Ministry of Environment, Lands & Parks
Ministry of Agriculture & Food

NUTRIENT MANAGEMENT PLANNING STRATEGIES FOR THE FRASER VALLEY

May 14, 2001

Report of the
Nutrient Management Action Plan Working Group
of the Partnership Committee on Agriculture and the Environment

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Glossary of Terms

ALDA	Agricultural Land Development Assistance
AC	Agriculture and Agri-Food Canada
AFC	Atlantic Farmers Council
BCAC	BC Agriculture Council
BCHC	BC Horticulture Coalition
BCLC	BC Lands Commission
EC	Environment Canada
DFO	Fisheries and Oceans Canada
FBC	Fraser Basin Council
ha	Hectares
HCBC	Horse Council of BC
IAF	Investment Agriculture Foundation
MDA	Mainland Dairymen's Association
MAFF	Ministry of Agriculture, Fisheries and Foods
MELP	Ministry of Environment, Lands and Parks
NPS	Non-Point Source Pollution
NMPS	Nutrient Management Planning Strategy
NMAP	Nutrient Management Action Plan (former name of NMPS, above)
OME	Ontario Ministry of the Environment
PST	Provincial Sales Tax
RIDC	Raspberry Industry Development Council
SPFG	Sustainable Poultry Farming Group
BCMPA	BC Milk Producer's Association
BCPPA	BC Pork Producers Association
OMAFR	Ontario Ministry of Agriculture, Foods and Rural Affairs
LMHIA	Lower Mainland Horticulture Improvement Association

Executive Summary

The Nutrient Management Action Plan Working Group, which reported to the Partnership Committee on Agriculture and the Environment, worked between March 1999 and April 2001 to develop a collaborative plan for addressing nutrient management concerns in the Fraser Valley. The focus of the Working Group's efforts was to identify actions to address the following objectives:

- Address areas of the Fraser Valley (i.e., individual farms and regions) where estimated nutrient budgets far exceed the capacity of the land and/or crops;
- Reduce agricultural sources of pollution to water and land, through the adoption of environmentally sustainable on-farm nutrient management practices, in areas where there is sufficient land base to assimilate sources of nutrients and;
- Through planning, avoid future imbalances in nutrients on agricultural lands in the Fraser Valley (i.e., individual farms and regionally).

This document, Nutrient Management Planning Strategies (NMPS) for the Fraser Valley, represents the collective efforts of the Working Group and includes a number of nutrient management options that were identified through dialogue among Working Group members and their respective agencies and associations. Section 6 of the NMPS, presents the specific nutrient management options and categorizes them under one of seven general themes including.

- Education and Awareness
- Infrastructure Development
- Research
- Monitoring (Environmental quality and producer practices)
- On-Farm Plans
- Long Term Planning
- Legislation and Regulation

Section 7 of this document illustrates priorities among all of the nutrient management options presented. Section 8 presents recommendations to facilitate implementation of options that are supported by government and agriculture producers. The recommendations are:

<u>Recommendation #1 - NMPS Implementation</u>
The Partnership Committee on Agriculture and the Environment appoint a Nutrient Management Planning Strategy (NMPS) Implementation Steering Committee (ISC) to provide direction on the development of the nutrient management options. Membership of the ISC should include one representative from each of MELP, MAFF, DOE and DFO, two representatives from BCAC and one representative of local government to be identified through dialogue with UBCM.

Recommendation #2 - Implementation Teams

The ISC appoint and coordinate the work of four implementation teams that will be responsible for pursuing the nutrient management options of the NMPS relating to Research, Monitoring, Long Term Planning and On-Farm Plans as follows.

- Research Team - The Research Team will address the high priority NMPS Options identified in Section 6.3 dealing with the key information needs to support improved nutrient management practices.
- Monitoring Team - The Monitoring Team will address the high priority NMPS Options identified in Section 6.5 dealing with a nutrient management monitoring program to assist in assessing effectiveness of NMPS implementation.
- On-Farm Plan Team -The On-Farm Plan Team will explore the structure and function of On-Farm Plans (OFPs) as outlined in Section 6.6 in order to define how OFPs should be used to assist in improving nutrient management practices.
- Long Term Planning Team - The Long Term Planning Team will address the high priority NMPS Options identified in Section 6.4 in order to avoid future nutrient imbalances in the Fraser Valley.

Recommendation #3 – Funding (Education and Infrastructure Options)

The ISC bring forward high priority Options identified in Section 6.1 (Education & Awareness) and 6.2 (Infrastructure) to the Agriculture and Environment Partnership Committee and for incorporation in the design of the proposed Green Fund for Agriculture and the Environment.

Recommendation #4 – Funding (Capacity Building in Agriculture)

The ISC encourages dialogue at the Agriculture and Environment Partnership Committee to identify potential funding sources, including the proposed Agriculture Green Fund, to support the development of capacity (i.e., Producer Conservation Organizations, extension services etc.) necessary for adoption of improved nutrient management practices.

Recommendation #5 - Legislation/Regulation

The ISC bring forward Legislative and regulatory Options identified in Section 6.7 to the Agriculture and Environment Partnership Committee for consideration.

Recommendation #6 - NMPS Annual Implementation Report

NMPS Implementation Steering Committee report annually, to the Agriculture and Environment Partnership Committee on the development of NMPS.

Recommendation #7 – NMPS Three Year Review

NMPS Implementation Steering Committee to undertake a review of NMPS progress every three years. The review would consider adoption of NMPS options, assessment of progress towards measurable targets, maintenance of funding for implementation and provide recommendations for updating the planning strategies.

Recommendation #8 – NMPS Communications Plan

NMPS Implementation Steering Committee, working with the Partnership Committee on Agriculture and the Environment's Communication Sub-Committee, develop and implement a communications plan for the NMPS.

1.0 Introduction

Agriculture and Sustainability

Agriculture is a significant contributor to the well being of communities in the Fraser Valley and much of the southern part of the Fraser Basin. Agricultural activities are a significant part of the regional economy (i.e., in excess of $1 billion in 1996) and provide food for local residents and export markets. In an area of rapid urban development, properly managed agricultural lands can contribute to maintaining the integrity of ecosystems by helping maintain hydrological systems and providing habitat for some species.

Today, the agricultural sector is facing a number of social, economic and environmental challenges, which are leading to changes in the way the sector operates. Some economic challenges include: high land values which challenge the economic viability of farming, changes in global trade agreements, increasing transportation costs and increasing international competition. Social challenges include increasing urban development and conflict between agricultural and non-agricultural interests on the rural and urban fringe. At the same time, agriculture, like all other sectors of the economy, is required to minimize the impacts of its activities on the environment. One of the key environmental challenges associated with agriculture in the Fraser Valley is the management of "nutrients".

In recent years, significant efforts have been made to address point sources of pollution (i.e., sewage treatment, industrial discharges). Today, efforts to improve water quality in the Basin are increasingly focusing on non-point source (NPS) pollution. In 1998, the provincial government released an Action Plan to tackle non-point source water pollution to provide direction on this issue (MELP, 1998). The Nutrient Management Action Plan represents an effort to focus on NPS pollution associated with agriculture. (See box for definition of Nutrient Management.

Nutrient Management Defined - The term nutrients, as used in this document, refers to nitrogen (N), phosphorus (P) and potassium (K). These nutrients are found in animal manure, fertilizer and feed. Nutrient management refers to the management of all sources of nutrients and the land, in order to avoid environmental impacts associated with harmful concentrations of N, P, and K in soil and adjacent water bodies (i.e., surface water and groundwater). Nutrient management practices that address N, P, and K are likely to address some of the concerns associated with the potential environmental and human health impacts of other substances contained in manure (e.g., biochemical oxygen demand, pathogens and parasites).

Nutrient Management in the Fraser Valley: Changes and Challenges

In general, the Fraser Valley is experiencing an increasing supply of nutrients. In some areas of the Fraser Valley there is a greater supply of nutrients than can be used in local agricultural production. This change has been driven by factors such as a shift to confined livestock management, increases in intensity of production requiring feed and fertilizer imports and a switch to lower nitrogen uptake crops (e.g., forage to raspberry). In addition to changes taking

place within the agriculture sector, the management of nutrients in the Fraser Valley is also influenced by urban development currently taking place in the region.

In addition to supply and demand issues, in some cases, inappropriate producer practices (i.e., application of manure or fertilizer in excess of crop needs, at an inappropriate time and/or in an inappropriate manner) further raise the risk of NPS pollution from nutrients as well as other substances contained in manure.

Environmental concerns associated with the management of nutrients include: nitrate contamination of groundwater, eutrophication, harmful ammonia levels in surface water, pathogens in surface water and excessive potassium levels in soils (FRAP, 1996). Section 4.2 provides an overview of specific environmental challenges associated with improper nutrient management practices.

In 1994, a multi-agency study was initiated to investigate the extent and nature of nutrient management concerns in the Fraser Valley (FRAP, 1996). The study, released in 1997 identified a number of potential actions to address nutrient management concerns. Section 4.1 reviews the key findings of the study and opportunities for addressing these concerns.

Government and Industry Perspectives

There is consensus among agricultural producers and government agencies that nutrient management concerns do exist. For this reason, efforts have been and continue to be made to address nutrient management concerns in the Fraser Valley. For example, manure management guidelines have been prepared by government, in consultation with commodity groups, and many producers have increased their manure storage. In addition, the Sustainable Poultry Farming Group has made significant progress in establishing programs to transport large quantities of poultry manure out of sensitive areas in the Fraser Valley.

While some initiatives have been undertaken and some progress has been made, there is significant work to do in order to achieve sustainable management of nutrients in the Fraser Valley. Addressing the remaining nutrient management challenges demands that both government and agricultural producers are committed – over the long term – to building the capacity to manage nutrients in a sustainable manner. This requires a commitment of financial resources as well as a commitment to on-going dialogue.

The purpose of the NMPS is to build upon and enhance existing efforts to better manage agricultural nutrients and to identify additional initiatives to be undertaken in order to address nutrient management concerns in the Fraser Valley. The objectives of the NMPS are:

- Address areas (i.e., individual farms and regions) where estimated nutrient budgets far exceed the capacity of the land or crop);
- Reduce agricultural sources of pollution to water and land, through the adoption of environmentally sustainable on-farm nutrient management practices and;
- Through planning, avoid future imbalances in nutrients on agricultural lands (i.e., individual farms and regionally).

2.0 Planning Process

2.1. Working Group Terms of Reference

The Nutrient Management Planning Strategy was developed through a collaborative process initiated in July 1999 and facilitated by the Fraser Basin Council. The development of a NMPS was supported by the Partnership Committee on Agriculture and the Environment through a Working Group which was comprised of representatives of government agencies and agricultural producers (Appendix 1).

The planning process consisted of two phases with Phase 1 bringing government agencies and agricultural producers together to collaborate on the development of a draft Action Plan. The development of the draft NMPS represents the end of Phase 1. Phase 2 is intended to provide for dialogue with a broader range of interests in order to refine the plan and build support for its implementation (Phase 2).

As per the Terms of Reference, the objective of the planning process was to bring together agricultural producers and government agencies to:

- Develop a Nutrient Management Planning Strategy (NMPS) for the Fraser Valley;
- Facilitate exchange of information and improved understanding among all interests on nutrient management issues and build broad support for the Nutrient Management Planning Strategy; and
- Develop working relationships between all interests that will support the implementation of the Nutrient Management Planning Strategy.

With respect to the focus of the planning process, the Terms of Reference limit the scope of the NMPS as follows:

- The focus will be limited to those actions that can assist in minimizing environmental impacts on soil health and water quality but, which may also provide inherent benefits to ecosystems and air quality.
- The definition of nutrients will be limited to nitrogen (N), phosphorus (P) and potassium (K).
- The geographic focus of the nutrient management planning strategy process will be the Fraser Valley including all lands from Hope to the Fraser River Estuary.

2.2 History

The Working Group held its initial meeting in July 1999 and met, as a group, over a dozen times in the next two years. In addition to meetings of the Working Group, individual members of the Working Group engaged in dialogue with their respective organizations (i.e., government agencies and agricultural associations). Fraser Basin Council staff engaged in dialogue with Working Group members in order to collect information. In some cases, FBC staff also attended meetings of commodity groups to assist Working Group members in giving presentations on the NMPS process and to gather industry feedback.

Dialogue between and among government and agricultural representatives to the Working Group provided a number of benefits including:

- raising awareness of the planning process;
- identifying the specific nutrient management concerns and needs of different commodity groups;
- developing a common understanding of the issues and potential solutions; and
- building bridges between government and non-government interests.

In June 2000, agricultural representatives on the Working Group submitted documents outlining a range of specific actions that their respective commodity groups would consider as appropriate actions to address nutrient management concerns. Written responses were received from the following groups.

- Poultry
- Dairy
- Hog
- Horse
- Horticulture

At the Working Group meeting in September, 2000, government agencies provided comments and recommendations on the draft. In October, government agencies submitted a number of additional nutrient management options for the NMPS that have been incorporated into the current draft.

3.0 Agriculture in the Fraser Valley: Profile

Agricultural activities in the Fraser Valley are a significant contributor to overall agricultural production in British Columbia and account for over half the gross farm receipts in the province on an extremely small piece of the province's overall agricultural land. Though dairy, poultry and a limited number of field crops account for the majority of agricultural production, the agriculture sector in the Fraser Valley is extremely diverse with an enormous variety of products being produced. At the same time, agricultural activities in the Fraser Valley are also dynamic and can change quite dramatically over time, depending on a number of factors including market conditions.

Table 1 illustrates a number of changes that have taken place in agriculture in recent years that could have implications for nutrient management. For example, between 1986 and 1996 significant increases were seen in chicken production (55%) while pork production decreased (-13%), the number of milk cows remained relatively constant. At the same time, the amount of managed pastureland has changed due to management changes in addition to land use changes. This trend in (land use and management practices) changes, has implications to nutrient management.

However, if such trends continue it is clear that both the agriculture sector and government will be challenged to ensure that nutrients are being managed in a sustainable manner, while at the same time ensuring that agriculture continues to be economically viable.

While Table 1 provides a profile of agricultural activities in the Fraser Valley and some of the changes that have taken place, Figures 1- 4 illustrate some of the changes in livestock production on a regional basis. These figures provide important context for helping to focus efforts to address nutrient management concerns in some areas of the Fraser Valley (i.e., there appears to be a trend towards increased chicken production in specific areas).

TABLE 1. AGRICULTURAL PRODUCTION IN THE FRASER VALLEY* (1986-96)[1]

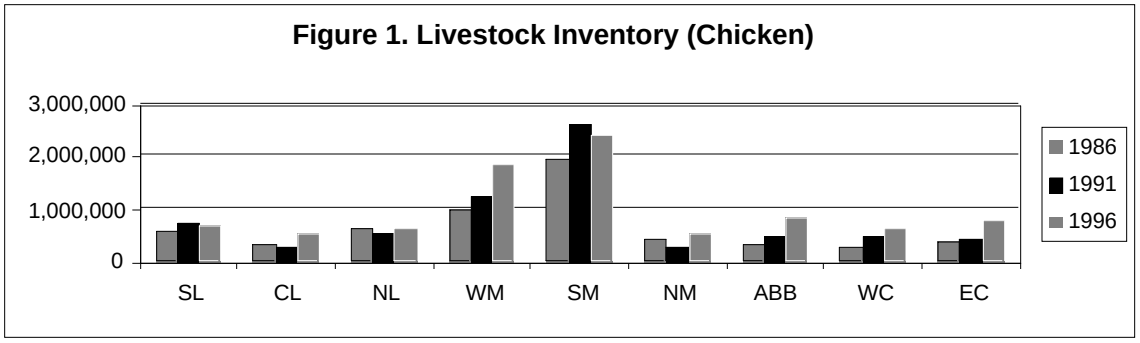
	1986	1991	1996	% Change**	% of BC Total
# of Farms	5,602	5,773	6,441	15%	29%
Ha. of Farmland	89,050	90,074	94,130	6%	4%
Average Farm Size (ha.)	15.9	15.6	14.6	-8%	13%
Farmland Owned (ha.)		62,977	68,535	9%	4%
Farmland Rented or Leased (ha.)		27,095	25,595	-6%	3%
Farmland					
Crops (ha.)		50,643	53,269	5%	9%
Summer fallow (ha.)		1,125		NA	NA
Pasture (managed) (ha.)		10,801	6,899	-36%	3%
Pasture (unmanaged) (ha.)		14,340	17,081	19%	1%
Other (ha.)		13,163		NA	NA
Crops (total ha.)		50,643	53,269	5%	9%
Field Crops (ha.)		33,617	37,020	10%	7%
Tree Fruits (ha.)		469	595	27%	6%
Berries & Grapes (ha.)		6,163	6,446	5%	82%
Vegetables (ha.)		6,831	5,116	-25%	72%
Other (ha.)		3,563	4,092	15%	99%
Greenhouse (Total Sq. M.)		1,386,376	1,955,749	41%	68%
Nursery Products (ha.)		1,614	2,026	26%	63%
Livestock					
Hens & Chickens (farms)	1,454	1,391	1,380	-5%	29%
Hens & Chickens (livestock)	6,948,851	8,856,682	10,771,766	55%	78%
Turkeys (livestock)		646,559	795,314	23%	93%
Turkeys (farms)		147	119	-19%	20%
Cattle & Calves (farms)	2,820	2,504	2,526	-10%	28%
Cattle & Calves (livestock)	136,825	135,396	138,029	1%	17%
Milk Cows (farms)		860	751	-15%	46%
Milk Cows (livestock)		49,822	51,886	4%	63%
Beef Cows (farms)		1,084	1,184	8%	19%
Beef Cows (livestock)		9,463	13,009	27%	5%
Pigs (farms)	351	373	335	-5%	24%
Pigs (livestock)	156,509	162,808	135,439	-13%	78%
Horses & Ponies (farms)		1,360	1,553	14%	22%
Horses & Ponies (livestock)		9,024	10,140	12%	21%
Gross Farm Receipts (1995$)	$588,250,961	$734,043,556	$1,033,595,499	76%	56%

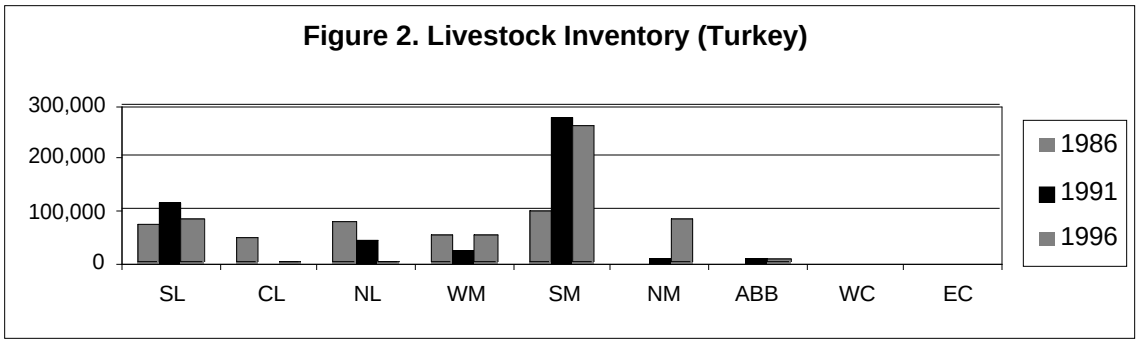
[1] Source: Statistics Canada. Census of Agriculture. 1986. 1991. 1996.

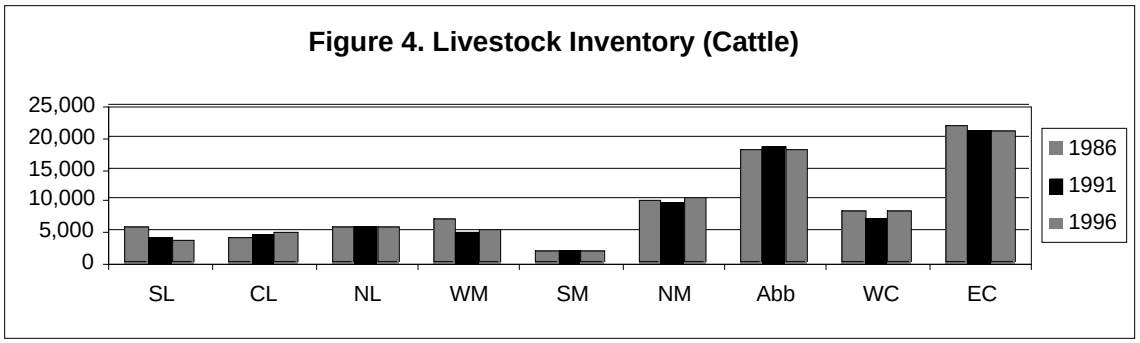
* Fraser Valley refers to data from the Greater Vancouver Regional District and the Fraser Valley Regional District

** % change refers to 1986/96 except where data is limited to 1991/96.

FIGURES 1-4. LIVESTOCK INVENTORIES IN THE FRASER VALLEY (1986-1996)[2]







[2] Source: Schreier et al. 2000.

SL (South Langley), CL (Central Langley), NL (North Langley), WM (West Matsqui), SM (South Matsqui), NM (North Matsqui), ABB (Abbotsford), WC (West Chilliwack), EC (East Chilliwack).

4.0 Nutrient Management: Challenges, Impacts, Potential Benefits

4.1 Challenges: Extent and Nature of Nutrient Management Challenges

The 1997 Fraser River Action Plan reports provided the first detailed description of the extent and nature of nutrient management challenges in the Fraser Valley as of 1991. The final report, which divided the Fraser Valley into 20 Agricultural Waste Management Zones provided a soil nitrogen balance for each zone. For discussion purposes, a suitable background soil "nitrogen balance" was considered to fall between 50 kg and 100 kg of nitrogen per hectare.

The 1997 report estimated, that for the year 1991:

- 10 zones received nitrogen loadings in excess of 100 kg of nitrogen per hectare per year;
- 6 zones received nitrogen loadings in excess of 50 kg but less than 100 kg of nitrogen per hectare per year;
- 4 zones received nitrogen loadings of less than 50 kg of nitrogen per hectare per year;
- 18 zones receive at least two times that of the potential crop removal of phosphorus; and
- 14 zones receive at least two times that of the potential crop removal of potassium.

The three zones with the greatest excess of nitrogen were South Langley (Brookswood aquifer), West Matsqui and South Matsqui (Abbotsford/Sumas aquifer). With respect to other nutrients, these zones also had net applications of phosphorus and potassium that were at least seven and three and one-half times the potential crop removal respectively.

More recent research (MacDonald, 2000) adds general support to the "soil nitrogen balance" discussed in the 1997 reports. This more recent research uses the term "residual nitrogen" which is defined as the difference between soil nitrogen available to the crop and that removed by the growing group. Residual soil nitrogen levels defined as Classes 3 or 4 (Table 2) refer to areas where nitrogen accumulates in the soil and poses some degree of environmental risk.

TABLE 2. CLASSES OF RESIDUAL NITROGEN LEVELS

Class 1	Class 2	Class 3	Class 4
$\leq$ 20 kg N/ha	21-40 kg N/ha	41-60 kg N/ha	$\geq$ 60 kg N/ha

Researchers who have subsequently used the base model, with some revised assumptions, generally support the initial findings for high residual nitrogen levels in areas of the Fraser Valley (Zebarth et al., 1997 and Schreier et al., 2000). Recent surveys in the Fraser Valley show high nutrient levels and some very low concentrations of dissolved oxygen in surface water adjacent to fields (Top et al, 1997).

In terms of addressing nutrient management challenges, the studies concluded:

- For much of the Fraser Valley, farms can achieve an acceptable nutrient balance by implementing actions such as improving on-farm nutrient management practices, reducing the use of inorganic fertilizers, improving feeding strategies and establishing adequate manure storage capacity.
- There are some zones where nutrient supply (i.e., feed, fertilizer and manure) far exceeds demand (i.e., the capacity of crop production systems/land to assimilate all nutrients). In such cases, manure must be relocated to other areas where it can be used effectively. Alternatively, animal densities will have to be reduced in these zones.
- Increasing animal numbers and a decreasing land base in the Fraser Valley indicate the need for an increased and on-going effort to manage nutrients in a sustainable manner.

4.2 Impacts: Environmental Issues Associated with Nutrient Management[3]

In several areas of the Fraser Valley studies have identified agricultural activities as significant contributors to reduced environmental quality (Top et al., 1997; Zebarth et al., 1995; IRC, 1994a; IRC, 1994b; Liebscher et al., 1992; and Wassenaar 1994). The impact of agricultural nutrients on the environment is often categorized as a form of NPS pollution and has been linked to public health concerns related to groundwater quality and fisheries concerns related to surface water and habitat quality. (See box NPS pollution).

NPS pollution - Non-point source pollution is defined by a number of small inputs rather than a single, distinct, identifiable source. NPS pollutants include; pathogens, nutrients, sediments, toxins and oxygen depleting substances. The impact of agricultural nutrients on environmental quality is often referred to as a form of NPS pollution.

The loading from individual sources may not always be large in a regional context, but on a localized scale contaminant concentrations may be high enough to have harmful effects (e.g., concentrations of ammonia that are lethal to fish in manure contaminated runoff). As well, the combined loading of several sources can result in very significant environmental impacts (e.g., nitrate contamination of drinking water in regional aquifers).

In the Fraser Valley, there are several situations where nitrate levels in groundwater exceed acceptable limits for drinking water and aquatic habitat degradation is seriously impacting commercially important fisheries. As well, tributaries of the Lower Fraser provide about 65% of the spawning habitat for Fraser River coho salmon and about 85% of the spawning habitat for Fraser River chum salmon. These aquatic systems provide an important societal (recreation, aesthetic) benefit and contribute to economically important commercial and recreational fisheries.

[3] Section 4.2 has been largely adapted from Management of Agricultural Wastes in the Fraser Valley. Report 9 (FRAP, 1996).

Water Quality

Agricultural activities have been implicated as the primary or contributing cause of high nitrate concentration in several Fraser Valley groundwater sources. Most notable is the Abbotsford aquifer where nitrate concentrations well in excess of drinking water standards are common. Other studies have indicated that agricultural activities have contributed to surface water degradation. While the highest profile water quality concerns are those related to the use of water for human consumption (i.e., drinking water), contamination of water with manure can also limit its use for agricultural uses such as irrigation. MELP site inspection reports include cases in the Fraser Valley where crop value and production has been impacted by manure contamination of irrigation water (MELP, 2000).

Aquatic Habitat Impacts

Agricultural nutrient management has an impact on aquatic habitat through three general mechanisms:

1. Toxic substances:

Some substances, such as ammonia (which is a component of manure and inorganic fertilizers) are directly toxic to fish and other aquatic organisms. Toxic substances disrupt cellular functions, resulting in the weakening or death of the exposed organism. Recent research has shown amphibians to be especially sensitive to nitrates and nitrites.

2. Eutrophication

Nutrients, primarily phosphorus, are usually the plant growth limiting substances in unpolluted streams. Introducing too much nutrient typically results in the excessive growth of algae. An excessive growth of algae can smother spawning gravels directly, negatively impact the aquatic insect community that fish rely on or slow the movement of water, resulting in sedimentation.

3. Dissolved Oxygen

The excessive algae growth associated with eutrophication, can also result in reduced levels of dissolved oxygen – required by aquatic organisms – in surface water. In addition, the decomposition of organic matter contained in manure and the conversion of ammonia to nitrate can both contribute to the depletion of surface water dissolved oxygen. The toxicity of many substances is increased at low dissolved oxygen levels.

Soil Quality

Excessive applications of potassium to the soil can lead to high concentrations of this nutrient in forage crops. This can result in costly problems for dairy producers who subsequently feed these forages to their livestock. Problems related to excess potassium in livestock feed include increased energy consumption, kidney stress and magnesium deficiency.

This problem is evident in several areas within the Fraser Valley, with magnesium being added to both dairy rations and fertilizer mixes in an effort to correct the imbalance. Estimates are that up to 75% of Fraser Valley dairy operations suffer from herd health problems due to excessive potassium in feeds.

Parasites and Pathogens

Other worrisome contaminants contained in manure and associated runoff include pathogens and parasites. These may come from a number of sources including humans as well as livestock and wild animal droppings. Inappropriate timing of manure application, when plants nutritional needs are low, coupled with winter precipitation can carry pathogens into waterbodies.

The 1997 Fraser River Action Plan report on the management of agricultural wastes in the Fraser Valley did not examine pathogens and parasites but focused on nutrients. Other FRAP reports on agricultural land use in specific watersheds found that the faecal coliform densities in the Matsqui Slough and the Sumas River exceeded the provincial criteria for irrigation water for produce that is eaten raw (200 FC/100mL) (IRC 1994a; IRC 1994b).

4.3 Benefits of Addressing Nutrient Management Challenges

There are substantial costs to responding to the challenges identified above and undertaking specific actions such as identified in Section 6 of this document. At the same time, there are a number of benefits that could be realized by adopting new approaches to nutrient/manure management. These benefits would be realized by farmers, as well as government and local residents and include:

- Public/Consumer perception – Proactively addressing issues of public concern such as nutrient management is an opportunity to improve agriculture's relationship with the public.
- Protecting natural resources - The integrity of natural systems (i.e., soil health and water quality) supports economic activities – including agriculture.
- Reducing Costs to Farmers - Reducing costs, associated with the effects of water and soil pollution that may affect the financial position of a farm. These include:

    - Potassium levels of forages - Excess nutrient application has created health risks for dairy cattle that consume the high-potassium forage;
    - Costs associated with lower quality irrigation water;
    - Fertilizer use - It has been estimated that $12 million a year could be saved in the Fraser Valley by reducing inorganic fertilizer to 30% of crop removal and using manure to supply the balance of nutrients (Brisbin and Runka, 1995); and
    - Avoiding costs associated with non-compliance under current legislation and regulation.

- Reducing greenhouse gases - Storing, or “sequestering” carbon in soil as organic matter and in trees helps reduce the amount of carbon dioxide in the atmosphere to the benefit of all of society.
- Improving ecosystem well-being – Improved manure/nutrient management practices will facilitate overall ecosystem well-being and help avoid or minimize the cost of mitigating environmental impacts.
- Protecting human health – Improved nutrient management practices will contribute to protecting human health through improved water quality.

5.0 Tools for Achieving Nutrient Management Objectives

There are a number of tools that can be applied in order to achieve the multiple objectives of addressing nutrient management concerns ,ensuring compliance with existing regulation and legislation and protecting the environment. Section 5.0 provides an overview of the spectrum of these tools from the role of regulation and enforcement to a variety of past and present nutrient management initiatives and support programs.

5.1 Role of Regulation and Enforcement

Agricultural operations are required to comply with a number of Acts and regulations as shown in Table 3. The two most applicable Acts, with regard to nutrient management on agricultural lands, are the federal *Fisheries Act* and the provincial *Waste Management Act*.

TABLE 3. LEGISLATION/REGULATION RELATING TO NUTRIENT MANAGEMENT

FEDERAL

- Fertilizers Act
- Fisheries Act

PROVINCIAL

- Agricultural Land Commission Act
- Drinking Water Protection Act
- Health Act Sanitary Regulations
- Farm Protection (Right to Farm) Act
- Local Government Act (Formerly the Municipal Act)
- Soil Conservation Act
- Waste Management Act
    - Agricultural Waste Control Regulation/Code of Agricultural Practice for Waste Management ,
    - Production and Use of Compost Regulation and storage
- Water Act
- Workers Compensation Act - Industrial Health and Safety Regulations

LOCAL GOVERNMENT

- Zoning (i.e., Community Plans)
- Setback distances
- Building requirements in floodplains
- Nuisances
- Storm water management on agricultural land
- Emissions of air contaminants
- Well water test requirements, amounts
- Construction materials, height, location of fences
- Building bylaws

The Fisheries Act

The *Fisheries Act* contains provisions that pertain to the conservation and protection of fish habitat. Under the *Fisheries Act*:

- No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat except in circumstances where an authorization is issued from the Department of Fisheries and Oceans prior to the works being conducted (Section 35);

The *Fisheries Act* prohibits the deposit of deleterious (toxic or harmful) substances into fish frequented waters or in a place or under any condition where it may enter fish-frequented waters (Section 36 (3)).

- A substance is deleterious if it is harmful to fish, if it limits the use of fish by humans (e.g., contamination of fish by dioxins or shellfish by E. *coli*), or if by going through some process of degradation, it harms the water quality (e.g., oxygen-depleting wastes). A substance is also deleterious if it exceeds a level prescribed by regulation.

The *Fisheries Act* applies to all Canadian waters, which include rivers, streams, wetlands, ditches, lakes, estuaries, salt marshes, coastal waters, and marine offshore areas. This Act also applies to work on shorelines, riverbanks, and floodplains, on privately and publicly owned land, as well as to areas not normally under water.

Contravention of the habitat protection provisions of the Fisheries Act (Section 35 or 36 (3)) may result in fines of up to $1,000,000 and/or imprisonment. In BC, the *Fisheries Act* is enforced by the Department of Fisheries and Oceans (DFO), Environment Canada (EC) and the provincial Ministry of Environment, Land and Parks (MELP). As well, private citizens can lay charges under the *Fisheries Act*.

Waste Management Act

The *Agricultural Waste Control Regulation* (AWCR), under the *Waste Management Act*, is a provincial regulation that pertains specifically to nutrient management on agricultural operations. This regulation authorizes agricultural operations to introduce agricultural waste to the environment provided it is conducted in accordance with the *Code of Agricultural Practices for Waste Management* (Code). The Code describes practices for using, storing and managing agricultural waste, however, the requirements of the Code may not be sufficient to ensure compliance with the federal *Fisheries Act*. The AWCR and Code states that agricultural wastes, wood waste and mortalities must be collected, stored, handled, used and disposed of in accordance with the Code and in a manner that prevents pollution.

Failure to comply with the AWCR may lead to the issuance of pollution abatement orders, pollution prevention orders, or formal prosecution. The AWCR is enforced by MELP. Operations that cause pollution may be subject to fines up to $1,000,000 and/or 6 months in jail.

Local Government

Local governments may develop bylaws that influence nutrient management practices. Bylaws that restrict operation size, setback distances, zoning and building dimensions can affect how agricultural operations manage their nutrients and facility.

5.2 Nutrient Management Initiatives: Past and Present

There are a variety of programs and initiatives that have been or which are still in place to help address environmental concerns associated with the management of nutrients. Only some of the following programs are still operating. Many were dependent on federal Green Plan for Agriculture funding which ended in 1997/98. Examples include:

Active

- Sustainable Poultry Farming Group and Initiatives on Manure Transportation
- MELP/INDUSTRY Manure Management Strategy/Guidelines

No longer active

- Manure Storage Expansion Program (Investment Agriculture Foundation) (Ended December, 2000)
- Hog Industry Transition Plan
- Dairy Producers' Conservation Group
- Best Agricultural Waste Management Plans (Service provided by MAFF)
- Hog Producers' Sustainable Farming Group
- Best Soil Management Plans (Service provided by MAFF)
- Nitrogen Behaviour Simulation Model (Service provided by MAFF)

These types of programs have been instrumental in the progress made to-date in addressing nutrient management concerns (i.e., increased awareness, expansion of infrastructure, improved producer practices).

While many of these initiatives demonstrated positive results, most are no longer active. Yet the need for such initiatives has clearly not disappeared. Changing nutrient management practices requires increasing awareness of the problems and solutions, investment in farm infrastructure, research and training. Building and maintaining the capacity to effectively manage nutrients cannot be done in the context of short term funding programs. As such, effective initiatives must be supported by sustainable funding over the longer term.

5.3 Role of Environmental Support Programs

While legislation and regulation set the legal requirements for nutrient management, there is evidence that the use of support programs (i.e., assistance and incentives) in combination with existing regulation and legislation can help change nutrient management practices and facilitate greater compliance with existing legal requirements.

The Manure Storage Expansion Program (MSEP) and Sustainable Poultry Farming Group (SPFG) are examples of support programs with a strong nutrient management focus. The following examination of the MSEP and SPFG illustrates some of the costs and benefits

associated with these programs. The purpose of examining these types of programs is to illustrate the ability to affect change in nutrient management practices through these type of programs.

Manure Storage Expansion Program

The MSEP provided funding for 20% of storage capital costs, to a maximum grant of $10,000. To date, a total of 85 grants have been approved for Fraser Valley producers. The 85 projects represent a total investment (excluding GST) of almost $4.1 million, of which about $650,000 was provided as grants through the program.

In terms of the economic benefits of the MSEP program, the relatively small amount of assistance provided by government ($650,000) has led to a significant investment by producers ($3,400,000) in storage infrastructure. For every $1 of government funding, $5.30 was invested in infrastructure by the private sector. Other potential economic benefits to farmers from increased storage include more effective use of manure and resulting lower costs associated with reduced need for chemical fertilizers.

In terms of environmental benefits, partly as a result of such support programs, the capacity to manage nutrients in a more sustainable manner is increasing and producers are more able to reduce the potential risk of excess nutrients in soils and water. In addition, such expenditures provide better capacity to utilize manure as a resource.

Table 4 illustrates the relative participation by commodity group in the program. The dairy group had the largest number of projects (57 of 85) for a total liquid storage capacity of 91,705 m^3. Poultry had the second largest number of projects (22 of 85) with a solid storage capacity of 8,199 m^2.

TABLE 4. MSEP PARTICIPATION BY COMMODITY GROUP

	Number of Projects	Liquid Storage (m3)	Solid Storage (m2)	Total Investment* ($)	Grants ($)	% Program Cost (Grants)	Average Investment per project ($)
Dairy	57	91,704	7,081	2,925,013	466,720	72.0	51,790
Poultry	22	2,227	8,199	777,486	141,525	21.8	35,340
Pigs	4	8,903	558	318,670	34,194	5.3	79,668
Beef	2	0	364	29,167	6194	0.9	14,584
	85	102,834	16,202	4,362,750	648,633		

* Excluding GST.

Table 5 summarizes data reflecting changes in manure storage capacity among dairy farms in recent years (1992-1998). In 1992, 57% of farms had < 4-months storage and in 1998, 60% of farms had < 5-months storage. Compared to a survey conducted in 1997 there is some indication that farms with < 2-months storage have decreased. Because of differences in the storage categories used in the surveys conducted in 1992 and 1998 it is difficult to show absolute trends. However, in general the data suggests that there were and still are many

farms with < 5-months storage, which was the minimum amount of storage that a farm needed to attain in order to qualify for MSEP funding.

TABLE 5. CHANGE IN STORAGE CAPACITY - FRASER VALLEY DAIRY, 1992-1998

Months (days)	1992	1997	1998
<2 (60)	30%	12%	-
<3.3 (100)	-	43%	12%
<4 (120)	57%	55%	-
<5 (150)	-	73%	60%

1992, 1998 (MAFF, 1998). 1997 (Carter, 1997).

Sustainable Poultry Farming Group

Another example of the value of environmental support programs is the Sustainable Poultry Farming Group (SPFG). Beginning in the fall of 1995, with support from the Green Plan for Agriculture, SPFG started to facilitate a groundwater protection program and the cost effective movement of manure from the Abbotsford aquifer and Central Fraser Valley. Table 6 shows the level of assistance provided to SPFG over the history of the organization. Assistance averaged $45,000 per year and represented approximately 60% of the total SPFG budget.

During this time the amount of manure being transported by SPFG has increased from 6, 200 yds^3/yr (1995/96) to 40, 600 yds^3/yr (1999/2000). In 1997/98, 68% of the poultry manure was shipped within the Fraser Valley, largely to Delta and Richmond and 30% to the interior.

While removal of poultry manure from sensitive aquifers is a positive step, the long-term sustainability of this approach, given the ongoing expansion of the poultry industry in the Fraser Valley, must be considered. While the amount of manure transported has increased, the amount of manure produced has also increased substantially. As well, impacts to the receiving environment where the poultry manure is applied following transport must also be examined.

TABLE 6. SUSTAINABLE POULTRY FARMING GROUP FUNDING, 1994 /01

1994-97	Green Plan ($40,000/year +$20,000 special project)	$140,000
1997-98	Federal and Provincial Ag and Environment Agencies	$50,000
1998-99		$50,000
1999-00		$45,000
2000-01		$35,000
Average (1994-2000)		$45,000

(SPFG. 2000).

Funding Environmental Support Programs

While environmental support programs can encourage actions that result in improved nutrient management practices, funding such support programs is a challenge to both farmers and government agencies. Appendix 4 outlines a number of issues, raised by agricultural producers, related to environmental support programs in general as well as a number of potential models for funding such programs. Consideration of these issues may be of value in the design of any future support programs to encourage the adoption of sustainable nutrient management practices.

6.0 Nutrient Management Options

This section describes various options that have been identified, by producers and/or agencies, as important components of the Nutrient Management Action Plan. Table 7 summarizes the options that have been identified in written submissions from agricultural producers.

The options are described in general and their strengths and weaknesses summarized. Section 7 assesses each of the options in terms of support between and among producers, the extent to which options can be delivered within existing financial resources, and the expected benefit in terms of addressing the three objectives of the NMPS planning process.

TABLE 7. NUTRIENT MANAGEMENT OPTIONS IDENTIFIED BY PRODUCERS

OPTIONS	Dairy	Poultry	Hog	Horse	Horticulture
Education & Awareness	x	x	x	x	x
Infrastructure	x	x			x
Research	x	x	x	x	x
Long Term Planning		x			
Monitoring		x			
On-Farm Plans (OFPs)	x	x		x	x

6.1 Education and Awareness

Education and awareness options are broadly recognized by government and farmers as important mechanisms for raising awareness of nutrient management challenges and promoting alternative practices.

Education and awareness activities include publications, training and communications initiatives designed to raise awareness of the nutrient management challenges, solutions, and resources available. Education and awareness options also refer to the capacity required to deliver education and awareness initiatives. In the past, producer conservation organizations (PCOs), including those sponsored by the Canada-BC Green Plan for Agriculture (1992-1997), played an important role in this regard. All education and awareness activities require an ongoing commitment of resources to build and maintain such programs. At the same time, the cost of such services can be shared by a large number of producers. While education and awareness activities require on-going financial commitment, they are essential to achieving the greatest benefit possible from research activities and enhanced physical infrastructure (i.e., storage, spreaders etc.).

Options

- Commodity specific education and awareness activities (i.e., training courses; awareness programs, fact sheets, demonstration projects, articles in trade/industry journals etc.)
- Promote use of Manure Management Guidelines
- Develop nutrient management recognition awards for all commodity groups.
- Make MAFF/MELP agricultural guidelines documents more "user-friendly"
- Initiate a technology development program to evaluate nutrient management technologies and transfer knowledge to growers.
- Maintain and strengthen the Agricultural Peer Advisory Service.
- Develop or strengthen Producer Conservation Organizations (PCOs) to support progressive nutrient management practices.
- Encourage, through marketing, increased use of manure/nutrients by crop producers.
- Encourage the use of manure to meet a larger proportion of the crop's fertility needs.
- Develop nutrient management demonstration sites on existing farms.
- Encourage use of fall cover crops to absorb excess nitrogen.
- Promote use of post harvest nitrogen test (PHNT)(raspberry) and pre-sidedress nitrogen test (PSNT) (corn) with growers.
- Promote the use of alternative feeding programs to decrease nutrient content of manure.
- Encourage the use of appropriate crops on sensitive lands.
- Develop Emergency Winter Spreading Guidelines.

6.2 Infrastructure

Enhanced infrastructure refers to increasing the agriculture sector's physical capacity to manage nutrients in a more sustainable way. It includes expanding manure storage as well as infrastructure to facilitate transportation of manure, processing of manure and application of nutrients in a way that meets crop production needs as well as minimizes environmental impacts. While most commodity groups have identified infrastructure needs, in some cases investments in infrastructure may not achieve the greatest benefit in terms of addressing commodity specific nutrient management challenges (i.e., berry producers). As such, commodity groups and individual farmers will focus their efforts on nutrient management options (i.e., education and awareness) that most effectively advance sustainable nutrient management practices.

At the same time, while the development of infrastructure may lead to some short term improvements in the capacity to manage nutrients, improved infrastructure does not guarantee improved practices (i.e., appropriate timing, rate of application or location of application) nor does it address future agricultural development or expansion. Infrastructure development should be complemented with appropriate education and awareness activities, and monitoring activities.

Options

- Expand manure storage capacity for livestock producers and crop producers where manure is part of the crop production regime.
- Increase capacity for transportation of poultry manure from environmentally sensitive areas.
- Pilot/demonstration of processing technologies for poultry manure.
- Develop centralized off-farm processing.
- Provide greater access to "environmentally friendly" nutrient application equipment (i.e., purchase or rental).
- Enhance infrastructure for movement of dairy manure within the area of each farm.
- Develop wash/waste water treatment facilities for mushroom industry.
- Develop transportation infrastructure for other commodities (i.e., mushroom compost).
- Upgrade (i.e., line) unlined manure pits.

6.3 Research

Adopting more effective ways of managing nutrients in the Fraser Valley requires that a large number of knowledge gaps be addressed. Research projects that have been identified include identifying and testing new nutrient related management practices, research related to the development of new soil testing tools as well as research to increase understanding of the costs and benefits (i.e., environmental and economic) of new management practices. In most cases, research activities require a long-term commitment. In order to ensure that research findings are effectively incorporated into practice, there is a need for coordination with education and awareness programs, extension services and infrastructure development activities.

Options

- Develop new and improved nutrient soil testing tools and procedures and define appropriate soil nutrient levels.
- Identify technical challenges to increased use of manure as a fertilizer replacement (e.g., changes in manure quality in storage) and potential solutions.
- Illustrate the production and economic benefits associated with improved nutrient management practices.
- Identify alternative feeding programs for livestock systems.
- Increase understanding of pollution risk associated with unlined manure storage systems.
- Research the feasibility of encouraging growth of animal industry outside the Fraser Valley.
- Research feasibility of processing surplus manure (e.g., composting) including incentives for using treated manure.
- Assess the impacts of a variety of nutrient spreading devices on non-point source pollution and water quality.
- Increase understanding of soil nitrogen, phosphorus and potassium levels in areas with surplus nutrients.
- Research potential environmental impacts associated with managing nutrients on-farm based on total available nitrogen.
- Audit the application of poultry manure transported out of and within the Fraser Valley to ensure it is being used appropriately.

6.4 Long Term Planning

Long term planning in the context of the NMPS refers to activities intended to prevent future nutrient imbalances. Long term planning activities seek to ensure that the agriculture sector's capacity to manage nutrients (i.e., producer practices, storage capacity, available land base etc.) keeps pace with changes in the agricultural land base, animal numbers and types of commodities. Long term planning activities can also address issues such as urban development, the loss of land for agricultural use and ongoing change in the diversity and intensity of farming in the Fraser Valley. Land use planning options include activities that could be undertaken by other interests to compliment the agriculture sector's efforts in addressing nutrient management concerns. There has been little substantive discussion on Long Term Planning at the Working Group level. Some options that should be considered to address long term planning needs are listed below.

Options

- Establish a government/industry working group to discuss long term planning options, to avoid future nutrient imbalances on agricultural lands in the Fraser Valley, and how long term planning objectives might be met.
- Explore options for maintaining or increasing preferential access – to agricultural nutrients - for application on agricultural lands.
- Develop and implement local government septic by laws and/or promote best management practices for septic field maintenance.
- Encourage improved storm water management and upland planning.
- Strengthen efforts to preserve the agricultural land base.
- Identify and designate protected water supply areas.
- Establish a provincial land use registry for agricultural lands supported by regular on farm practice surveys.
- Establish a government/industry working group to evaluate local multi-stakeholder watershed planning processes and make recommendations on establishing similar programs.
- Establish a provincial/local government process for evaluating new and expanding operations.

6.5 Monitoring

Monitoring and reporting of trends in both environmental quality and producer practices is essential to demonstrating where progress is being made in improving nutrient management practices and minimizing impacts on the environment, and where additional efforts may be required. Currently, there are a number of environmental monitoring and farm practices monitoring programs in place (e.g., MAFF State of Resources Report, 2000). Monitoring programs can be costly and must be maintained over the long-term in order to be of value in longer-term assessment of the implementation and effectiveness of the NMPS. Having farmers and government agencies collaborate in establishing the objectives and the design of monitoring programs is essential to building monitoring programs that can be used in evaluating implementation of the NMPS. Appendix 2 summarizes input on the establishment

of targets for environmental quality and producer practices that would assist in tracking implementation of the NMPS.

Options

- Identify producer practices and environmental quality parameters to be tracked, as well as existing monitoring capacity.
- Quantify targets for environmental quality, producer practices and nutrient loading to assess implementation and effectiveness of the NMPS.
- Evaluate current ground and surface water quality monitoring programs and make recommendations for monitoring water quality in specific watersheds.
- Develop commodity specific reporting programs to assist in assessing effectiveness of NMPS implementation (i.e., changes in commodity, intensity of operations, establishment of new farms, increased manure storage, etc.)
- Regularly evaluate Statistic Canada census results to determine numbers of farms, numbers of animals and nutrient loading for regional areas in the Fraser Valley.

6.6 On-Farm Plans (OFPs)

OFPs are used in other jurisdictions as a planning tool to assist in identifying potential nutrient management concerns and develop appropriate management responses where concerns are identified. Currently, some planning activities which could be included in an OFP (i.e., soil testing, on-farm nutrient budgeting etc.) are carried out by farmers in the Fraser Valley on an ad-hoc basis. Government agencies support that a more formalized and standardized approach to OFPs, if adopted by farmers, would provide farmers with information necessary to make better nutrient management decisions in terms of achieving and maintaining an acceptable nutrient balance (i.e., infrastructure development, management practices). Similar to other nutrient management options, simply developing an OFP will not ensure improved practices. As such, OFPs should be integrated with other nutrient management options such as education/awareness activities, extension services, and research activities. Appendix 3 provides an overview of some of the design considerations that could be included in an OFP.

Option

- Establish a government/industry working group to clarify outstanding questions regarding the structure, function and application of OFPs.

6.7 Legislative/Regulatory Options

The development or amendment of legislative or regulatory mechanisms is another option that could be pursued in order to address nutrient management concerns. The two options that have been put forward regarding legislative and regulatory options relate to the need for groundwater legislation and changes to the existing Agricultural Waste Control Regulation and the Code.

The development of new legislation, or even the amendment of existing regulation, would be a significant undertaking on the part of government and agricultural producers. At the same time, legislative and regulatory instruments provide the framework that influences the way in which

nutrients are currently managed or could be managed in the future. The recently enacted *Drinking Water Protection Act* has provisions for drinking water plans, including water source standards and by amendment, adds “Wells and Groundwater Protection” to the *Water Act*.

With respect to the Agricultural Waste Control Regulation and the Code, both agricultural producers and government agencies have noted that a review may be appropriate. The focus of such a review could include clarifying sections of the Regulation and Code (i.e., defining “fertilizer” and “soil conditioner”) or adding sections (i.e., incorporating Manure Management Guidelines as part of the regulation). More significant proposals for amendments to the Regulation and Code include: placing greater responsibility on producers to demonstrate that farm practices are not causing pollution and removing the automatic permit exemption from the Code (i.e., requiring application for a permit exemption).

Options

- Develop and implement provincial groundwater legislation.
- Review and amend the Agricultural Waste Control Regulation and the Code of Agricultural Practice for Waste Management.

7. Analysis of Nutrient Management Options

7.1 Approach to Analysis

While, the options put forward by agricultural representatives and government agencies can help address nutrient management concerns, there are limited resources (i.e., time and fiscal constraints) that require that priorities be set among the various options. As such the specific nutrient management options presented in Section 6 have been analyzed and prioritized based on dialogue among Working Group members (See Table 8).

The high, medium and low priority designations are general guidelines and give some indication, among Working Group members, of the relative interest in specific options. Those options not ranked "High Priority" should not be interpreted as not being effective or necessary nutrient management options. Government agencies or commodity group may wish to undertake an action designated "low priority" or an action not included in the NMPS.

1. Priority
   - High
   - Medium
   - Low

2 Number of NMPS objectives addressed
   - Improved Practices (IP)
   - Address Nutrient Hot Spots (HS)
   - Avoid Future Nutrient Imbalance (FI)

3. Implementation Lead
   - Government
   - Agriculture (i.e., producers or commodity groups)
   - Partnership (i.e., government/agriculture)

Figures 5 and 6 summarize opinions within the agricultural community on the rate of adoption of nutrient management options with and without environmental support programs. The figures suggest, that environmental support programs will encourage more rapid adoption of nutrient management options although many of the options would be implemented regardless.

FIGURE 5. IMPLEMENTATION OF NUTRIENT MANAGEMENT OPTIONS (WITHOUT INCENTIVES)[4]

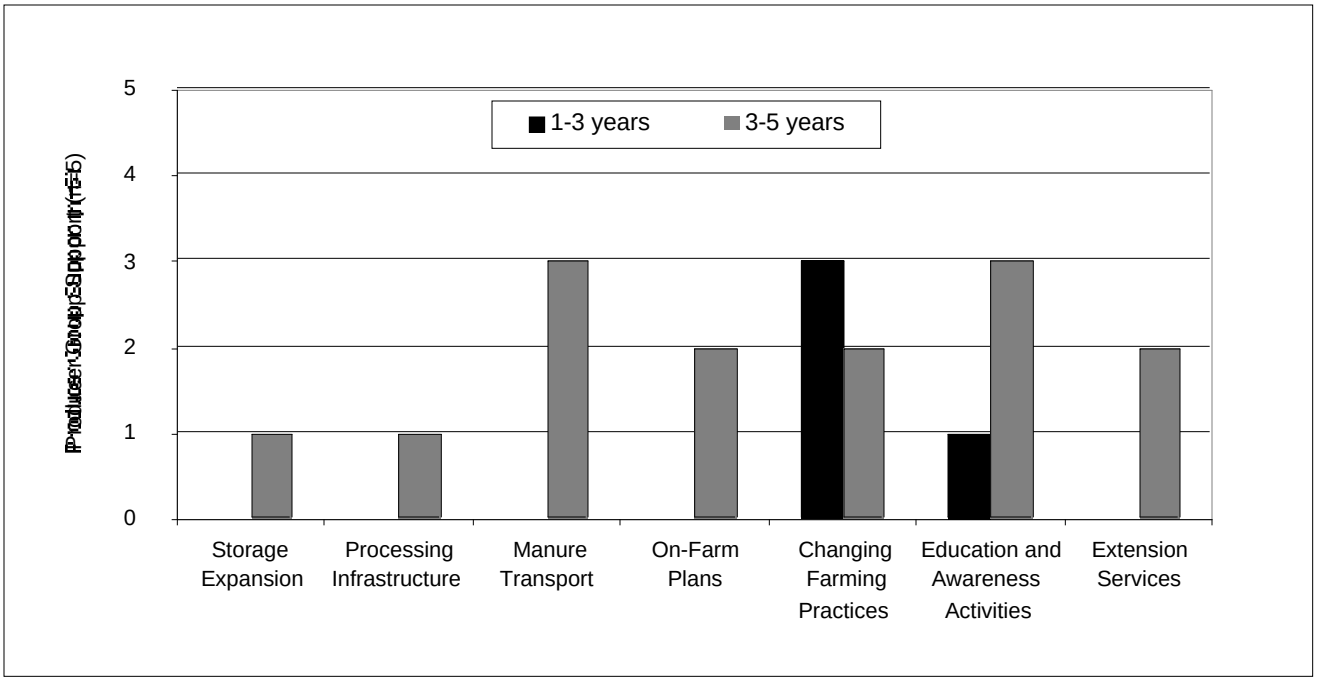
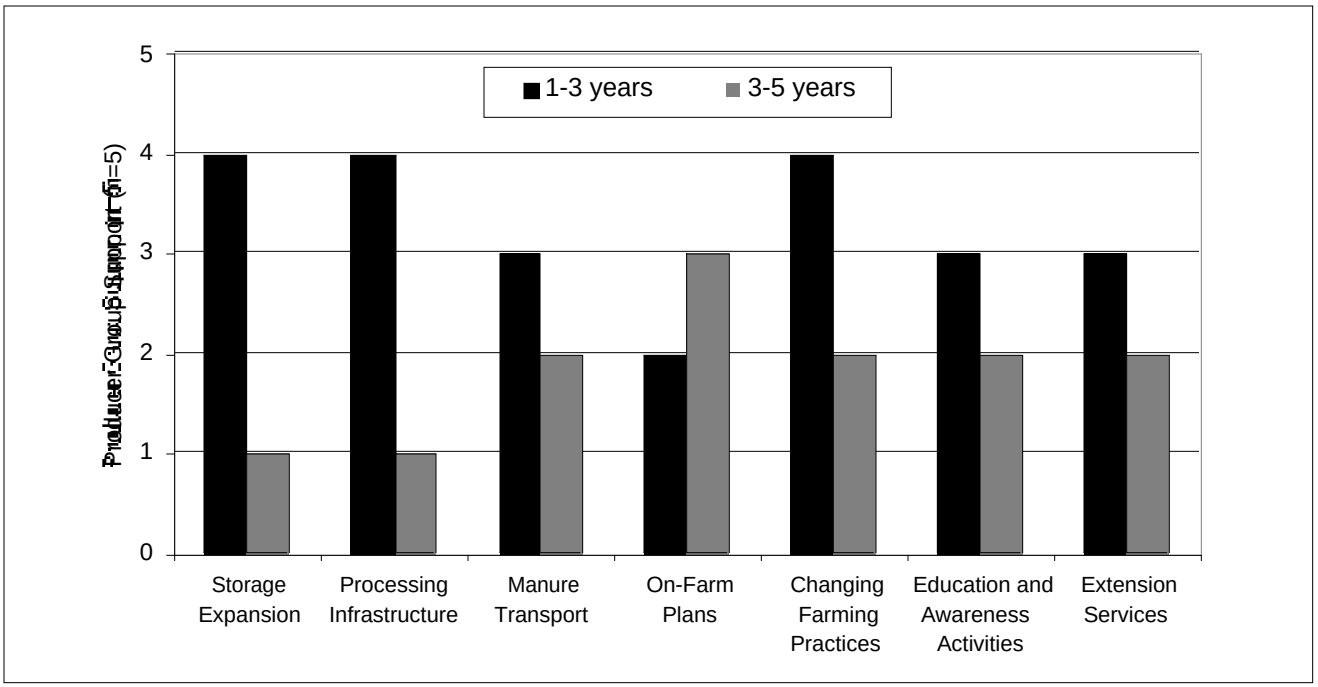


FIGURE 6. IMPLEMENTATION OF NUTRIENT MANAGEMENT OPTIONS (WITH INCENTIVES)



[4] [4] Data is the summary of responses from a producer survey undertaken at a meeting of agricultural producers (April 26th, 2000). Producer associations have been grouped into five major categories (i.e., dairy, hog, horse, horticulture and poultry)

TABLE 8. NUTRIENT MANAGEMENT OPTIONS

	Nutrient Management Options	Priority	NMPS Objectives Addressed	Delivery Lead	Comments
	6.1 Education and Awareness				
1	Commodity specific education and awareness activities (i.e., training courses; awareness programs, fact sheets, demonstration projects, articles in trade/industry journals etc.)	High	IP	Agriculture	Some initiatives underway. Need exists to expand education and awareness initiatives.
2	Promote use of Manure Management Guidelines	High	IP	Government	
3	Develop nutrient management recognition awards for all commodity groups.	Medium	IP	Agriculture	
4	Make MAFF/MELP agricultural guidelines documents more "user-friendly	Low	IP	Government	
5	Initiate a technology development program to evaluate nutrient management technologies and transfer knowledge to growers.	High	IP, FI	Agriculture	
6	Maintain and strengthen the Agricultural Peer Advisory Service.	High	IP	Government	Initiated.
7	Develop or strengthen Producer Conservation Organizations (PCOs) to support progressive nutrient management practices.	High	IP, FI	Agriculture	
8	Encourage, through marketing, increased use of manure/nutrients by crop producers.	Medium	IP, FI, HS	Agriculture	
9	Encourage the use of manure to meet a larger proportion of the crop's fertility needs where applicable.	High	IP, FI, HS	Agriculture	
10	Develop nutrient management demonstration sites on existing farms.	Medium	IP	Agriculture	
11	Encourage use of fall cover crops to absorb excess nitrogen.	High	IP, HS	Agriculture	
12	Promote use of post harvest nitrogen test (PHNT) (raspberry) and pre-sidedress nitrogen test (PSNT) (corn) with growers.	High	IP	Agriculture	Initiated in raspberry.
13	Promote the use of alternative feeding programs to decrease nutrient content of manure.	Medium	IP	Agriculture	Link to research activity (Option 28)
14	Encourage the use of appropriate crops on sensitive lands.	Medium	IP	Agriculture	

	Nutrient Management Options	Priority	NMPS Objectives Addressed	Delivery Lead	Comments
15	Develop Emergency Winter Spreading Guidelines.	Low	IP, HS	Partnership	Industry lead and get agreement from agencies.
	6.2 Infrastructure				
16	Expand manure storage capacity for livestock producers and crop producers where manure is part of the crop production regime.	High	IP, HS	Agriculture	MESP ended in December, 2000.
17	Increase capacity for transportation of poultry manure from environmentally sensitive areas.	High	IP, HS, FI	Agriculture	Link to research activity (Option 35)
18	Pilot/demonstration of processing technologies for poultry manure.	Medium	IP, FI	Agriculture	
19	Develop centralized off-farm processing.	Low	IP	Agriculture	
20	Provide greater access to "environmentally friendly" nutrient application equipment (i.e., purchase or rental)	Medium	IP	Agriculture	
21	Enhance infrastructure for movement of dairy manure within the area of each farm.	Low	IP,FI	Agriculture	
22	Develop wash/waste water treatment facilities for mushroom industry.	Low	IP	Agriculture	
23	Develop transportation infrastructure for other commodities (i.e., mushroom compost).	Low	IP	Agriculture	
24	Upgrade (i.e., line) unlined manure pits.	Medium	IP, HS	Agriculture	
	6.3 Research				
25	Develop new and improved nutrient soil testing tools and procedures and define appropriate soil nutrient levels.	High	IP, FI	Partnership	
26	Identify technical challenges to increased use of manure as a fertilizer replacement (e.g., changes in manure quality in storage) and potential solutions.	Medium	IP	Partnership	
27	Illustrate the production and economic benefits associated with improved nutrient management practices.	High	IP, FI	Partnership	
28	Identify alternative feeding programs for livestock systems.	High	IP, FI	Partnership	

	Nutrient Management Options	Priority	NMPS Objectives Addressed	Delivery Lead	Comments
29	Increase understanding of pollution risk associated with unlined manure storage systems.	Medium	IP, FI	Partnership	
30	Research the feasibility of encouraging growth of animal industry outside Fraser Valley.	Medium	HS, FI	Partnership	
31	Research feasibility of processing surplus manure (e.g., composting) including incentives for using treated manure.	Low	IP, FI	Partnership	
32	Assess the impacts of a variety of nutrient spreading devices on non-point source pollution and water quality.	Medium	IP	Partnership	Some work underway, requires on-going support.
33	Increase understanding of soil nitrogen, phosphorus and potassium levels in areas with surplus nutrients.	High	IP,HS, FI	Partnership	
34	Research potential environmental impacts associated with managing nutrients on-farm based on total available nitrogen (i.e., instead of phosphorous or potassium).	Not Rated			Some work underway already.
35	Audit the application of poultry manure transported out of the Fraser Valley to ensure it is being used appropriately.	Not Rated			
	6.4 Long Term Planning				
36	Establish a government/industry working group to discuss long term planning options, to avoid future nutrient imbalances on agricultural lands in the Fraser Valley, and how long term planning objectives might be met.	High	FI	Partnership	Link to Option 30.
37	Explore options for maintaining or increasing preferential access – to agricultural nutrients - for application on agricultural lands.	High	FI	Partnership	
38	Develop and implement local government septic by laws and/or promote best management practices for septic field maintenance.	Medium	FI	Government	Requires dialogue with local governments.
39	Encourage improved storm water management and upland planning.	Medium	FI	Government	Initiated. Requires dialogue with local governments.
40	Strengthen efforts to preserve the agricultural land base.	High	FI	Partnership	Requires dialogue with Agricultural Land Commission.

	Nutrient Management Options	Priority	NMPS Objectives Addressed	Delivery Lead	Comments
	6.4 Long Term Planning (cont.)				
41	Identify and designate protected water supply areas.	High	IP, FI, HS	Government	Possibly included in new provincial government Drinking Water Action Plan.
42	Establish a provincial land use registry for agricultural lands supported by regular on farm practice surveys.	Medium	FI	Government	
43	Establish a government/industry working group to evaluate local multi-stakeholder watershed planning processes and make recommendations on establishing similar programs.	Medium	FI	Partnership	Linked to Option 36.
44	Establish a provincial/local government process for evaluating new and expanding operations.	High	FI	Partnership	
	6.5 Monitoring				
45	Identify producer practices and environmental quality parameters to be tracked and existing monitoring capacity.	High	IP, FI	Partnership	
46	Quantify targets for environmental quality, producer practices and nutrient loading to assess implementation and effectiveness of the NMPS.	High	IP, FI	Partnership	
47	Evaluate current ground and surface water quality monitoring programs and make recommendations for monitoring water quality in specific watersheds.	High	FI	Government	
48	Develop commodity specific reporting programs to assist in assessing effectiveness of NMPS implementation (i.e., changes in commodity, intensity of operations, establishment of new farms, increased manure storage, etc.)	High	IP, FI	Partnership	Consider watershed based reporting programs.
49	Regularly evaluate Statistic Canada census results to determine numbers of farms, numbers of animals and nutrient loading for regional areas in the Fraser Valley.	Medium	FI	Partnership	Available on a five-year cycle.

	Nutrient Management Options	Priority	NMPS Objectives Addressed	Delivery Lead	Comments
	6.6 On Farm Plans (OFPs)				
50	Establish a government/industry working group to clarify outstanding questions regarding the structure, function and application of OFPs.	High	IP, FI	Partnership	Linked to Options 48, 42
	6.7 Legislation/Regulation				
51	Develop and implement provincial groundwater legislation.	High	HS	Government	Drinking Water Protection legislation enacted. Linked to Option 41.
52	Review and amend the Agricultural Waste Control Regulation and the Code of Agricultural Practice for Waste Management.	Medium	IP, FI	Partnership	Linked to Options 2, 15.

8.0 Implementation Strategies and Recommendations

Sections 6 and 7 describe a range of options that could be undertaken to achieve sustainable nutrient management in the Fraser Valley and establish priorities among them. Section 8 presents a number of recommendations that collectively represent a strategy for implementing specific the Nutrient Management Action Plan.

8.1 NMPS Implementation

The implementation strategy suggests that a number of small teams of individuals be charged with addressing specific options. At the same time, there is a need for coordination among the various teams.

Recommendation #1 - NMPS Implementation

The Partnership Committee on Agriculture and the Environment appoint an NMPS Implementation Steering Committee (ISC) to provide direction on the development of the nutrient management options . Membership of the ISC should include one representative from each of MELP, MAFF, DOE and DFO, two representatives from BCAC and one representative of local government to be identified through dialogue with UBCM.

The responsibilities of the ISC, which would report to the Agriculture and Environment Partnership Committee, would be to:

1. Identify, coordinate and ensure linkages between the four NMPS implementation teams identified in Recommendation #2;
2. Provide a dispute resolution function where consensus cannot be reached by implementation teams;
3. Review and report, on an annual basis, on the implementation of the NMPS;
4. Review, every three years, progress towards NMPS targets and develop a NMPS Progress Report; and
5. Based on annual implementation reports and three year Progress Reports, develop recommendations for revisions to the NMPS.

Recommendation #2 - Implementation Teams

The ISC appoint and coordinate the work of four implementation teams that will be responsible for pursuing the nutrient management options of the NMPS relating to Research, Monitoring, Long Term Planning and On-Farm Plans as follows.

- Research Team - The Research Team will address the high priority NMPS Options identified in Section 6.3 dealing with the key information needs to support improved nutrient management practices.
- Monitoring Team - The Monitoring Team will address the high priority NMPS Options identified in Section 6.5 dealing with a nutrient management monitoring program to assist in assessing effectiveness of NMPS implementation.
- On-Farm Plan Team -The On-Farm Plan Team will explore the structure and function of On-Farm Plans (OFPs) as outlined in Section 6.6 in order to define how OFPs should be used to assist in improving nutrient management practices.

- Long Term Planning Team - The Long Term Planning Team will address the high priority NMPS Options identified in Section 6.4 in order to avoid future nutrient imbalances in the Fraser Valley.

The Implementation Teams will be structured similar to the ISC with balanced representation from federal, provincial, and local governments and the agriculture community. The size of the teams will vary depending on the needs of each group. The Implementation Teams will operate on a consensus model with the ISC providing a dispute resolution function where consensus cannot be reached. Each implementation team will be expected to develop and submit to the ISC a workplan that outlines which NMPS options they will be addressing and includes which includes a timeline, deliverables and a budget.

8.2 General Funding

There are a number of options identified in the NMPS under Education and Awareness and Infrastructure Development for which there is support for implementation. The availability of resources in (i.e., private and public sector) will influence the rate at which many of these options are implemented.

Recommendation #3 – Funding (Education and Infrastructure Options)
The ISC bring forward high priority Options identified in Section 6.1 (Education & Awareness) and 6.2 (Infrastructure) to the Agriculture and Environment Partnership Committee and for incorporation in the design of the proposed Green Fund for Agriculture and the Environment.

8.3 Capacity Building in Agriculture

While there is interest among agricultural producers in undertaking activities to achieve better nutrient management practices, there appears to be a lack of capacity (i.e., time and focused expertise) within the agricultural community to facilitate implementation of various programs and initiatives. There appears to be a need for people who can work between government agencies and farmers to assist in the transfer of information, provide advice on the implementation of management strategies and generally promote nutrient stewardship in agriculture.

This capacity existed, to some extent, in the Producer Conservation Organizations supported by the 1992-1997 Green Fund. Where such capacity no longer exists it needs be rebuilt in order to support effective implementation of many of the nutrient management options outlined in the NMPS.

Recommendation #4 – Funding (Capacity Building in Agriculture)
The ISC encourages dialogue at the Agriculture and Environment Partnership Committee to identify potential funding sources, including the proposed Agriculture Green Fund, to support the development of capacity (i.e., Producer Conservation Organizations, extension services etc.) necessary for adoption of improved nutrient management practices.

8.4 Legislation/Regulation

Dialogue at the Working Group did not focus a great deal on legislative and regulatory options. However, some support was noted for considering new legislative tools (i.e., groundwater legislation) and/or revising existing regulatory tools (i.e., Agricultural Waste Management Regulation and the Code).

Recommendation #5 - Legislation/Regulation

The ISC bring forward legislative and regulatory options identified in Section 6.7 to the Agriculture and Environment Partnership Committee for consideration.

8.5 NMPS Review and Update

The nutrient management options outlined in the NMPS represent important steps towards improved management of agricultural nutrients. However, it is important that the impact of nutrient management initiatives be assessed in terms of how effectively they are being implemented and the extent to which measurable progress is being made in addressing nutrient management concerns.

At the same time, effectively addressing nutrient management demands ongoing commitment, including financial resources, on the part of both government and the agriculture sector. As such, reviews of the implementation of the NMPS should consider the degree to which implementation of nutrient management initiatives is being adequately funded.

Recommendation #6 - NMPS Annual Implementation Report

NMPS Implementation Steering Committee report annually, to the Agriculture and Environment Partnership Committee on the development of NMPS.

Recommendation #7 – NMPS Three Year Review

NMPS Implementation Steering Committee to undertake a review of NMPS progress every three years. The review would consider adoption of NMPS options, assessment of progress towards measurable targets, maintenance of funding for implementation and provide recommendations for updating the planning strategies.

8.6 Communication

Involvement in the process of developing the NMPS has been limited to government agencies and farmers. However, effective implementation will require the support and cooperation of other partners such as local government. As well, raising awareness about the NMPS among a broader group of community interests, is essential to building awareness of collaboration between government agencies and farmers and the commitment of the agricultural community to environmental stewardship. Communication related to NMPS implementation is necessary to ensure understanding where progress is being made or additional efforts are required.

Recommendation #8 – NMPS Communications Plan

NMPS Implementation Steering Committee, working with the Partnership Committee on Agriculture and the Environment's Communication Sub-Committee, develop and implement a communications plan for the NMPS.

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Appendix 1. Nutrient Management Action Plan Working Group

Agricultural Producers		
BC Agriculture Council	Steve Thomson	
Sustainable Poultry Farming Group	Kevin Chipperfield	
BC Chicken Grower's Association	Greg Peter	Art Penner
BC Egg Producer's Association	Garth Bean Jack Vaandrager	David Siemens
Fraser Valley Egg Producers Association.	Rolf Van Nuys	Peter Krause
BC Turkey Association	Ralph Volkmann	
BC Broiler Hatching Egg Producer's Association.	Dennis Beck Robert Schreurs	Dion Wiebe Allen James
BC Milk Producer's Association	Andy Dolberg Cornelis Hertgers	Ben Brandsema Len Bouwman
Mainland Dairymen's Association	Albert van Esch	Alfred VandenBrink
BC Pork Producers Association	Lorne Swaan Clarence Jensen	Jack Dewitt
Horse Council of BC	Ken Huber Wendy Sewell	Dave Smith
BC Horticulture Coalition	Stephen Torrence Henry Wiens	Mike Wallis
BC Raspberry Council	Maria Jeffries	
Money's Mushrooms	Jennifer Meier	
Government Agencies		
Agriculture and Agri-Food Canada (Research Branch)	Grant Kowalenko (Technical Resource)	
Environment Canada	George Derksen	Lisa Walls
Fisheries and Oceans Canada	Jennifer Nener Christina Engel	Jennifer Simpson
BC Lands Commission	Trevor Murrie	
BC Ministry of Agriculture and Foods	Ron Bertrand	Rick Van Kleeck
BC Ministry of Fisheries	Christine Hunt	
BC Ministry of Environment, Lands and Parks	Dick Roberts Bev Anderson Wilbert Yang Myriam Bloemhard	Ray Robb Dr. Narender Nagpal Kathleen MacDonald-Date
Fraser Basin Council	Marion Robinson Parm Bains	Malcolm Smith

Appendix 2. NMPS Monitoring

Proposed Monitoring Information

- % of farmers (that use or produce manure) to have 6 months or more manure storage capacity;
- Distribution of animal densities on farms and nutrient balances;
- % of farms with completed on farm plans;
- % of water bodies meeting provincial water quality objectives;
- Nutrient levels in surface/ground water;
- Evidence of balanced soil nutrients (N, P, K);
- Pilot areas where changing farm practices can be linked to specific environmental quality indicators;
- % compliance with Code; and
- Tracking of trends reported in MAFF State of Resources Report 2000, Carter 1997 or Schreier et al., 2000.

Proposed Soil Nitrogen Loading Targets (Ministry of Environment, Lands and Parks)
Nitrogen loading targets (dairy equivalents per hectare)

- Grass and Corn 2.0 to 2.5
- Cereals 0.8 to 1.0
- Cabbage and potatoes 2.1 to 2.2
- Most other vegetables 1.0 to 1.5
- Sweet Corn 1.0 to 1.5
- Raspberries 0.7

Appendix 3. On-Farm Plans (Background)

Plan Design

Initiation of an on-farm (nutrient) planning process would include the following:

1. Base map, preferably on an air photo base, of the farm

2. Inventory of farm management units
   - Review soils, drainage and management practices to define field management units.
   - Plot field management units on base map.
   - Summarize the characteristics of each unit (soils, drainage, irrigation, planned crops)
   - Summarize past management practices for each unit (past cropping, manure applications, fertilizer, yields, results of soil sample analyses)
   - Collect and analyze composite soil samples from each management unit to determine background soil characteristics.

3. Assessment of environmentally sensitive areas
   - Characterize environmentally sensitive areas (areas over vulnerable aquifers, areas adjacent watercourses) which require special management such as “no spread" buffers near watercourses.
   - Areas with high water tables
   - Areas subject to flooding
   - Note adjacent land use and anticipate odour issues
   - Note these sensitive areas on base map.

4. Waste Storage Facilities (for each storage structure)
   - Type of waste
   - Storage volume
   - Storage period provided
   - Ability to contain wastes (no leaks, minimal if any overflow)

5. Characterization of wastes to be applied to land.
   - Identify each waste which is to be applied to land and, using actual measurements if available, or appropriate published values, estimate:
     - Quantities and timing of waste production (note livestock inventories and management practices which impact waste characteristics and volumes),
     - Nutrient concentrations (both total and available)
     - Concentrations of other constituents of interest

6. Plant Nutrient Requirements
   - Estimate plant nutrient requirements based on anticipated cropping patterns, expected yields and available fertility management information (soil test results, expected rate of mineralization, crop nutrient content)

7. Application Rate Determination
   - Match, as best as possible, the nutrients available from the waste to the needs of the crop to develop a manure application schedule
   - Consider the uniformity of application that can be achieved with available spreading equipment

8. Fertilizer Rate Determination
   - Identify crop nutrient needs which cannot be met with waste application and develop a program using other sources of nutrients (primarily commercial fertilizer) to address the shortfall

9. Waste Storage Facilities
   - Using the estimated amounts and timing of both the production of waste and the later application of wastes, determine the required capacity of storage.

Monitoring And Record Keeping

Once the process has been initiated some amount of monitoring and record keeping needs to be done to provide information to fine-tune nutrient applications. For each management unit, monitor and record:

- Nutrient applications (date, type and amount)
- Crop yields and crop sample analyses (total N, P and K)
- Soil sample analyses
- Rates of waste generation
- Waste sample analyses
- Observations of runoff event which may contain wastes

After start up the plan will be reviewed annually. Review and interpret the results of the previous season, incorporate new information which has become available (i.e., the results of OFPs for similar operations, recent research) and formulate specific nutrient management actions for the coming season.

TABLE 9. SOIL SAMPLING FOR ON-FARM PLANS (EACH MANAGEMENT UNIT)

Parameters	Time of Year	Frequency	Comments
Complete soil fertility and other parameters which may be of concern	Spring	At the start of the planning process and then every 4 to 5 years	Provides the background soil data and monitors long term changes
Nitrate	fall	Annually	Evaluates nitrate levels at the end of the season
Available P and K	spring	Annually	To provide fertility needs for coming season
PSNT (pre-side dress nitrogen test)	Prior to side dressing corn with nitrogen	Annually	

Appendix 4. Environmental Support Programs

General Feedback

Agricultural producers contend that higher levels of program support will encourage faster and more intensive changes to nutrient management practices. Farmers raised a number of issues related to program support levels including:

- Tax issues – Some degree of assistance provided by government, which levers increased investment by farmers, is recouped in taxes. The perception that increased infrastructure development might lead to increases in tax revenues larger than the assistance provided, discourages participation in such programs to some extent.

- Support in other jurisdictions - Agricultural producers look to other jurisdictions (i.e., U.S. and Eastern Canada) that have access to greater levels of environmental support programs to encourage change in nutrient management practices.

- Term of funding - Another issue with respect to environmental support programs is the issue of consistency or length of funding. Many of the actions required in order to advance sustainable nutrient management practices are long term in nature. Beyond the development of appropriate infrastructure, there will be ongoing needs for actions such as research, extension and in some cases on-going cost sharing for activities such as transportation.

- Caps on assistance programs – As an example, the existing Manure Storage Expansion Program limits total grants to $10,000. This approach limits such programs from being able to fund larger infrastructure projects (i.e., regional composting facility). As such, assistance programs for infrastructure could provide assistance on a percentage basis with larger contributions from government presumably levering larger investments by the private sector. In Atlantic Canada access to assistance programs has been capped at $30,000.

Environmental Support Program Options

In addition to assistance in the form of grants, agricultural producers have identified a number of mechanisms that could be utilized in order to provide additional assistance and do so on an ongoing basis.

- Reinstatement of Agricultural Land Development Assistance (ALDA) type programs
- PST elimination on infrastructure
- Cost sharing for nutrient management infrastructure
- Removal of property tax on capital improvements
- One to one funding (matching grants) for environmental improvements.
- The return of the 3 year write-off on manure storage structures (federal)
- Fuel Tax reduction for manure transportation

"Green" Fees

Green fees are fees (i.e., levy, surcharge etc.) that are passed on to the consumer and tied to some sort of certification program. Such programs target consumers willing to pay a premium for a certified "environmentally friendly" product. The revenue from such fees can provide a funding mechanism to support nutrient management activities among certified producers. The benefit to producers, in addition to a revenue stream to offset higher operating costs, is increased market visibility.

Green Fees are already applied to some products (i.e., paint, tires, batteries, etc.) to cover costs over and above the cost of production. In the U.S. dairy industry, "Green Products" are being explored, though more as a marketing tool than as a funding mechanism. With supply management, a green fee appears more feasible as most of the production is consumed locally. A creatively designed 'Green Fee' is one option for providing long-term, focused resources that support nutrient management activities.