (Submittal to U.S. EPA) (Albany: The Department,

Traditionally, land use control in Canadian jurisdictions has not been designed specifically for the protection of groundwater. For example, there are several potash mines in Saskatchewan most of which are located on or near potable aquifers[188]. British Columbia plans to establish groundwater control areas in regions of groundwater use conflicts or overuse.[189] The province acknowledges unacceptable levels of nitrates and waste in groundwater in various places in the province[190] and yet it does not plan any protection area for high quality groundwater.

The water authorities in Ontario, Nova Scotia and Newfoundland are given the powers to designate an area surrounding a public water supply a protected area in respect of which actions can be taken to prevent any activity that would contaminate the water supply.[191] By alluding to swimming as one of the activities to be prohibited, the Ontario and Newfoundland provisions contemplate only surface

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1990) at 18-19, 21: "for all public water supplies utilizing groundwater, the overall wellhead protection area (WHPA) delineation will be subdivided into two parts. The innermost zone is referred to as the Remedial Action Area. The remainder of the WHPA is referred to as the Wellfield Management Area."

[188] Cherry, "Groundwater Occurrence and Contamination in Canada" supra note 185, at 413: "the geology at many sites of actual or potential contamination is complex which makes the design of networks of monitoring wells difficult and site specific." Economic interests should, however, be respected in proper cases.

[189] Sustaining the Water Resources supra note 181, at 10.

[190] Ibid.

[191] Ontario Water Resources Act R.S.O 1980, as amended by Ont. Stat. 1986 c.68, and 1988 c.54 Part II, s.19(1)(a)(b)(c); (Nova Scotia) Water Act R.S.N.S. 1989 c.500, s.16(1)(2); (Newfoundland) The Department of Environment and Land Act S.Nfld. 1989 c.21, s.26(1)(2)(3).

water. However, the general context of their water legislation may suggest a basis to apply these provisions to groundwater.

Newfoundland has designated several public water supply areas as protected areas[192] but there is no indication that groundwater in these areas is covered. Such a scheme, where applied to groundwater, offers strong prctection. However, the inability of Newfoundland to assess and classify some aquifers[193] militates against including groundwater in the areas designated as public water supply areas. Nevertheless, groundwater protection zones have been initiated for some communities dependent on groundwater supply for drinking. For each of such zones, land use, storage of hazardous materials and road salt deicing zones have been defined. The zone closest to the wellfield area has the most stringent regulation.[194]

New Brunswick's case is not significantly different from Newfoundland's. Section 14(1)of the Clean Water Act empowers the Minister with the approval of the Lt. Governor in Council to "designate as a protected area all or any portion of a watershed, aquifer or groundwater recharge area that is used as a source of water for

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[192] See for example, Nfld. Reg. 284/83; Nfld. Reg. 152/84.

[193] Personal Communication with Wasi Ullah, Director Water Resources Division, Newfoundland, dated January 21, 1992, see Appendix.

[194] Ibid.

a public water supply system."[195] In a protected area, the Minister can prohibit, limit or control any activity that might impair the quality or quantity of water.[196] He can also prohibit, limit or control land use in the area and impose standards, terms and conditions for the use and protection of both the water quality and quantity.[197] The construction, alteration and maintenance of works or any activity in a protected area must be duly approved and carried out in accordance with the terms and conditions of such approval.[198] The Minister has designated several protected areas and these are "those portions of land upstream of the respective surface water supply intakes of Municipalities set forth herein".[199] These protection areas are, however, for surface water. Groundwater protection zone based on site-specific information is said to be in the process of being designated.[200] The application of surface water protection criteria to groundwater would overlook the particularity of groundwater which can only be addressed by specifically-directed

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[195] S.N.B. 1989, c.6.1.; Water Quality Regulation-Clean Environment Act N.B. Reg.82-126, s.20.

[196] Clean Water Act s.14(3)(a).

[197] Ibid s.14(3)(c)(d)(e).

[198] Water Quality Regulation-Clean Environment Act supra, note 195, s.3(8.1)(8.2)(9).

[199] Order of Designation of the Minister of the Environment of New Brunswick N.B.Reg.90-136, 1st para.

[200] Personal Communication with Douglas Craig, Groundwater Protection Hydrogeologist, New Brunswick Environment, dated March 12, 1992, see Appendix.

measures. Therefore, until groundwater protection areas are designated with proper delineation and assessment of the aquifers, adequate protection might not be achieved.

Quebec has organized municipalities into regional districts for the purposes of land use planning taking into consideration vulnerability of groundwater to contamination by particular land uses.[201]

IV. Criticisms, Comments and Recommendations:

a) Aquifer Assessment Data:

Adequate hydrogeological data on aquifers/groundwater are needed for better groundwater protection as management decisions have to be based on them. Well drillers' reports contribute to a groundwater database because they provide knowledge of groundwater occurrence. However, in Onario, for example, such reports are not up to date. [202] British Columbia is yet to make the submission of such reports mandatory.[203] As suggested by a groundwater expert, well drillers should

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[201] Vonhof supra, note 9, at 82: maps showing groundwater contamination potential have been prepared for some areas.

[202] "Groundwater Protection The Lack of Government Action in Canada" supra, Chapter Four, note 190, at 21.

[203] Sustaining the Water Resource supra note 181, at 10.

be trained on proper boring techniques so that hydrogeological data obtained and reported by them can be more reliable.[204]

Insufficient data thus impedes groundwater protection in Canada. According to one writer "we know little about many aquifers in Canada....we lack the data to make the decisions that will have to be made in drafting meaningful legislation"[205] such as legislation that incorporates classification of groundwater and the degree of protection to be given to each class.

b) Classification of Groundwater/Aquifers:

Classification can be done on the basis of quantity, quality, existing and potential uses including recharge of surface water and/or vulnerability to contamination. Classification helps to channel more of the financial and technical resources, and legislative enforcement efforts to the protection of groundwater found to be of highest uses in a particular jurisdiction. It helps to order protection priorities so that resources are not wasted on groundwater which are of little or no value.

As we have seen, aquifer assessments which should supply the necessary data for making groundwater protection decisions remain a major problem in Canadian

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[204] "Groundwater Protection The Lack of Government Action in Canada" supra note 202, at 21: Saskatchewan has done this.

[205] J.N. Bishop, "Groundwater Protection" Hazardous Materials Magazine (June 1991) at 17.

groundwater management.[206] Most jurisdictions are yet to assess their major aquifers. Accordingly, the classification of aquifers is impossible. Without classification, in turn, groundwater protection priorities can easily be misplaced. The quality and beneficial uses of groundwater must be a guiding principle to setting protection priorities.

By contrast, some U.S. States have followed the EPA's classification guidelines to develop classifications for their aquifers and groundwater. For example, Florida states its approach as follows:

> it is impractical, and perhaps unnecessary, to require non-degradation standards to all water at all places and all times. The principal of "most beneficial use" is adhered to in Florida. Potable water aquifers are protected to the highest level possible while nonpotable aquifers are utilized for storage or disposal of treated effluents or other beneficial uses.[207]

Florida has four classifications based on groundwater quality measured by Total Dissolved Solids (TDS) and geological confinement (i.e. vulnerability to contamination).[208] In keeping with the EPA Wellhead Protection Program,[209]

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[206] DOE Groundwater Strategy supra Chapter Four, note 191, at 18 and accompanying text.

[207] Florida Department of Environmental Regulation, Bureau of Groundwater Protection, Florida's Ground Water Strategy (Tallahassee: 1989) Part III, at 2: the quality of drinking water and that of potable water are identical.

[208] Ibid at 3.

[209] Supra, Chapter Four, notes 239-240.

the State has adopted an additional class of groundwater with a different regulation. Pollution discharges in the different groundwater zones vary from total prohibition to strict regulation.[210]

Another interesting classification is that of Colorado. The Basic Standards for Ground Water regulation establishes

> statewide standards and a system for classifying groundwater and adopting water quality standards for such classification to protect existing and potential beneficial uses of groundwaters.[211]

There are five groundwater classifications, namely: 1) Domestic Use-Quality, 2) Agricultural Use-Quality, 3) Surface Water Quality Protection, 4) Potentially Usable Quality and 5) Limited Use Quality.[212] In determining or delineating an area referred to as a "specified area" within which a polluting activity exist or is proposed, the following factors are taken into account:

> a) the presence, extent, and nature of existing uses of groundwater that may be affected by the activity, and the nature of reasonably expected future uses of groundwater that may be affected by the activity; and b) the nature and location of the activity and of its discharge; and c) existing groundwater quality that may be affected by the activity; and d) relevant geologic and hydrogeologic conditions, including but not

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[210] Florida's Ground Water Strategy supra note 207, at 3.

[211] 5 CCR 1002-8 as amended Nov. 1991, s.3.11.2.

[212] Ibid s.3.11.4(A)(B): also specifies the criteria for determining each classification for example, groundwater in a specified area is classified "Surface Water Quality Protection" when "a proposed or existing activity does or will impact groundwaters such that water quality standards of classified surface water bodies within the specified area will be exceeded." Section 3.11.5 states the numerical and narrative groundwater quality standard for each classification.

> limited to the presence of groundwater hydrogeologically connected to surface waters and recharge areas.[213]

Once a specified area is determined and groundwater within it is classified, appropriate measures are taken to maintain the quality of each class of groundwater. The rule is that "an activity shall comply with the groundwater quality standards established under s.3.11.5 at the point of compliance".[214]

On the other hand, Michigan does not classify aquifers:

> because many Michigan residents are dependent on groundwater for drinking, and because glacial aquifers are very diverse and frequently interconnected with each other, classification schemes are difficult to consider in Michigan. Classification of aquifers would suggest that certain Michigan aquifers are "less desirable" for drinking water than others.[215]

Thus Michigan maintains a policy of non-degradation of water quality in usable aquifers.[216] A fortiori degradation of water quality in non-usable aquifers may be permitted for beneficial purposes such as the disposal of treated effluent. "Usable

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[213] Ibid s.3.11.4(C).

[214] Ibid s.3.11.6(A). "Point of Complaince" is defined under s.3.11.3(10) as "a vertical surface that is located at some specified distance hydrologically downgradient of the activity being monitored for compliance; provided that the Commission may establish a point of compliance other than a vertical surface on a site-specific basis pursuant to s.3.11.6(E)".

[215] Michigan Department of Natural Resources, State of Michigan Groundwater Protection Strategy and Implementation Plan (Place omitted, The Dept. 1989) at 21.

[216] The Michigan Water Resources Commission Act (MWRCA) (Public Act 245 of 1929 as amended, 1980) Part 22 Rules.

aquifer" means "an aquifer or that portion of an aquifer or aquifer system, that is capable of providing water in sufficient quantity and of satisfactory quality to serve one or more protected uses."[217] The meaning of protected uses is found in the following provision: "all groundwaters of the state, in usable aquifers and of a quality suitable for use as individual, public, industrial or agricultural water supply, shall be protected for these uses."[218]

The major difference between classification regimes and the "reasonable use" concept of Ontario is that the former emphasizes the degree of protection, whereas the latter emphasizes degree of degradation. Where the latter does not favour degradation, it does nothing to improve the quality of the groundwater even where such improvement is desirable. In other words, while protection is the rule in the former, degradation is the rule in the latter, albeit in principle, the degradation is confined to the provincial drinking water objectives.

Degrading groundwater which is higher in quality than the provincial drinking water standard under Ontario's reasonable use concept is an irresponsible assault on groundwater quality. Such policy legitimizes contamination of drinking water and decreases its value. It is submitted that such degradation should not be allowed lest lowering the water quality, the provincial drinking water objective is exceeded by

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[217] Ibid Part 22 Rule 2203.

[218] Ibid Rule 2204.

error or other failures. As in Michigan, a non-degradation policy should be maintained for such usable groundwater. All groundwater that can be used for drinking, domestic, agricultural and industrial purposes (hereinafter usable aquifer/groundwater) should be protected from further degradation. However, because the quality and quantity of such groundwater vary, and depending on the priority of the jurisdiction concerned, different degrees of protection may be given to them. For example, drinking groundwater may be given a higher protection in order to maintain its high quality than groundwater which is used in industrial processes.

The guidelines for determining "reasonable use" under Ontario's reasonable use policy do not necessarily avoid arbitrary decisions for degradation. According to one critic, the decision remains discretionary in that the status of adjacent land to a waste disposal site can be changed either by rezoning it for a different land use or obtaining an alternative water supply. The effect in either case is to change the status of the groundwater and to allow its quality to deteriorate.[219]

Again under the reasonable use concept, no special effort is made to improve the quality of groundwater for drinking purposes which is inferior to the provincial drinking water objective. As Vonhof puts it: "excellent quality does not have to be

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[219] Vonhof supra, note 9, at 77-78: "the concept of 'reasonable use' is concerned only with the present and the immediately foreseeable future, but does not address long term demographic and economic developments." This authority represents a strong critique of the reasonable use policy, and is therefore, greatly relied upon.

maintained and poor quality is acceptable as long as it does not deteriorate further."[220] Furthermore, the concept uses the natural attenuation capacity of the subsurface environment to determine allowable contamination of the shallow subsurface aquifers. Although this is restricted to waste disposal sites, transboundary flow of contaminants from waste sites is allowed as long as it does not impair the reasonable use of groundwater on the adjacent property. It allows groundwater contamination in an isolated subsurface environment which is not adjacent to any property. The term "isolated" environment is determined on a case by case basis with variable criteria. Therefore, in some cases, there may be no absolute isolation of subsurface environment from surface water. In such cases, the groundwater allowed to be contaminated under the reasonable use policy may impair the quality of the surface water it feeds.[221]

Vonhof maintains that "attenuation should be considered as a last line of defense and definitely not as a primary design parameter".[222] He concludes that

> the "reasonable use" concept of groundwater management is unreasonable, because it allows contamination of the shallow subsurface and does not offer sufficient protection of the groundwater resources for the future.[223]

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[220] Ibid at 78.

[221] Ibid 78-79: such subsurface environment is rendered useless for any future use especially since clean up is expensive and hardly successful.

[222] Ibid at 79.

[223] Ibid.

However, he endorses classification of aquifers or groundwater according to their sensitivity to contamination, and protecting them with appropriate regulations including land use control.[224] Vonhof seems to oppose any form of degradation of groundwater even under a classification regime. Indeed, one danger inherent in classification is the risk of discharging contaminants to receiving aquifers in an amount that destroys the acceptable water quality. We have seen that rather than take such a risk for usable aquifers, Michigan maintains a non-degradation policy. On this score, there is a merit in Michigan's approach.

This writer subscribes to non-degradation classification of usable aquifers. However, groundwater that is contaminated to a level that makes clean-up difficult and expensive should be used for waste disposal and classified as such. Such groundwater must be in an isolated subsurface environment to prevent contaminants migration to usable groundwater or surface water. This is one way of putting such groundwater to beneficial use. It is only in such instances that degradation should be allowed. This would make the regulatory burdens placed on industries regarding discharges less onerous.

It is also acknowledged that, as in Michigan, classification is not possible where usable aquifers are "frequently interconnected" so that the protection of one and the relative neglect of another would be counterproductive. It is only in such cases that Canadian jurisdictions would be justified not to adopt classifications for usable

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[224] Ibid at 80.

aquifers. Whether or not classification is undertaken in a jurisdiction, groundwater quality must be known if it is to be properly protected. Where aquifers have not been assessed, water quality objectives cannot be followed. Even where groundwater quality is known, the quality objectives should be set higher than those of surface water because of the slow rate of contaminant dilution in groundwater. Manitoba applies water quality objectives for surface water to groundwater.[225] This is true of other jurisdictions because discharge permits issued under the different environmental regulations generally do not distinguish between discharge levels or standards for ground and surface water. Even Ontario's Groundwater Quality Management which has the goal of protecting groundwater for human consumption and maintaining a certain quality for groundwater used for agricultural purposes[226], does not set a higher quality standard for groundwater than for surface water.

Interestingly, Michigan sets a higher quality standard for groundwater than for surface water, the reason being stated as follows:

> the more stringent standard for groundwater quality is warranted because contaminants are not diluted in groundwater in the same fashion as surface water, because volatilization of pollutants cannot occur in groundwater, and because biological breakdown of contaminants tends to be much slower in groundwater than in surface

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[225] Personal Communication with Dennis Brown, Chief, Water Quality Management, Manitoba Environment, dated September 4, 1991, see Appendix.

[226] MOE, Water Management-Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment (Revised 1984) (Toronto: MOE, 1986).

water.[227]

By setting a higher quality standard for groundwater than for surface water, Michigan recognizes the uniqueness of the problem of groundwater contamination and adopts measures to meet the challenge thus presented. To maintain a high quality standard for groundwater, groundwater discharge permits are issued.[228] The conditions in the permit are more stringent than the conditions for surface water discharge. The Allowable Discharge Levels (ADLs) of substances with respect to groundwater is contained in the permit. With the numerical quality of groundwater set, pollution occurs when the ADLs are exceeded.[229] But to the extent that discharges are permitted within ADLs, Michigan's non-degradation policy is afterall not absolute unless the ADLs are the same as the background water quality.

All sources of contaminant discharges into groundwater, for example, landfills, USTs and agricultural pesticide use, are subject to a groundwater discharge permit regime. In Arizona, for example, the Ground Water Quality Protection Permit Program (GWQPPP) requires applicants to submit a notice of disposal (NOD) specifying the quantity and type of wastes to be discharged and the method of discharge to groundwater. Permit is denied where a potential discharge would

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[227] Michigan Groundwater Protection Strategy supra note 215, at 22.

[228] MWRCA supra note 216, s.323.7.

[229] Michigan Groundwater Protection Strategy supra, note 215, at 23.

derogate from the prescribed quality of groundwater.[230]

The (Arizona) Environmental Quality Act establishes an Aquifer Protection Permit Program (APPP) which replaces the GWQPPP but retains requirements under it. In addition, the APPP requires discharging facilities to use the best available demonstrated control technology (BADCT) to reduce discharges.[231]

In Florida,

> the backbone of the regulatory arm of the (Groundwater Protection) program is based on a permitting mechanism that requires dischargers to groundwater to meet waste stream quality (treatment) criteria as well as compliance with water quality standards in the receiving aquifers.[232]

Canadian jurisdictions should, as in Michigan, set different water quality objectives for groundwater and institute a special discharge permit regime congruent with the objectives. They should, as in Arizona, require applicants for such permits

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[230] Arizona Department of Environmental Quality, State of Arizona Groundwater Protection Strategy (Place omitted, The Department, 1989) at 29.

[231] Ariz. Rev. Stat. s.49-101 et seq. It is also required that a permit applicant demonstrate that contaminants discharged would not violate Aquifer Water Quality Standards and will not further degrade the quality of an aquifer which is already in violation of the Aquifer Water Quality Standards for that contaminant.

[232] Florida Groundwater Protection Strategy supra note 207, Part III at 1: "Dischargers are allowed a 'zone of discharge' within which water quality standards are not enforceable. Quaterly groundwater monitoring and reporting requirements are necessary permit conditions to ensure that the quality of the water is not degraded beyond the standards, outside the zone of discharge....The purpose of a 'zone of discharge' is to allow for dilution and possibly degradation of contaminants in the groundwater and to a certain extent ease the burden of immediate compliance with the standards."

to have the best available demonstrated control technology. Such technology helps to ensure that discharge levels are consistent with terms and conditions in the permit.

c) Land Use Control:

Aquifer assessment and perhaps classification would provide an informed basis for land use control decisions for the protection of groundwater. If aquifer recharge zones, quality and yield, and vulnerability to contamination are not known, the extent of the protection area, the kind of land use that would be prohibited or restricted may not be known. A blind decision may have far-reaching economic and social consequences. For example, it would be unwise to prohibit recreation activities in confined aquifer areas especially where the area is perhaps as large as the town in which it is located.

In Canada, groundwater protection through land use control is wanting. The fact that some communities depend solely on groundwater and that there are aquifers which merit protection programs analogous to the U.S. "sole source aquifers" and "wellhead protection" programs does not seem to persuade the provincial governments to adopt strong land use legislation primarily designed to protect groundwater. For example,

> ... in Ontario communities that derive nearly all their water supply from groundwater, such as the cities in Waterloo Region (Waterloo, Kitchener, Cambridge, Guelph), very little specific effort is directed at

> prevention of groundwater contamination through land use restrictions and municipal planning except for siting of landfills.[233]

In the words of one writer,

> ...Ontario has no legislation which provides for the designation and protection of sole source aquifers or requires the development of wellhead protection programs. There are also no provincial statement or zoning orders issued under the Planning Act for the protection of susceptible aquifers, which municipalities would be required to have regard to when drafting land use planning documents.[234]

Ontario is not alone in this. Indeed no Canadian jurisdiction has groundwater protection areas.[235] New Brunswick protection areas are basically for surface water although its Clean Water Act permits the designation of groundwater protection areas. But groundwater protection areas cannot be designated unless the aquifers are first charted and assessed. For usable aquifers which have been assessed in Canada, there is an urgent need to protect them through the establishment of protection areas and controlling land uses in them.

Furthermore,

> The provinces need to enact modern and comprehensive legislation with stringent regulations that will pertain to all causes of groundwater contamination...Emphasis should be directed to protect potable groundwater resources and groundwater that could feed contaminants to streams, lakes and wetlands. The groundwater resource needs to be

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[233] "Groundwater Protection The Lack of Government Action in Cananda" supra note 202, at 21.

[234] Neufeld supra note 167, at 22: referring to now s.3(1)(4)(5) of the Ontario Planning Act R.S.O. 1990, c.P-13.

[235] See Personal communication with various jurisdictions in Appendix.

> managed so that the contribution to surface waters (baseflow) can sustain ecological systems according to long range plans of governments and conservation authorities.[236]

This quote suggests a groundwater protection strategy which takes into account the hydrologic cycle as a whole and which employs both contaminant-focused and resource-focused approaches.

V. Proposed Elements of a Model Provincial Comprehensive Groundwater Protection Legislation

In the opinion of this writer, comprehensive groundwater legislation should address not only point and non-point sources of groundwater contamination, but also embody groundwater protection strategies and programs as in the U.S., instead of using mere policy guidelines. This means that groundwater legislation should provide zones for aquifer protection: aquifer recharge areas, sole source aquifer and wellhead areas programs should be contained in the legislation. The legislation should, in addition, provide for the establishment, development and maintenance of groundwater databases covering the following aspects: determining and assessing aquifer recharge and discharge areas, yields, qualities, existing and potential uses (including discharge into surface water and support of wetlands) and vulnerability to contamination. As this would require a long-term monitoring programs, the legislation

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[236] "Groundwater Protection The Lack of Government Action in Canada" supra, note 202, at 21.

should provide for funding, the establishment and maintenance of a systematic and comprehensive long-term monitoring programs, and other aspects of aquifer assessments.

To realize these goals, the federal government should assist the provinces in undertaking aquifer assessments by providing financial and technical resources. Should the federal examplary groundwater management practices[237] be put in place, the provinces should model their management practices upon those while giving consideration to local hydrogeological conditions. Also, the proposed minimal national standards for aquifer protection as well as hydrogeological guidelines and standards for siting, constructing and operating landfills[238] would help provinces improve their groundwater protection management. This should also have to be entrenched in comprehensive legislation.

Upon obtaining sufficient data from assessment programs, groundwater or aquifers should, for the purposes of allocating protection priority, be classified according to yield, quality, use and potential use, and vulnerability to contamination. Both classification and protection priority should be enshrined in comprehensive legislation. Also to be incorporated into this legislation is a separate permit system for groundwater discharges from contaminant sources such as landfills, USTs, pesticide uses. The legislation and the discharge permit system should contain

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[237] Federal Water Policy supra Chapter Four, note 173 and accompanying text.

[238] DOE Groundwater Strategy supra, Chapter Four, note 183.

groundwater quality standard to be maintained which should be higher than that of analogous surface water. Also, the use of "best available demonstrated technology" should be made a legal requirement.

Furthermore, the legislation should provide a mandatory framework for local governments to follow in promulgating proper zoning bylaws for groundwater protection. It should, in addition, provide a framework within which local governments are to participate in groundwater protection. For example, it should establish pilot projects and monitoring programs at the local government level and commit provincial governments to funding such programs.[239] In Florida, for example, the Water Quality Assurance Act of 1983 established the Ambient Groundwater Monitoring Network designed to determine the background groundwater quality and the impact of land use activities on groundwater quality. This information is made available to local and regional authorities and is used as a basis and guide for designing local and regional programs and measures for protecting aquifers from contamination by land use activities.[240]

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[239] "Groundwater Protection The Lack of Government Action in Canada" supra note 202, at 22, 21: "passing new legislation, regulations, or guidelines without provision of funding for the staff to make them work is common in the Canadian provinces".

[240] Florida Ground Water Protection Strategy supra, note 207, Part III at 4-5: There is also the Pesticide Program which focuses primarily on the protection of water quality from pesticide.

VI. The Role of Local (Municipal) Government in Groundwater Protection:

Beyond executing pilot projects and groundwater monitoring programs discussed above, the local governments' important role lies in employing land use to protect groundwater. This can be done by zoning or subdivision ordinances.

a) Zoning:

Traditionally, zoning ordinances were designed to regulate residential land uses[241] without regard to the environment or to groundwater protection. It is only recently that zoning has become a tool for groundwater protection.[242] Zoning bylaws are in the domain of local governments. The purpose of zoning is to restrict or prohibit developments in certain areas while encouraging it in other areas. It can, therefore, be used to serve groundwater protection.

Where aquifer recharge, wellhead and sole source aquifer areas (sensitive

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[241] I.McF. Rogers, Canadian Law of Planning and Zoning: Cummulative Supplement (Toronto; Calgary; Vancouver: Carswell, 1989) at 122.

[242] D.A. Yanggen and L.L. Amrhein, "Groundwater Quality Regulation: Existing Governmental Authority and Recommended Roles" (1989)14:1 Columbia J. Environt'l Law at 52-58.

areas) are not owned by the government, they may be acquired.[243] Residential developments could be clustered in non sensitive areas and those who have lands in sensitive areas can be given transferred rights or credits to lands in non sensitive areas in exchange.[244] In New Jersey, for example, it is reported that several towns have passed ordinances complying with the Pinelands Comprehensive Management Plan which provides a credit program to "facilitate the movement of development out of areas which are to be preserved into areas where growth is to take place."[245] Without such economic incentives to influence movements from sensitive to non-sensitive sites, zoning might be too coercive a tool to effect such movements.[246]

In Ontario, for example, zoning bylaws have been used to move population density from one site to another for purposes of creating open spaces and protecting environmental features[247]. It has also been used to stop the operation of a food processing factory which emitted odour, fumes and noise notwithstanding that the operation of the factory was approved under the Ontario Environmental Protection

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[243] J.T.B. Tripp, "Local Measures to Control Groundwater Pollution: Innovative Strategies and Legal Problems" in Ground Water Quality Symposium supra, Chapter One, note 105, at 54.

[244] Ibid.

[245] Ibid at 55.

[246] S.M. Makuch, "Zoning: Avenues of Reform" (1973-74) Dalhousie L.J. 294 et seq.

[247] C.B. MacFarlane and R.W. Macaulany, Land Use Planning Practice, Procedure and Policy (Toronto, Vancouver: Butterworths, 1984) at 1153.

Act.[248] Also, a zoning bylaw prohibiting the use of sites for the treatment and disposal of liquid industrial waste and hazardous waste has been upheld.[249]

Zoning can also take a hydrogeological dimension. For example, Long Island has 8 hydrogeologic zones determined according to groundwater quality and vulnerability to contamination.[250] Regulation of land uses in each zone has to be such that it maintains the desired groundwater quality in that zone. A land use control approach which gives the same level of protection to all zones regardless of groundwater vulnerability to contamination is not considered adequate.[251] Nebraska would designate an area as "special protection area" where: 1) groundwater is contaminated or will be contaminated in a reasonably foreseeable future, 2) such contamination would pose substantial economic hardships to the users and 3) there are ways of stabilizing or reducing the contamination.[252] In such an area best

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[248] Martin Feed Mills Ltd. v. Woolwich (Corporation of Township of) (1984) 9 D.L.R. (1984) 446 (Ont. Div. Ct.). The zoning by law was enacted under the Ont. Planning Act

[249] Minister of the Environment v. Tilbury West (Corporation of Township of) (1984) 28 M.P.L.R. 97 (Ont. Div. Ct.). See also Robecker Milk Co. v. London (Corporation of the City of) (1984) 25 M.P.L.R. 8 (Ont. H.C.).

[250] E.G. Tanenbaum, "Hydrogeologic Zoning On Long Island" in Ground Water Quality Symposium supra note 243, at 60-61.

[251] Ibid: for examle, the same land use activity which contaminates unconfined shallow aquifers in a day of discharge may take several years to contaminate confined deeper aquifers.

[252] Nebraska Groundwater Management and Protection Act 1989, c.46, art.46-674.07.

management practices consistent with reduction or prevention of contamination are required.[253]

b) Subdivision:

Like zoning, subdivision regulations traditionally focus on the division of larger tracts of land for purposes of sale or building development[254]. However, this traditional approach which is said to emphasize individual interests is waning in favour of public interest.[255] A public interest approach arguably embraces environmental concerns. Thus subdivision regulations can be used to protect groundwater as demonstrated below.

c Criticisms and Comments on Zoning and Subdivision:

Although municipalities are given the power to enact zoning bylaws to prohibit

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[253] Ibid art.46-674.09(2).

[254] J.B. Miller, "An Introduction to Subdivision Control Legislation" (1965) 43 Can. Bar Rev. 49.

[255] S.H. Troiter and K.A. Waters, The Law of Subdivision Control in Ontario: A Practical Guide to Section 49 of the Planning Act (Toronto; Calgary; Vancouver: Carswell, 1988) at 2.

or restrict certain land uses,[256] zoning has, in most Canadian jurisdictions, not been employed to specifically protect groundwater. The Planning Acts of all jurisdictions provide that municipalities should have regard for the protection of the environment.[257] This is, however, environmental protection in a general sense. Some jurisdictions require municipal governments to promulgate zoning bylaws consistent with and for the implementation of municipal official or development plans. Such plans are usually required to contain environmental objectives.[258]

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[256] (N.S.) An Act Respecting Provincial and Municipal Planning (hereinafter N.S. Planning Act) R.S.N.S. 1989, c.349 ss.51(1), 52, 53(2)(3); (Man.) The Planning Act R.S.M. 1987, c.P-80, ss.32(2), 38; (Nfld.) The Urban and Rural Planning Act (hereinafter Nfld. Planning Act) R.S.Nfld. 1970, c.387, s.36; (N.B.) Community Planning Act (hereinafter N.B. Planning Act) R.S.N.B. 1973 as amended by S.N.B. 1986 c.21 and 1989 c.8, s.34(1)(2)(3); (NWTs.) Planning Act R.S.NWTs. 1988 c.P-7 s.13; (Ont.) Planning Act R.S.O. 1990 c.P-13, s.34(1); (PEI) Planning Act R.S.PEI. 1988, c.P-8, s.16; (B.C.) Municipal Act R.S.B.C. 1979 c.290 as amended by S.B.C. 1989, c.59. s.716; (Sask) The Planning and Development Act (hereinafter Sask. Planning Act) S.S. 1983-84, c.P-13.1, ss.66, 73, 77-78; (Alta.) Planning Act R.S.A. 1980, c.P-9, ss. 68, 69, 70, 71; (Yuk.) Municipal Act R.S.Y.T. 1986, c.119, ss.308, 312; (Que.) An Act Respecting Land Use Planning and Development (hereinafter Que. Planning Act) R.S.Q. 1979, c.51, s.113.

[257] Que. Planning Act ss.5(4), 159(2); Sask. Planning Act ss.55(1), 192(1)(c); B.C. Municipal Act ss.729(11)(12)(13), 932(b), 716(1)(2); PEI Planning Act ss.2(c), 8(1)(c)(iv), 8(1)(h)(i), 12(a); Alta Planning Act ss.2(b), 98(c)(i); Yuk Municipal Act ss.297(d), 331(2)(a)(b); Ont. Planning Act s.1: definition of Official plan; Ontario Planning Development Act 1980 R.S.O. c.354, s.5(iii)(iv); N.B. Planning Act s.2(m), 17(4), 23(5); NWTs Planning Act s.15(1)(d), 18; Nfld. Planning Act ss.59, 66; Man. Planning Act s.25(1)(e), (3), (4)(a)(iii)(viii); N.S. Planning Act ss.37(a)(b), 38(2)(b)(c)(f)(h)(r).

[258] N.S. Planning Act s.51(1); Ont. Planning Act s.24(1)-(4); Man. Planning Act s.32(2), 42(1)(2); Nfld. Planning Act s.36(1)(b)(c); N.B. Planning Act s.34(1)(2); Yuk. Municipal Act s.310; PEI Planning Act s.16; Sask Planning Act s.66; Que. Planning Act ss. 25, 33, 102; NWTs Planning Act s.14.

In the opinion of this writer, the power and resources to designate groundwater protection areas lie with the provincial governments more than with the municipal governments. Under the Planning Acts of some jurisdictions, it is always within the powers of the approriate minister to approve, modify or reject an otficial or development plan submitted by a municipality or to approve the zoning bylaws.[259] Jurisdictions such as Alberta and Ontario go even further in vesting the provincial authorities with the power of the municipal government with respect to land use control.[260] The provincial governments wield control over the content of official plans and the implementing zoning bylaws. Therefore, it behoves the provincial governments to require, by legislation, zoning bylaws to control activities in protected areas. However, such areas can neither be designated or protected if they have not first been technically delineated. We have seen that little progress has been made regarding such delineation.[261]

Where such delineations are completed, the province should designate protection areas and compel municipalities to incorporate such areas into their zoning bylaws. Nova Scotia, for example, provides that municipal planning strategies (including zoning) should conform to provincial land use policies and to this end, the

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[259] N.S. Planning Act s.25; Sask Planning Act s.46; PEI Planning Act s.17; Ont. Planning Act s.17(9)-(11); Man. Planning Act s.30(13); N.S. Planning Act s.59; NWTs Planning Act s.27.

[260] Alta Planning Act s.144(2); Ont. Planning Act s.47.

[261] See supra notes 165, 193-201 and accompanying text.

strategies should have regard to "the supply and distribution of water, including the management and protection of watershed areas, groundwater recharge areas..."[262] With this approach, municipalities would have a duty to pattern their zoning bylaws to protect groundwater. Alternatively, municipalities that have a reasonable idea of areas of groundwater occurrence both for drinking and/or for ecosystem and surface water support, should use zoning bylaws to prohibit or restrict land uses in such areas. The power of municipalities under the Planning Acts to acquire land for implementation of their plans and zoning bylaws enhances this possibility.[263]

Although zoning is an effective tool for groundwater protection, it is subject to some limitations. First, due to existing land use practices, zoning does not effectively address already contaminated sites, and the relocation of such land uses may be problematic. Second, where the protection zone is as large as the town where it is located, the prohibition of industrial activities in the critical area means prohibition of such activities in the whole town. This may not be politically or economically acceptable. Third, where land uses are categorized for purposes of

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[262] N.S. Planning Act s.38(1)(2)(h)(v). Section 7(1)(2)(ix) empower the Lt. Gov. to adopt land use policies for the province which may address "water supply, watersheds and groundwater recharge areas". See also Sask. Planning Act s.58.

[263] See for example, N.B. Planning Act s.78; NWTs Planning Act s.10; Sask Planning Act s.63; Nfld. Planning Act ss.31(2), 33(1); Ont. Planning Act ss.25, 34(8); Man. Planning Act ss.10(9), 34; N.S. Planning Act s.46(2).

determining into which zone they fall, zoning may miss out "grey area" land uses.[264]

To fill the gap in zoning measures, it is suggested that municipalities should be given power to enact ordinances regulating the source of contaminants in such a way that meets the need of each locality.[265] For example, the hydrogeology of a municipality might be such that the groundwater is so vulnerable as to justify the regulation, for example, of casual or domestic application of pesticides which is exempted from the licensing regime of a jurisdiction like Nova Scotia.[266]

There are other limitations of zoning. Provincial Crown is not bound by a zoning bylaw except where the legislation under which the bylaw is made commits the Crown to respect it.[267] Also, the federal Crown is not bound by zoning bylaw except where Parliament adopts or consent to it.[268] In the absence of this exception, federal undertakings or works which generate pollution cannot be

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[264] S.W. Horsely, "Beyond Zoning: Municipal Ordinances To Protect Groundwater" in Ground Water Quality Symposium supra note 243, at 73-74: the first case has happened in Barnstable, Falmouth and Yamouth in Cape Cod county in Massachussetts. The second case has happened in Barnstable in Cape Cod county, Massachussetts.

[265] Ibid at 74-78: for example federal and Massachussetts laws on toxic and hazardous wastes exempted generators of less than 1.1 tons of such waste per month. But because of the special problems of Cape Cod, its model bylaw covers these generators.

[266] See supra note 128.

[267] See for example, Sask Planning Act s.213(1); Que Planning Act s.2. Ontario Planning Development Act s.9(a)(b).

[268] Shuniah (Township of) v. Richard et al (1982) 19 M.P.L.R. 71 at 81.

regulated or controlled by zoning bylaws. Where however, federal and provincial governments have regard for groundwater protection, they should cooperate with zoning bylaws geared to achieve this goal.

Again, zoning can only be effective if the aquifers have first been assessed and the boundaries delineated so that zoning regulation can be based on such assessments: respecting the hydrogeological conditions of different aquifers and their water.

Subdivision regulations in most Canadian jurisdictions require a subdivider to have regard for the environment.[269] This, however, is with regard to surface water bodies and not for groundwater protection. Nevertheless, subdivision regulations can be used to control the discharge of groundwater contaminants. For example,

> in areas of suspected contamination such as locations downflow from landfill sites, special precautions such as requiring subdivisions to be served by a single deep well rather than shallow individual wells can be used to ensure a safe water supply.[270]

In response to increasing groundwater contamination from septic tanks in Rio Arriba County, New Mexico, the County developed a more stringent requirement in

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[269] Alta. Planning Act s.98; Yuk Municipal Act ss.331(2)(a)(b); N.B. Planning Act s.47 et seq.; Que. Planning Act ss.115(4), 116(3); Man. Planning Act s.70(g)(h; B.C. Municipal Act s.729(11)(12)(13); Sask Planning Act s.192; Ont. Planning Act s.50(3)(e).

[270] Yanggen and Amrhein supra note 242, at 55.

its subdivision regulations by requiring a larger lot for the placement of septic tanks.[271] This requirement which minimized groundwater contamination from septic tank was more stringent than the requirement under New Mexico State Environmental Improvement Division guidelines.[272]

Nova Scotia requires larger lots for septic tanks under its Onsite Sewage Regulation[273]. This can be incorporated into its Planning Act so that municipalities with high groundwater table or groundwater vulnerable to contamination from septic tanks can make subdivision bylaws requiring larger lots. This approach can help jurisdictions which as yet do not have such provisions. Canadian jurisdictions would do well to follow the zoning and subdivision techniques discussed above. In addition, they should give local governments the latitude to adopt stricter regulatory measures for contaminant sources where necessary to supplement zoning strategy.

C. OVERALL CONCLUDING REMARKS: CONTAMINANT-FOCUSED AND RESOURCE-FOCUSED APPROACHES

The contaminant-focused laws in the provinces are fragmented. Each province largely addresses its water pollution problems separately as well as independently of

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[271] R.J. Roddewig, "Recent Developments in Land Use, Planning and Zoning Law" (1990) 22 Urban Lawyer 719 at 797, 799.

[272] Ibid at 800.

[273] Supra notes 78 and 79 and accompanying text.

the others as if the aquatic environment is not a single continuum involving other jurisdictions. This fragmented approach discounts the fact that some jurisdictions may have more serious contamination problems than others. The laws in all jurisdictions are not of equal strength. For example, jurisdictions like British Columbia and Alberta which have stronger waste disposal laws than some jurisdictions have poor UST control regulations. As groundwater pollution does not respect political boundaries, a strong law or efforts of a province to protect groundwater might be marred by a lack of reciprocity on the part of the others. These laws need to be strengthened.

Accordingly, jurisdictions should be encouraged to harmonize their environmental protection laws. Federal leadership role in coordinating and even unifying provincial efforts in this regard is crucial. A uniform adoption of federal model legislation or guidelines will help to eliminate or minimize this problem. The Environmental Code is a positive step in this direction. Similar measures can be extended to other contaminant sources. For example, pesticide management plans specifically designed for groundwater protection can be established uniformly across Canada with the help of the federal government.[274] Financial and technical resources for the contruction of landfills with engineered facilities can be offered to the provinces by the federal government. Such measures will also help to ensure that each contaminant-focused law exhaustively addresses the source of contamination it

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[274] See supra, note 160: a step in the right direction.

is designed to control with specific emphasis on groundwater protection.

Furthermore, groundwater protection strategies are still underdeveloped owing to inadequate financial and technical resources. Resource-focused programs such as wellhead protection, aquifer recharge areas and sole source aquifer programs should be added to the DOE groundwater protection strategy offered to the provinces. In addition, guidelines for groundwater or aquifer classifications should be developed so that efforts and financial resources can be concentrated on more valued groundwater.

There is also the need to have a comprehensive groundwater protection legislation at the provincial level.[275] Various contaminant-focused and resource-focused elements of groundwater protection have been articulated as the standard provisions of such legislation. The legislation contains crucial areas in respect of which the federal government should join efforts with the provinces.

Governments should accept groundwater protection in Canada as a single inter-connected problems which defy political boundaries and accordingly can better be dealt with by a unified rather than fragmented efforts of the federal and provincial governments. Yet for an efficient result, such unified efforts must adopt a combination of contaminant-focused and resource-focused approaches as well as an integrated hydrologic cycle approach. It is only in this way that groundwater

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[275] This is possible since, unlike the federal government, the provinces have legislative jurisdiction over the resource.

protection in Canada can be more successful.

CHAPTER SIX

CONCLUSION: A CASE FOR INTEGRATING WATER RESOURCES AND MANAGEMENT EFFORTS

Water supports all life and the ecosystems. It is, therefore, no exaggeration to say that water is the most valuable resource of any country. This is even more true in view of the fact that surface or groundwater is a finite resource and must be managed to meet both present and future needs of any society.

In Canada, given population growth and increasing economic, social and environmental activities which entail increasing use of water, there is an increasingly urgent need to manage water resources more efficiently. While demand for water is on the increase, supply is decreasing due to incessant and growing pollution, waste, and climatic factors. Only efficient management of water resources can counter the effect of these negative factors on Canada's water supply. The best management approach to achieve sustainable development in the most efficient way is one that recognizes the unity of the aquatic environment. The hydrologic cycle is a single natural, cohesive unity and defies fragmented management decisions.

The greatest challenge in managing Canada's water resources remains the reconciliation of the laws with scientific reality of the environment particularly the aquatic environment as a unity. The laws at both federal and provincial levels are fragmented. Each political division addresses water resources and the aquatic environment separately and independently from the others in disregard of their inter-

connectedness. Furthermore, the laws are not comprehensive.[1] Each addresses either a different source of contamination[2] or contamination in general[3], or focuses only on one component of the hydrologic cycle, namely: surface water.[4]

Although the contaminant-focused laws are very practical in dealing with groundwater contamination, they need to be combined with resource-focused laws or strategies to provide the desired protection. The resource-focused approach protects groundwater specifically as a resource in its own right and offers at the same time protection to the ecological environment supported by the resource. Efforts in developing and applying this approach at both the provincial and federal levels are yet to be advanced.

Efficient management of Canada's water resources and aquatic environment demands a harmonization of the fragmented contaminant-focused and resource-focused approaches in response to the unity of the resources and their environment. Regard must be given to jurisdictional and practical considerations in achieving this goal. The extent to which water policies of Canadian jurisdictions encourage or constrain the achievement of this goal, that is, integration, is examined below.

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[1] The only exception is CEPA. However, its effect is too general in that it offers no specific protection to groundwater.

[2] See supra, Chapter Five for the different waste disposal, UST, sewage disposal and pesticides control laws in the provinces.

[3] See supra, Chapter Five for the different general environmental protection laws of the provinces.

[4] See for example, the federal Fisheries Act, Navigable Waters Protection Act and the Canada Water Act which primary focus on surface water discussed supra in Chapter Four.

Admittedly,[5] ground and surface water quantity allocations are governed by a single statute and managed by a single administrative body in most Canadian jurisdictions. It has been demonstrated[6] that, to different degrees, the statutes of the different jurisdictions bring surface and groundwater quantity and quality management under one administration. These are important steps towards an efficient integrated water management. However, more needs to be done. Two aspects of integration, namely resource and institutional integration emerge from these steps.

A. Resource Integration:

I. The Theory of Resource Integration:

The Inquiry Into Federal Water Policy recommended integrated watershed management as an approach for a federal water policy. According to the Inquiry, the advantage of this approach is that it takes into account the natural occurrence of water and the interdependence of interests. It also allows for the management of water resources in a fashion that encompasses the hydrology of an area without

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[5] See supra, Chapter Three, notes ~~220-230~~ 225-233 and accompanying text- under the sub-heading "Allocation Management of Hydrologically Connected Surface and Ground Water".

[6] Ibid (Ont.; PEI.; N.B.; Nova.; Nfld.; NIWA).

regard to political boundaries[7]. The Inquiry further stated that "water management must recognize the continuity of the hydrologic cycle. Surface water, groundwater and the atmosphere must be considered as an integrated system."[8]

An integrated management of surface and groundwater resources demands profound hydrogeological knowledge and technical and financial resources to put such knowledge to work. Canada's Department of the Environment has reported that the paucity of aquifer identification and assessment, aquifer management-planning and implemetation constrain efficient groundwater management[9]. Another problem is developing strategies or ways of achieving water management goals. Part of the federal government's strategies for integrated water management is the adoption of an approach which

> takes into account all water uses and water-related activities, within whatever, political, administrative, economic, or functional boundaries they are defined (and) encourages on the basis of a watershed , or other appropriate spacial unit, the integration of water management plans and objectives with those of other natural resource interests- fisheries, forestry, wildlife, mining, hydro power, and agricultural- to reflect the unity of natural processes and the interdependence of uses and users in that spatial unit[10].

The recognition of the unity of natural processes is sound but, overall, the

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[7] Pearse et al., supra, Chapter One, note 22, at 96-97: essential elements of a sound watershed management include a comprehensive plan which takes into account the uses of the water system and other activities that affect water quantity and quality; and criteria for assessing management alternatives.

[8] Ibid. at 8.

[9] DOE Groundwater Strategy, supra, Chapter One, note 77, at 18.

[10] 1987 Federal Water Policy, supra, Chapter One, note 52, at 10.

strategy is an extensive "holistic"[11] approach because it covers a wide range of management variables, namely: water, fisheries, forestry, wildlife, hydro-power, agriculture and mining which make it too comprehensive and complicated to be efficiently managed at the same time. It is practically impossible to integrate all natural and interrelated processes under one management as contemplated by this strategy. Therefore, a "comprehensive" approach in the sense of involving elements that are not central to the hydrologic cycle, for example, forestry, mining and agriculture, is not advocated. According to one writer, this approach is not "integrated" because an integrated approach focuses on a smaller number of management variables such as water quantity and quality or water and land management[12]. For our purpose, an "integrated" approach refers to integrated management of the hydrologic cycle, namely: surface and groundwater quantity and quality, the ecosystem they support as well as land-use.[13] These variables are closely interrelated. Land-use can affect surface and groundwater quantity and quality. Impact on surface water quantity or quality would inevitably be reflected on the quantity or quality of groundwater hydrologically connected to it and vice versa. This also impacts upon the ecosystem. Variables such as fisheries and other aquatic life

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[11] Encompassing and integrating almost all activities that depend on water.

[12] B. Mitchell "Improved Flying Without New Wings" in Innovations in River Basin Management, supra, Chapter One, note 41, at 8-9: noted that a comprehensive approach was adopted in the 1970's but was later rejected because it focused on everything without doing any one of them thoroughly.

[13] Although agriculture, mining and forestry metioned in the federal policy are land uses, only the aspects which relate to water use and quality may be integrated with water resources management, and not their overall management.

should be tied into such management only to the extent that enough water of good quality must be reserved in their natural habitat to sustain them. In other words, fisheries and other aquatic life per se are not to be managed but rather the water which supports them. However, within an integrated hydrologic cycle management, planning and implementation must proceed in a comprehensive or exhaustive fashion. It is only in this sense that a "comprehensive" approach is approved herein.

The advantages of an integrated or streamlined approach are manifold. By narrowing down the number and scope of aspects to be managed, managers are given a clearer focus of intended objectives and goals. This increases the needed managerial concentration and efficiency. It is for this reason that the United Kingdom abandoned its idea of a multi-purpose authority with a broad scope of management variables and opted instead for an integrated approach.[14] Apart from enhancing the management focus, an integrated management also reduces the number of agencies involved in different aspects of what is being managed and thus makes coordination less difficult.

II. Emerging Practice of Resource Integration:

It is encouraging that several provinces have begun to implement certain

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[14] D. Kinnersley, "Privatization and River Basin Management in United Kingdom" in Innovations in River Basin Management, supra, Chapter One, note 41, at 175: "the multipurpose authority failed to adequately cope with their numerous functions." See also, L.E. Taylor, supra, Chapter Three, note 74, at 355-364.

aspects of the integrated approach. The following are examples of these emerging policies.

(i). Manitoba's integrated approach has been stated as follows:

> ...Completion of a set of water policies could pave the way for preparation of management plans for major river basins and smaller watersheds, based on an integrated approach to managing all our resources.[15]

The province thus integrates the management allocation of surface and groundwater. The Draft Policy states:

> allocation priorities for groundwater and surface water shall be determined through a basin planning process for Manitoba taking into account existing commitments, economic requirements, environmental integrity and the protection of potable water supplies.[16]

The integration does not as yet involve conjunctive use of surface and groundwater in the sense of the Colorado Model.[17] Considering that the policy is

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[15] Government of Manitoba, Land and Water Strategy The process Begins Workbook (Winnipeg: Office of the Executive Director, Sustainable Development Unit, 1989) at 4: the policy is in a draft form. It is intended to elicit public comments which would lead to the final policy.

[16] Ibid. at 13; see also Government of Manitoba Sustainable Development Land and Water Strategy: A Summary of Public Input What You Told Us. (Winnipeg: Office of the Executive Director, Sustainable Development Unit, 1989); Personal communication with Jim Petsnik, Aquifer Data Geologist, Groundwater Section, Water Resources Branch, Manitoba dated February 19, 1992, see Appendix: "For aquifers where the 'sustainable yield' has been determined this is used in allocating groundwater to various users."

[17] See supra, Chapter Three, notes ~~278-279~~ 281-282 and accompanying text.

still in the making[18], it would be premature to evaluate its effects on Manitoba's groundwater quantity and quality. It would also be inappropriate to inquire into whether or not the policy has been reflected in the relevant statutes governing quantity and quality of surface and ground- water. Suffice it to say that the allocation policy is a positive step the implementation of which will serve groundwater allocation and protection well.

ii). British Columbia also follows integrated resource management. British Columbia Environment states that: "integrated resource management identifies and considers all resource values including social, economic and environmental needs, in deciding on land-use and development".[19] The success of such management is said to depend on the inventory of all resource values, information on how the use of one affects the other, and effective means of decision- making and conflict resolution at the provincial, regional and local levels[20]. The province also manages the quality and quantity of surface water on a watershed basis[21]. However, groundwater is as yet not integrated as it is not currently regulated in the province.

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[18] D.V. Doyle, "Water Policy Development in Manitoba: Meeting the Challenge of the 1990's" (1990) 15 (No.2) Can. Water Res. J. 154-163: also discusses the various processes of public participation in formulating the policy.

[19] British Columbia Environment, Environment 2001 Strategic Directions for British Columbia (Victoria: The B.C. Environment, 1991) at 31.

[20] Ibid.

[21] British Columbia Environment, Planning for the Future Sustaining the Water Resource (Victoria: B.C. Environment, 1991) at 4.

iii) It has been stated that Ontario has no water policy but rather policies for specific aspects of water management[22]. This raises the problem of having to reconcile the diverse and often conflicting water management interests. One water manager believes that an overall water policy for Ontario is not necessary. According to him, the formulation of such a policy takes time, and difficult inter-agency liason. He further submits that "a general policy often equates with a 'blander' policy."[23] Policies of different aspects of Ontario water management are represented in the Municipal Industrial Sewerage Abatement (MISA) Program, the Soil and Water Environmental Enhancement Program (SWEEP), and different watershed studies conducted by Conservation Authorities, for example, the Toronto and Area Water Management Study (TAWMS)[24].

The Conservation Authority Act of Ontario establishes conservation authorities on a watershed basis with the mandate of conserving, developing and managing all natural resources other than gas, oil, coal and minerals within their respective watersheds[25]. Under s.21(a) of the Act, each authority has power to undertake a study or investigation of a watershed to determine a suitable program for

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[22] G.Smith, "Ontario's Water Policy: From Policy Vision to Plan Implementation" (hereinafter Ontario Water Policy) (Being a summary of the Canadian Water Resources Association Workshop held in Cambridge on October 19, 1989) (1990) 15 (No.2) Can. Water Res. J. 172 at 172: B. Mitchell's submission.

[23] Ibid at 174: the submission of Peter Dennis.

[24] Ibid.

[25] R.S.O. 1980, c.85 s.20.

conservation, development, restoration and management of the natural resources of the watershed. By s.21(j) each authority has power to control surface water flow for purposes of controlling or preventing flood and pollution. Under s.28(1) each authority has power to restrict the use of surface water bodies within its jurisdiction. It can also regulate any works, construction, or dumping which may promote flood or pollution within its jurisdiction. However, s.28(2) prohibits the authorities from regulating water use for domestic, livestock watering, municipal and Ontario hydro purposes. They are also barred from interfering with any rights to use water conferred under the Public Utilities Act[26]. Critics say this limitation is a contraint on the ability of the autorities to undertake and implement a comprehensive watershed management plans hence the activities of the authorities in practice are limited to flood control, and to a lesser extent pollution control and water supplies[27].

Sections 21 and 28 define the powers and duties of the authorities and there is nothing in them or in any other section which suggests that the mandate of the authorities extends to groundwater quantity and quality management. Although the words "natural resources" in s.21 may be construed to include groundwater, this can hardly be sustained given that the intent and purpose of the Act is the management of surface water resources in each watershed. Since groundwater is, arguably, not included in the mandate of the authorities, there is no question of integrating surface

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[26] R.S.O. 1980, c.423.

[27] CELRF supra, Chapter Three, note 57, at 127.

and groundwater management.

However, the authorities in managing surface water can integrate the management of the ecosystem supported by it. The ecosystem approach followed in the Rouge River Watershed study by the Metropolitan Toronto Region Conservation Authority (MTRCA) can be said to be representative of an integrated approach[28]. The MTRCA embarked upon a study focusing on flood control, water quality and the ecosystems of the Rouge River Watershed. It defined the objectives and the goal of the study as ecosystem centered[29]. It then secured the agreement of different agencies responsible for the different aspects of the ecosystems. The result was reported to be successful[30].

The Conservation Authority mandate is a streamlined, integrated approach since it is limited to the management of surface water quantity and quality and the ecosystems. However, the inclusion of groundwater quantity and quality in the management is desirable because of the close inter-connectedness to surface water. The Conservation Authority approach contrasts sharply with the federal approach which appears to be practically too comprehensive.

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[28] Mitchell, "Improved Flying Without New Wings" supra note 12, at 11.

[29] C. Mather and B. Hindley, "Rouge River Watershed Management A New Approach" in Innovations in River Basin Management supra, Chapter One, note 41, at 129-132.

[30] Ibid.

III. Concluding Remarks:

As we have seen, both federal and provincial governments subscribe to the strategy of integrating water resources management on a watershed basis. This strategy is a positive response to the unity of natural processes and could ensure efficient management of Canada's water resources. However, the Federal Water Policy does not clearly define or state the substantive content of integrated water management. The policy states what should be done without emphasizing how it should be done. One commentator has criticized the policy for emphasizing only "the mechanism of policy development rather than the substantive content of the policy itself."[31]

B. Institutional (Coordination) Integration:

Although surface and groundwater quantity and quality need to be integrated, one institution cannot handle everything. Therefore, the institutions involved may not necessarily be integrated but rather coordinated.

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[31] "Ontario Water Policy", supra, note 22, at 173: the observation of Ralph Pentland of Environment Canada. He attributes the poor content of the policy to the difficulty of achieving consensus with the provinces.

I. Theory of Institutional Integration:

Planning and implementation are obvious stages of integrated management. There are three stages of planning. They are: 1) program planning which is best done at the regional level (watershed/groundwater basin). It defines the target to be achieved, for example, safe yield of aquifers or surface and groundwater quantity and quality management for beneficial uses. It is at this stage that financial and technical resources are allocated; 2) project planning which determines the location and capacity of any structure to be constructed, for example, groundwater well capacity, location and spacing; 3) designing of the components of the project for example, dams, canals or groundwater diversion or monitoring wells[32]. Booy submits that these planning stages

> provide for integration in that each planning level controls the objectives of the next lower one. It may be suspected therefore, that integration and control break down when the basic structure is ignored and when planners at any level are allowed to set their own objectives and priorities.[33]

Thus all agencies concerned must be represented in the planning process and

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[32] C. Booy, "Water Resources Planning: Integration and Control" in Agassiz Centre for Water Studies The Allocative Conflicts in Water Resource Management (Winnipeg: Agassiz Centre for Water Studies, The University of Manitoba, 1974) at 548.

[33] Ibid. at 549: the omission of program planning stage, for example, would produce a result which does not consider alternatives to a particular aspect of a project which program planning stage would have provided. According to him, program planning objectives form the basis of project planning objectives which in turn determine the design planning objectives.

must exchange important information. This is particularly important at the program-planning stage where decisions which might affect their interests are made[34]. This presents the challenge of coordinating the concerned agencies both at the planning and implementation stages. Consequently, the concept of a "floating" lead agency has been developed whereby at a particular time and for a particular problem, an agency that has the most relevant skill is given the responsibility of leading others[35]. In this way, each agency may have the opportunity of leading others. This helps to diffuse tensions raised by agencies pursuing their individual and often conflicting interests.

Coordination may be horizontal between agencies of one government or committees of one government department[36]. Integrated management of surface and groundwater quantity and quality may not possibly be undertaken by a single agency because of the many activities which impact on water quality. There is, however, always a department or agency that has the dominant responsibility for such

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[34] Ibid. 550: submits that at the designing and implementation stage the project has become technical and only the agencies that have the necessary expertise would be involved.

[35] B. Mitchell, "Improved Flying Without New Wings.", supra, note 12, at 10-11; McPhee and Wiebe "Coordinating Management Activities in the Fraser River Estuary" in R. Lang Integrated Approaches to Resource Planning and Management (Calgary: University of Calgary Press, 1986) 229 at 230: explains the difficulty in coordinating agencies. Some scholars argue that the overlap in the functions of agencies might be helpful in some cases so that where one fails, the other may succeed: P.N. Nemetz, "The Fisheries Act and Federal-Provincial Environmental Regulation: Duplication or Complementary" (1986) 29 (No.3) Canadian Public Admin. 401-424.

[36] R.C. de Loe, "Strategies for Coordinating Water Management A Multi Jurisdictional Survey" in Innovations in River Basin Management, supra, Chapter One, note 41, at 95-96.

management. This department can lead other departments concerned. It is also important to narrow down, as much as possible, the number of agencies involved to enhance coordination.

II. Emerging Practice of Institutional Integration:

i). In Ontario, for example, water quality alone is under the control of the Ministry of Environment, Ministry of Natural Resources and Ministry of Agriculture and Food. Each of these ministries has different agencies responsible for different aspects of water quality[37]. Loe submits that the institutional pattern for water management in Ontario developed on ad hoc basis in response to a variety of problems as they arose. According to him, "this is typical of water management in many jurisdictions" and integration is difficult under such arrangements[38].

ii). In contrast, in response to public complaints that "there were too many departments, boards and agencies involved in water management resulting in numerous fragmented and diverse policies regarding water,"[39] the Saskatchewan government has established the Saskatchewan Water Corporation with a broad

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[37] R.C. de Loe, "The Institutional Pattern for Water Quality Management in Ontario" (1991) 16 (No.1) Can. Water Res. J. 28, 33.

[38] Ibid 40-41; see also, C.H. Templeton, "Developing A Water Resources Management Strategy" (1986) 11 (No.2) Can. Water Res. J. 6 at 7-8.

[39] R.A. McLean "Saskatchewan Water Corporation" (1986) 11 (No.3) Can. Water Res. J. 62 at 63.

mandate. This presents a situation that is at risk of falling into the traps associated with an extensive comprehensive management approach which may be impracticable. To avoid involving too many agencies in water management and at the same time avoid giving a single agency numerous functions that would lead to inefficiency is a great challenge to water resources managers.

Under s.16 of the Water Corportion Act[40], the Corporation is empowered to develop, conserve, administer, manage, protect and control surface and ground-waters and related land resources. It also controls and maintains water quality, allocates and supplies water to Saskatchewans and determines water uses. Its mandate also extends to scientific research into water and related land resources and the construction of waterworks and sewages. The only water related issue which does not come under the responsibility of the Corporation is the "establishment and enforcing of environmental and health standards. These powers and duties remain with the departments of Environment and Health respectively."[41]. In other words, overall environmental quality protection including water quality is not primarily the responsibility of the Corporation.

The Corporation has four major divisions namely: 1) Corporate affairs division which oversees the overall administration; 2) Watershed management division which undertakes integrated water management in the six watershed regions of the

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[40] S.S. 1984 c.W-41; Saskatchewan Water Corporation, Corporate Mandate-Managing A Vital Resource (Moose Jaw: The Corporation, 1988).

[41] McLean, supra, note 39, at 63.

province: 3) Water supply and utility management division which manages water supplies and water supply projects; and 4) Resource management division which undertakes water resources planning and supplies technical services to the other divisions[42]. The Corporation is said to be "unique in Canada as no other jurisdiction has established a corporation dedicated to water management and development."[43]

The Saskatchewan model represents a good administrative structure for efficient implementation of integrated water management based on watersheds. The model does not, however, entirely eliminate the problem of coordination. The different divisions that form the corporate structure need to have their activities coordinated. This is, however, less difficult to achieve as all the divisions are under the control of a single superior authority.

While the Saskatchewan approach brings the management of all aspects of water and related land resources under one management, the laws[44] relating to them have not been streamlined or brought under one framework. It is important to do this in order to align the legislative intents and thus avoid conflicting interpretations. Although it might not be possible to have a single body of laws, the

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[42] Ibid. 64-66. For details of the activities of the Corporation see generally, Saskatchewan Water Corporation Annual Report 1990 (Moose Jaw: The Corporation, 1990) at 6-19.

[43] Saskatchewan Water Corporation Annual Report 1990, supra, note 42, at 6.

[44] Ibid. at 9: lists about ten statutes relating to the mandate of the Corporation.

importance of a streamlined legislation cannot be over emphasized[45].

Compared with other provinces, the Saskatchewan model encourages better integrated water management. Although the mandate of the Corporation is too broad, the overall organization and approach of the Corporation to water management is an acceptable concept. Water management is integrated on a watershed region basis. Each regional administration is accountable to or controlled by the central administration, thus making coordination less difficult. Ontario's convservation authorities established to integrate water management on a watershed regional basis are close to Saskatchewan model. The difference, however, is that there is no central superior body as the Saskatchewan Corporation controlling the conservation authorities or coordinating them to ensure that they do not pursue conflicting interests. Also, the conservation authorities do not have a clear mandate to manage groundwater.

iii). Coordination can also be vertical between two levels of government. Already we have seen various water agreements signed between the federal and provincial governments.[46] However, federal-provincial cooperation for the clean-up of

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[45] J. Peterson, "Director General's Forward: The End of the Begining " in Department of Water Resources, Third Annual Report 1986-1987 (Melbourne, Australia: Department of Water Resources, 1987) at vi: discusses how different water statutes were reduced to a single body of comprehensive legislation, better clarifying the functions and powers of the water department.

[46] See supra, Chapter Two, notes 108, 113, 114, 116 and Chapter Three, notes 157-159.

national contaminated sites under the National Contaminated Sites Remediation Program (NCSRP) developed by the CCME[47] should serve as a model for the integration of federal-provincial efforts in managing ground and surface water resources. The Environmental Quality Criteria under the program draw upon the Canadian Water Quality Guidelines, Guidelines for Canadian Drinking Water Quality and the remediation guidelines of some provinces.[48] Thus the remediation standard guidelines developed are acceptable to and used by both levels of government.[49]

Under the NCSRP, $250 million is to be spent over a 5 year period (which began in 1990) on a matching fund basis by the federal, provincial and territorial governments. Already the federal government has signed six separate bilateral

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[47] Canadian Council of Ministers of the Environment (CCME), Interim Canadian Environmental Quality Criteria for Contaminated Sites (hereinafter Environmental Quality Criteria) (The National Contaminated Sites Remediation Program) (Winnipeg: CCME, May 1991) at 1, 3. See also September 1991 issue of the Environmental Quality Criteria.

[48] Ibid: "the Interim Criteria provide a working set of values that have already been used in some jurisdictions in Canada and appear to provide an adequate degree of human and environmental protection based on experience and professional judgement"; See also, pages 3, 9, 10: adopted include: (British Columbia) Ministry of the Environment, Criteria for Managing Contaminated Sites in British Columbia (Draft) (Waste Management Program) (Victoria: the Ministry, 1989); (Ontario) Ministry of the Environment, Guidelines for the Decommissioning and Cleanup of Contaminated Sites in Ontario (Toronto: the Ministry, 1990); Alberta Environment, Alberta Tier 1 Criteria for Contaminated Soil Assessment and Remediation (Draft) (Waste Management and Chemicals Division, Soil Protection Branch) (Edmonton: Alberta Environment, 1990).

[49] Ibid. at 1, 4. See also, CCME, National Classification System for Contaminated Sites (Winnipeg: CCME, March, 1992) 1-2: developed a system to be used across Canada to assess and classify contaminated sites according to the degree of risk or danger posed to the environment and human health and prioritizes them for remedial action.

agreements in this regard with the provinces of Ontario, Quebec, British Columbia, Alberta, Nova Scotia and New Brunswick representing $200 million out of the $250 million NCSRP funding.[50] Remediation activities under the NCSRP have begun in ten sites across Ontario, Quebec, Nova Sotia, British Columbia, Alberta and New Brunswick.[51] The matching fund provision under the program is an incentive for the provinces to participate in it.

Thus, the NCSRP is essentially the remediation program of the participating provinces. A fusion of federal and provincial groundwater quantity allocation and quality protection programs in this way should serve the management of the quality and quantity of ground and surface water more efficiently.

C. Overall Comments on Integrated Management:

Integrated water management must, however, be undertaken with some precautions. As one writer puts it,

> ... integration is a means to an end rather than an end itself. Integration requires efforts and entails costs. It should not be pursued so relentlessly and single-mindedly that we lose sight of the idea that its application is intended to improve environmental, economic and social conditions....The rationale for it must be established relative to

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[50] CCME, The National Contaminated Sites Remediation Program 1990-1991 Annual Report (Winnipeg: CCME, 1991) 1-2: under the bilateral agreements, the federal government and the respective provinces are to spend the following: British Columbia, $23.40 million; Alberta, $23.25 million; Ontario, $91.25 million; Quebec, $63.75 million; Nova Scotia, $8.50 million; and New Brunswick, $6.75 million.

[51] Ibid. at 2-3.

the specific problem or situation being addressed.[52]

This warning is appropriate. However, the hydrological connection of surface and groundwater makes their integration important for efficient mangement. Components of integrated management of surface and groundwater on a watershed or groundwater basin area basis should include water conservation, avoidance of waste, prevention of groundwater mining, and maintaining water levels for instream uses and ecological support. Also, water quality protection, allocation of water and determination of their uses should be a part of such management.

These goals can only be achieved with improved financial and technical resources needed to collect, assess, store, process and interprete data on groundwater quantity and quality and their connection with surface water quality and quantity. Such information is important to guide allocation decisions for both sources of water supply and management strategies for their protection from contamination. Also, a clear legal mandate for integrated management of surface and groundwater resources should be given to the appropriate agencies.[53] There is as yet no clear legal

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[52] Mitchell, "Improved Flying Without New Wings", supra, note 12, at 15; K. Kernaghan and O. Kuper, Coordination in Canadian Government: A Case Study of Aging Policy (Toronto: The Institute of Policy Administration of Canada, 1983) at 12-13: say coordination is not a "panacea" for government weaknesses such as unresponsiveness, ineffectiveness or inefficiency. They further state that coordination cannot displace shared values and goals among policy makers which according to them, are needed for sound policy decisions.

[53] G. Thornburn, "Integrated Approaches to Water Resources Development in the Practice of the International Joint Commission (IJC)" in Innovation in River Basin Management, supra, Chapter One, note 41, at 36-42: discusses inter alia, how the legal mandate of the IJC enables it to integrate water quantity and quality.

mandate for such management in the water or environmental protection statutes of the various jurisdictions.[54]

Overall, it is more desirable to streamline the holistic approach in terms of resource integration as well as narrow down the number of agencies involved in managing water resources. This will make management objectives clearer and will help to concentrate managerial efforts more efficiently on set goals. Federal-provincial cooperation in this area can follow the model of the NCSRP under which the provinces participate by agreements. With such a fusion of federal and provincial programs, conflicting objectives and goals are avoided. As both federal and provincial governments are willing to manage their water resources on a watershed basis[55], a program modelled upon the unity of the NCSRP and applied across Canada will make such management easier and more efficient.

Such unity of efforts already exists in the United States. The American Constitution has been interpreted in such a way that environmental protection is to a considerable extent under the power of Congress. Congress passes umbrella legislation and provides terms and conditions which states must follow in enacting implementation regulations. Since the unified management efforts derive from the

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[54] See, supra, Chapter Three and Chapter Five.

[55] And arguably groundwater basin basis, see Chapter Three, supra, note ~~222~~ 225 and accompanying text.

Constitution, the American approach is characterized by the presence of legal obligations. As long as Congress is taking action, there is no risk of fragmenting environmental management.[56] There is also a recognition of the interrelationship between water resources and aquatic life.[57] There is, therefore, both institutional and resource integration (coordination).

The American experience further demonstrates a combination of contaminant-focused and resource-focused approaches executed by both federal and state governments in a unified fashion. American water problems are more serious and urgent and could be worse without this strategy in place. While the Canadian situation is not as serious or urgent, Canada must nevertheless have a mechanism in place to avoid serious water problems or to respond to such problems when they arise. We have seen how the common law doctrines evolved and changed in response to changing needs and problems. In the same way, combining contaminant-focused and resource-focused approaches and executing them in a unified fashion in Canada provides a mechanism to respond to the reality of the unity of water resources and the environment.

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[56] P.R. Wandschneider, "Managing River Systems: Centralization Versus Decentralization" (1984) 24 Natural Res. J. 1045 at 1049: using the the Columbia River as a case study, critizes as inefficient a system where decisions to withdraw water and to regulate stream flow for instream uses are made by different agencies.

[57] See, for example, the Clean Water Act supra, Chapter Four, notes 218-219; the Fish and Wildlife program under the Northwest Power Planning Act of 1980 (1982) 16 USC s.839; Columbia Basin Project Act (1982) 16 USC s.835; Wild and Scenic Rivers Act (1982) 16 USC s.1271. See also, supra, Chapter Four, notes 260-279 and accompanying text

Currently, because Canada's problem is not as urgent as that of the United States so that there is no case of national concern for groundwater, the federal government cannot pass groundwater law. Such legislation would not pass the constitutional test. The distribution of legislative powers under the Canadian Constitution does not permit the merging of federal and provincial powers to have a centralized or unified management approach in response to the unity of the aquatic environment. Arguably, the unity of the aquatic environment may merit the use of the POGG power by the federal government to unify and coordinate efforts for groundwater protection across Canada. However, by emphasizing the "pith and substance" test, the Oldman River case appears to suggest that the POGG power may not be expanded beyond interprovincial groundwater cases to include groundwater in general.

Therefore, the Constitution sets out a fragmented management approach. Each level of government is confined to its legislative heads of power and each province must exercise its powers within its political boundaries. Since political boundaries do not coincide with natural occurrence of surface or groundwater, measures adopted by different provinces could, in the absence of harmony, have conflicting impacts on water and its environment. An active federal role is thus necessary to harmonize or even unify the measures adopted by different provinces. Such a unified approach, however, cannot have a legal backing as in the United States because of the constitutional setting. Political reality makes constitutional amendments an unlikely solution.

The impossibility of achieving a unified management approach purely on a legal or constitutional score compels resort to cooperative solutions. Some cooperative agreements between the federal and provincial governments and agreements among the provinces themselves have been concluded.[58] Most of these agreements focus on interprovincial surface water. Although they may be adapted to interprovincial groundwater, they need to go beyond interprovincial concerns to include groundwatwer generally.[59] The federal government should offer the contaminant-focused and resource-focused approaches as model groundwater management strategies to the provinces along with financial and technical incentives. It is only in this way that the natural unity of the resource can be fully respected in cooperative management efforts.

Yet uncertainty surrounds the legal validity of these agreements. Although they are extra-constitutional, the agreements cannot be valid if they deny any one level of government its legislative powers in favour of the other. Therefore, only a limited compromise can be achieved in uniting efforts to manage water resources and the aquatic environment. Furthermore, it is usually difficult and time-consuming to reach coopreative agreements which are acceptable to all the provinces and the federal government. Even where such agreements are reached, any province can decline cooperation where it thinks appropriate. Also, these agreements are political and may

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[58] See supra 46 and accompanying text.

[59] See, for example, the agreement between federal and Prince Edward Island governments, supra, Chapter Three, note 158 and accompanying text.

not be given a legal force. A unified management of the aquatic environment in Canada is thus not without risks.

Although a unified management with a legal backing would be preferable, it is suggested that non-binding cooperation in the areas canvassed in this work, and the model of integration discussed above could help to manage the water resources and their environment more efficiently than under a fragmented management approach. Ignoring this reality is unrealistic. Rather it is our responsibility to devise a mechanism that would be a step towards making sure that the goals of sustainable development are met as far as water resources management is concerned. While the law and management efforts of both levels of government remain significantly fragmented, suggestions have been made on how these could be fashioned into a unified or integrated approach streamlined in a way that enhances managerial focus and efforts.

Even at the inherently fragmented international level efforts are being made to recognize ecological unity. While States retain their sovereign status, their collective efforts transcend political boundaries in response to the unity of the hydrologic cycle and the environment.[60] Canada as a federation should take advantage of existing structures to better pull together the efforts of its political divisions in managing its water resources and environment. While this issue will remain on the agenda of future water management discourse, it is hoped that the

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[60] See, supra, Chapter Two, notes 135-143.

suggestions made in this work will be a contribution to a more efficient management of Canada's water resources. The crux of the suggestions is that water resources management in Canada must proceed upon a combination of contaminant-focused and resource-focused approaches adopted under integrated or unified federal-provincial efforts as well as under an integrated management of the hydrologic cycle.

As Canada faces the future, it should be prepared for a worse case scenario with respect to water supplies and the aquatic environment. The suggestions herein have been made with this in view. If carried into effect, they will help Canada to meet these challenges.

APPENDIX

This Appendix contains personal communications with the water resources and environmental authorities of the provinces including the territories. Reproduced first is a copy of my letter. It is followed by the responses from some of the relevant authorities.

7643 Bouvier Street
LaSalle, Quebec
H8N 2G6
January 09, 1992

Phone # 514 365 2971

To the Provincial Environment
or Water Officer(s) Who is in
a Position to Give Authoritative
Answers to the Questions Below.

QUESTIONNAIRE

This questionnaire is intented to elicit certain information for my doctoral dissertation at McGill University. The questions can be answered by more than one officer where appropriate. Since this will be cited as personal communication in my dissertation, the officers are advised to give their full names, job positions and the dates of supplying the information. A separate sheet(s) of paper and necessary enclosures are expected to be used by the officers in aswering the questions. If this questionnaire is sent to an officer who is not in a position to give authoritative information, he or she should please send it to the appropriate officer(s). The questions are:

1) Does your province have integrated or coordinated management of surface water and groundwater in terms of QUANTITY allocation? If yes, supply relevant information. If no, give reasons.

2) Does your province have integrated or coordinated management of surface water and groundwater in terms of protecting and maintaining the QUALITY of both? If yes, supply relevant information. If no, give reasons.

3) In allocating groundwater quantity to users, does your province take into consideration the importance of ensuring and maintaining "SAFE YIELD" of the aquifers and avoiding contaminants intrusion into groundwater system. If yes,

supply relevant information. If no, give reasons.

4) Does your province have integrated or coordinated management of GROUNDWATER QUANTITY (in terms of allocation and use) and GROUNDWATER QUALITY (in terms of protection from contamination)? If yes, supply relevant information. If no, give reasons.

5) Does your province classify aquifers (groundwater) in terms of their quality, yield, use and vulnerability to contamination as a basis for determining priority or degree of protection to be given to each class? If yes, supply relevant information. If no, give reasons.

6) Does your province use zoning system or other land use mechanisms to protect critical aquifer recharge areas? If yes, supply relevant information. If no, give reasons.

7) Does your province have demonstration projects where, for example, farmers are instructed on best fertilizer and pesticide application methods to prevent them from leaching into groundwater systems? If yes, supply relevant information. If no, give reasons.

8) Does your province receive from the federal government financial and technical assistance specifically directed at groundwater protection? If yes, supply relevant information. If no, give reasons.

THOROUGHLY CLEAR AND COMPREHENSIVE ANSWERS TO THE QUESTIONS WILL BE APPRECIATED.

PLEASE MAKE A SPEEDY REPLY.

Thank you for your cooperation.

Sincerely yours,

Ken Orie.

SASKATCHEWAN WATER CORPORATION

Managing a Vital Resource

SASKATCHEWAN IN THE WORLD 1990

February 14, 1992

694-3963

Mr. Ken Orie
7643 Bouvier Street
LaSalle, Quebec
H8N 2G6

B4-4-9

Dear Mr. Orie

RE: QUESTIONNAIRE

Please find enclosed the results of the questionnaire you asked to be filled out as part of your Ph.D. thesis. Several of the questions fell under the jurisdiction of Saskatchewan Environment and Public Safety (SEPS). Accordingly, I have passed the questionnaire on to Mr. Bob Ruggles of SEPS. His address is:

Mr. Bob Ruggles
Saskatchewan Environment and Public Safety
3085 Albert Street
Regina, Saskatchewan
S4S 0B1

If you have any further questions pertaining to groundwater management in Saskatchewan, please call me at the above number.

Yours truly,

Nolan Shaheen
Hydrogeologist, Hydrology Branch
Water Management Division

NJS/ljc
Enclosure

Victoria Place, 111 Fairford Street East, Moose Jaw, Saskatchewan S6H 7X9
(306) 694-3900, Fax 694-3944

ANSWERS TO QUESTIONNAIRE

1. Allocation of surface and groundwater in Saskatchewan is integrated in that the allocations for a given area are approved by the Sask Water regional office for that area. Thus, both surface and groundwater approvals are issued from the same office and often by the same individual. All surface and groundwater allocations are then recorded and stored by the registrar, who is based in the head office.

2. Referred to Saskatchewan Environment and Public Safety (SEPS)

3. As a matter of policy Sask Water attempts to allocate groundwater on the basis of sustainable yield. Unfortunately, many aquifers in the province are poorly documented, thus, the sustainable yield can only be roughly estimated. In order to overcome this problem Sask Water is undertaking a program of developing a series of aquifer management plans. These management plans are multi-agency programs which attempt to better quantify the resources of major aquifers. The first of these plans to be initiated was the Regina Aquifer Management Plan. The first step of each plan is to form a technical committee of the participating agencies. For the Regina plan this included: Sask Water, Saskatchewan Environment and Public Safety, the Saskatchewan Research Council and the City of Regina. This committee then oversees the various components of the plan which include: compilation of a comprehensive data base, detailed hydrogeologic study, study of present and future groundwater demands and a final groundwater allocation report. Other components may include modelling and sensitivity mapping. Currently, three management plans have been initiated with the Regina plan nearing completion and work on the Southeast having recently begun.

   Most allocation requests occur in areas not yet covered by management plans, therefore allocation decisions are generally based on limited knowledge. The scale of investigation that Sask Water will of a request of a proponent depends on the magnitude of the allocation. Small allocations will typically require a monitoring well be installed and a 24 hour pumptest be conducted. Some proponents, depending on the size of their allocation request, may be required to conduct more extensive test drilling programs, install more extensive monitoring networks, and conduct longer term pumptests. For example, some projects have been required to conduct pumptests of up to 30 days duration.

   In short Sask Water is continually trying to improve groundwater management, with one of the most important goals being to ensure that allocations will not exceed the safe yield of the aquifer.

4. No, management of groundwater allocations is not integrated with protection of groundwater quality. Sask Water is the crown corporation which is responsible for administering and allocating water, but responsibility for pollution control and contaminant cleanup rests with Saskatchewan Environment and Public Safety (SEPS). This split in duties requires that SEPS and

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Sask Water co-operate closely, but nonetheless, gray areas exist between the agencies. While groundwater quality is handled by the SEPS, natural groundwater quality (or chemistry) is also of interest to Sask Water. Groundwater chemistry is of fundamental importance to aquifer delineation and determination of aquifer hydraulics which are of direct concern to Sask Water.

5. This is something of a yes and no answer. The aquifers targeted for management plans are chosen mainly due to demands being placed on them and their susceptibility to overuse and/or contamination. As a rule however, most aquifers are not classified under the criteria you mentioned.

   Most of the aquifers in the province have not been formally classified according to the criteria you have listed. Although in a number of situations the information is available to do the job, substantial resources, which are not presently available, would be required.

6. No. High sensitivity aquifer areas have only been formally identified for only a small portion of the province. The main project was an aquifer sensitivity mapping project conducted by SEPS as part of the Regina Aquifer Management Plan. An additional sensitivity mapping project is being conducted by the NHRI for the Prairie Provinces Water Board, Committee on Groundwater. This project involves a map sheet on either side of the Alberta-Saskatchewan border. Resource limitations prevent province wide documentation of recharge areas and appropriate sensitivity mapping.

7. Refer to SEPS

8. Refer to SEPS

Saskatchewan
Environment and
Public Safety

Walter Scott Building
3085 Albert Street
Regina, Canada
S4S 0B1

File: F6-2

February 27, 1992

Mr. Ken Orie
7643 Bouvier Street
LaSalle, Quebec
H8N 2G6

Dear Mr. Orie:

Your memo/questionnaire of January 9, 1992 has been sent to this department from the Saskatchewan Water Corporation as several of the questions posed can best be addressed by this agency. I assume that the SWC will respond to those pertaining to the administration of their jurisdiction of water management.

Question 2) - The Saskatchewan Department of Environment and Public Safety integrates and coordinates management of surface water and groundwater in terms of quality maintenance.

Question 4) - The province does not presently have integrated management of groundwater quality and groundwater quantity. Those functions were divided between the two agencies in 1984.

Questions 5) and 6) - Aquifers are not presently classified in terms of quality, yield, use and vulnerability to contamination. However, land use guidelines and aquifer management plans are, or have been formulated for high-use aquifers. Specific examples include the Regina Aquifer and Yorkton Aquifer Complexes and the Estevan Valley Aquifer in southeast Saskatchewan.

Questions 7) and 8) - I am not aware of any demonstration projects, as described or of any federal financial or technical assistance specifically directed to groundwater protection in the province at this time.

Should you have any further questions on the foregoing please call at the number provided below.

Yours sincerely,

R. J. Stewart, P. Eng.,
Supervisor
Groundwater Quality Unit
Water Quality Branch
Phone (306) 787-6201

Manitoba

Natural Resources

Water Resources Branch
1577 Dublin Avenue
Winnipeg, Manitoba
R3E 3J5

Tel: (204) 945-7425
Fax: (204) 945-7419

February 19, 1992

File: 5.7.2

Mr. Ken Orie
7643 Bouvier Street
LA SALLE, Quebec
H8N 2G6

Dear Sir:

Your letter requesting information on groundwater management practices is acknowledged herewith. We can provide the following responses to your questions.

1. Yes, both groundwater and surface water are allocated by the Department of Natural Resources under the Water Rights Act.

2. Yes, the province does have coordinated management of surface water and groundwater in terms of protecting quality. This is handled by the Department of Environment under the Manitoba Water Quality Guidelines. In addition provincial water policies have also been developed to deal with this situation.

3. For aquifers where the "sustainable yield" has been determined this is used in allocating groundwater to various users.

4. No, the province does not have an integrated approach to the management of groundwater quantity and groundwater quality. Groundwater quantity is managed under the Water Rights Act while groundwater quality is managed under the Environment Act.

5. No, the province does not classify aquifers in terms of quality, yield, use and vulnerability to contamination as a basis for determining priority or degree of protection. Groundwater quality is managed by the Department of Environment and groundwater quantity is managed by the Department of Natural Resources.

6. No land use mechanism has been set up to protect aquifer recharge areas.

7. Yes, farmers can receive instruction on the best fertilizer and pesticide application methods by taking a homestudy course entitled Agricultural Chemicals in the Nineties sponsored by the Department of Agriculture.

8. The federal government does not supply any financial and technical assistance specifically directed to groundwater protection to the province at this time.

Answers to your questions have been supplied by the following people:

Question 1	Jon Stefanson Head, Water Licensing Section Water Resources Branch Department of Natural Resources
Questions 2, 4, 8	Dennis Brown Head, Water Standards and Studies Environmental Quality Standards Department of Environment
Questions 3, 5, 6	Jim Petsnik Aquifer Data Geologist Groundwater Section Water Resources Branch Department of Natural Resources
Question 7	Mark Goodwin Weed Specialist Soils and Crops Branch Department of Agriculture

Yours truly,

J. Petsnik, P. Eng.
Aquifer Data Geologist
Groundwater Section

JP/jj

Manitoba

Environment

Building 2
139 Tuxedo Avenue
Winnipeg, Manitoba, CANADA
R3N 0H6

September 4, 1991

Mr. Ken Orie
7643 Bovier Street
LaSalle, Quebec
H8N 2G6

Dear Mr. Orie,

Your request for groundwater management information has been forwarded to me for reply by Mr. Thompson. Manitoba Environment presently has the mandate for environmental quality but works in close cooperation with many other government departments and agencies to address the various groundwater quality issues which arise in the province. In keeping with your request on water quality criteria, I have attached a copy of the Manitoba Surface Water Quality Objectives. Although this document is specific for surface waters in Manitoba, it has been utilized as the basis for drinking water protection for groundwater in the province.

Previous Communication

In addition to the above, I would suggest that you contact the following;

Manitoba Sustainable Development Coordination Unit,
c/o Mark Boreskie,
305-155 Carleton Street,
Winnipeg, Manitoba,
R3C 0H8

to request the latest copy of Manitoba's water policies. Portions of these draft policies relate specifically to groundwater.

Yours sincerely,

Dennis J. Brown
Chief
Water Quality Management

Province of
British Columbia

Ministry of
Environment,
Lands and Parks

BC Environment

Water Management Division
765 Broughton Street
Victoria
British Columbia
V8V 1X5

442

February 4, 1992

File: 00320

Mr. K. Orie
7643 Bouvier Street
LaSalle, Quebec
H8N 2G6

Dear Mr. Orie:

Thank you for your inquiry of January 9, 1992. I would advise that the answer to each of your questions would be "No", as there is no legislation in place in British Columbia specific to groundwater allocation and protection. The existing Water Act pertains to surface waters only. I have enclosed for your information, an outline of our current groundwater program activities. Options for groundwater legislation are currently being examined.

If you require any further information, do not hesitate in contacting me directly at 604-387-9465.

Yours truly,

A. P. Kohut
Acting Head
Groundwater Section
Water Management Division

APK/ccw
GR8589

Enclosure

GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
DEPARTMENT OF ENVIRONMENT AND LANDS
P.O. Box 8700
St. John's, Newfoundland
A1B 4J6

In Reply Please Quote
File Ref. No.

January 21, 1992

Mr. Ken Orie
7643 Bouvier Street
LaSalle, Quebec
H8N 2G6

Dear Mr. Orie:

Thank you for your questionnaire concerning water resources regulations received January 13th by this division. I will answer each of your questions in order as they appear on your questionnaire.

1. Newfoundland does not have an integrated or coordinated management of surface or groundwater in terms of quantity allocation. Fortunately, our Province is blessed with an abundance of both surface and groundwater resources. We have a relatively sparse population for our landmass, therefore water quantity allocation of water resources is not a significant problem.

2. Newfoundland does have legislation concerning the protection of water quality. Acts and subsequent regulations such as the Department of Environment and Lands Act, the Waters Protection Act, the Well Drilling Act, the Pesticides Control Act, and the Waste Materials Disposal Act, are designed either wholly or in part to protect surface and groundwater resources from water quality degradation. I have enclosed copies of these Acts for your information.

3. The safe yield of an aquifer with regards to aquifer depletion is not taken in to consideration in Newfoundland for a number of reasons. They are:

a) Overdraft of an aquifer has never been a problem here due to a sparse population, 20% to 30% of which, rely on groundwater. A large land area and adequate recharge of aquifers prevent any depletion of aquifers. Several localized cases of well interference of adjoining properties have been documented, but none of depleted aquifers due to over pumping over a wide area.

b) Specific aquifers have not been identified because of insufficient data and lack of human resources to undertake the work.

c) In areas of suspected salt water intrusion, particularly along coastlines and offshore islands, well users are instructed to exercise care in the amount of water pumped from their well to avoid salt water intrusion into their wells.

4. Allocation and use of groundwater is monitored through our division by the submittal from licensed well drilling firms of well records for each well drilled in the Province. We have a computerized data system that displays information on well yields, locations, owners, and well usage. Problems arising from groundwater overuse are dealt with as they arise. Management allocation of groundwater is not necessary due to it's abundance in the Province.

5. We do not have enough information on groundwater regimes to classify aquifers in this province. About 700 wells a year are drilled. Greater than 90% of drilled wells end in bedrock. Communities that are supplied solely by wells, especially wells where groundwater is obtained from overburden, are already or are in the process of having the areas around the well field protected by a groundwater protection zone. Although their are few towns like this, those that are, need some form of protection to ensure their water supply is protected from contamination.

Groundwater quality is protected from contamination by the following:

a) The Well Drilling Act provides for the safe distances a well must be drilled from pollution sources, well construction,and the disinfection of wells.
b) Brochures distributed to well drilling firms, pump installers, town councils, and the general public, explain how wells get contaminated, how to protect a well from contamination, proper completion methods, and provide assistance in obtaining a reputable drilling firm.
c) Inspections of new drilled wells is done routinely. A brochure is left with the well owner.
d) Legislation on waste materials and landfill sites, have sections which deal with protecting groundwater from contamination.

6. We have initiated groundwater protection zones around well fields that provide drinking water to a few communities. One such community is Stephenville Crossing. This town is totally dependent on a glacial till deposit aquifer near the town. Water from four pumping wells supplies the town. Zones of protection with regards to land use, hazardous materials storage, and road salt deicing have been defined for each zone. The farthest zone from the well field's drainage area will have the less stringent requirements.

8. We do not receive from the federal government any financial assistance specifically related to groundwater protection. Both levels of government are presently involved in a study of a landfill site near Gros Morne National Park. This is a cost shared program. A fact sheet on groundwater, and a primer on water which includes a section on groundwater, is available to the general public from Environment Canada, Conservation and Protection.

Enclosed you will find documentation supporting these answers to your questions. If you require additional information, please contact this department.

Yours truly,

Wasi Ullah
Director
Water Resources Division

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

NWT Water Resources Division
Northern Affairs Program
P.O. Box 1500
Yellowknife, N.W.T.
X1A 2R3

March 27, 1992

N9500-1

Ken Orie
7643 Bouvier St.
Lasalle, Que
H8N 2G6

Re: NWT Water Management Questionnaire

Dear Mr. Orie,

Your letter, which was addressed to the Renewable Resources Department of the Government of the Northwest Territories, has been given to me for reply. I apologize for the delay.

Although this is a federal department, the provincial water management functions are carried out here until these functions are assumed by the NWT.

Our first problem in replying to your request was to define what you meant by integrated (or coordinated) management of surface and ground water. Do you mean the arbitration of use of these sources together or separately?

There are limited sources of groundwater in the NWT due to large areas of permafrost and Precambrian shield. There is also very little use of groundwater, so it is seldom, if ever, a consideration in allocating water rights. In general, an integrated approach is taken to allocating water quantity and protecting water quality in the NWT, although we primarily deal with surface water issues. We are unaware of any specific programs dealing with groundwater.

In a general sense, an integrated approach is followed by the NWT Water Board in issuing water licences for water use and waste disposal, whereby additional input is sought from various government agencies (coordinated by Water Resources division) and the public.

Specific answers to your questions:

1. This department, through its involvement with the Water Board in developing water licences, considers the source and quantity of water requested by a licensee, and specifies these details in the licence. In most cases, we are dealing with surface

water, but there may be situations, eg certain municipal licences, where groundwater (from wells) is considered. This information is reviewed to ensure that quantities are appropriate and sources adequate, given other potential users - including local fish population requirements.

2. We are usually more concerned with protection of water quality than quantity, and again, primarily with surface water. However, implications for groundwater are considered in those cases where it has been identified as a possible problem. Groundwater monitoring may then be included as a requirement of the water licence, eg monitoring groundwater with piezometers in tailings ponds or monitoring and regulating minewater (which is groundwater, although more a waste than a resource).

   NWT water licences include stringent terms and conditions designed to protect water quality, including waste disposal criteria and effluent disposal limits for various organic and inorganic parameters.

3. No. As with most of the water sources in the NWT, there is very little heavy development of sources of water due to the relative sparsity of development.

4. In general, no. See the replies to questions 1 and 2.

5. Aquifers are not classified and for the most part they are uncharted, except for work done within the Wood Buffalo National Park and the Pine Point Mine area. Several years ago, groundwater logs were put on a computerized system. This may be accessed through Vlado Schilder, Water Resources, DIAND, Terrasses de la chaudiere, Hull, Que. K1A 0H4. Phone (819) 997-9623, FAX (819) 997-1587.

6. Not applicable.

7. No demonstration projects. However an emergency spill line is maintained and the occurrence of spills must be reported. Spills are responded to quickly to prevent surface and ground water contamination.

8. Our Division receives literature from the Environment Canada groundwater group under John Gilliland. It is noted, but very little of it is of relevance because of our low use of groundwater.

I hope this will answer your question. I have enclosed several sets of procedures, legislation and other literature that might provide a more appropriate answer.

Good luck with your research work.

Sincerely,

Brian Latham
Head, Water Management and Planning
Water Resources Division

cc. K. Robertson
K. McDonnell

New Nouveau Brunswick

March 12, 1992

Mr. Ken Orie
7643 Bouvier Street
LaSalle, Quebec
H8N 2G5

Dear Mr. Orie:

Unfortunately most of the questions that you ask have no simple, short answers and it is difficult to provide sufficient information to answer them in detail.

One significant point is that in New Brunswick, under the Clean Water Act, Section 14, the Minister of the Environment may designate water protection areas. A copy of this act is attached, please note the powers of the Minister under section 14.

Surface water protection areas have been designated. Ground water protection areas are in the process of being designated, based on site specific information. It is estimated that it will take a number of years (>5) to complete the process. We are currently in the process of producing protection plans for five municipalities within the provence.

Within the protection areas we can answer yes to questions 1, 2, 3, 4, and 6.

With regard to question 5 the answer is no. The reason are lack of information, lack of manpower and low priority. Within protection zones we recognize that different aquifers have different vulnerabilities to contamination and account for this in the protection plan. We do not however, classify them by some arbitrary scheme.

With regard to question 7 the answer is no. The reasons are lack of manpower and low priority.

.../2

P.O. Box 6000
Fredericton
New Brunswick
Canada E3B 5H1

Case postale 6000
Fredericton
Nouveau-Brunswick
Canada E3B 5H1

With regard to question 9 the answer is yes, in the past. In 1988 Environment Canada funded a consultant study of the various municipalities within the province and recommended ground water protection zones. Currently we are not actively receiving such assistance. I would be curious to know what technical assistance the federal government could provide. We currently receive some monies through the water agreements that impact the ground water protection program to some degree.

Outside of the designated protection areas the answer to all questions would be no.

I trust this is sufficient for your interest, if not please advise me. Also, I would apologize for the delay in this reply.

Yours truly,

Douglas Craig
Ground Water Protection
Hydrogeologist

/jem

Attachment

McGill

514 398 6787
FAX 514 398 4680

November 14 1991

Mr. Ken Orie
3661 Peel Street
Institute of Comparitive Law
McGill University
Montreal QC H3A 1W9

Dear Ken:

I hope you will find the attached outline of Darcy's Law helpful. Based largely on Freeze and Cherry (1979), which reference you have, it is developed to describe flow in a confined aquifer. If this helps you with your work then I will be happy.

Regards,

Paul Toft

Dr. Paul B. Toft

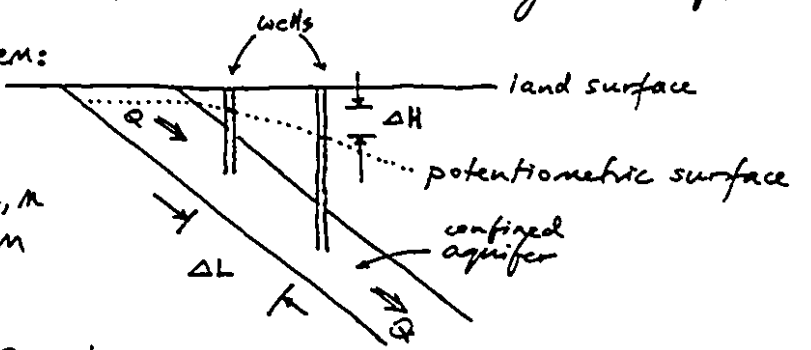
Darcy's Law (describes flow of fluids through porous media)

1/ recall that stream discharge is

$$Q = V A = \frac{m}{s} m^2 = \frac{m^3}{s}$$

2/ how to describe underground flow? $Q = (\text{constant}) A$

3/ system:



L = distance, m
H = head, m

$Q = (\text{constant}) A$
↑ units of velocity
↑ proportional to what?

Suppose Q ∝ to:

hydraulic gradient $= \frac{\Delta H}{\Delta L}$, dimensionless

4/ $Q = K \frac{\Delta H}{\Delta L} A$ K has units of velocity, $\frac{m}{s}$

5/ call K the hydraulic conductivity

What factors will affect K?

	acceleration of gravity	g	m/s^2	inc K
	fluid density	ρ	kg/m^3	inc K
	media permeability	k	m^2	inc K
← a viscous fluid resists shear deformation, i.e. flows slow	fluid viscosity (dynamic)	μ	$kg/m.s$	dec K

$$\frac{g \rho k}{\mu} = \frac{m}{s^2} \frac{kg}{m^3} \frac{m^2}{kg} \frac{m.s}{} = \frac{m}{s}$$

6/ $$Q = \frac{g \rho k}{\mu} \frac{\Delta H}{\Delta L} A = K \frac{\Delta H}{\Delta L} A = \frac{m^3}{s}$$

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