BRITISH COLUMBIA
Ministry of Environment

Compliance Assessment of Manure Application Practices in the Chilliwack and Agassiz Areas of the Lower Fraser Valley, British Columbia February 7 – March 4, 2005

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Executive Summary

An assessment of manure spreading activities was completed in early spring 2005 in the Agassiz and Chilliwack areas of the Lower Fraser Valley. The objective was to quantify the degree of compliance of observed manure spreading activities with the requirements of the *Agricultural Waste Control Regulation* (*AWCR*) of the *Environmental Management Act* (*EMA*) and the manure spreading advisories produced by the Nutrient Management Working Group.

Separate manure spreading advisories, released on January 28 and February 11, advised against manure spreading. A subsequent advisory, released on February 15, suggested that spreading of manure on grasslands was appropriate provided other measures were taken to minimize the risk of pollution. Six helicopter flights, three prior to February 15 (February 7, 8 and 10) and three after (February 17, 23 and March 4) were used to assess compliance.

A total of 40 active manure spreading occurrences were observed on individual farms – 93% of which were liquid manure with all but one occurring on dairy farms. Of the 40 occurrences, 19 were observed prior to February 15. There were also indications that manure had been spread on approximately 20 additional dairy farms prior to the first flight. Given that there are approximately 310 dairy farms in the Chilliwack and Agassiz areas, these observations suggest that approximately 88% of dairy farms in the area were following the advisories. This high rate of compliance is consistent with the understanding that the manure spreading advisory is a widely used tool throughout the dairy industry.

Riparian buffers were implemented 89% of the time and 90% of the spreading occurrences took place on grasslands versus bare land. Light or moderate rates of manure were being spread 89% of the time. Despite the relatively high rates of overall compliance, there were indications that compliance rates were significantly less when manure was being spread prior to February 15.

Ministry of Environment (MoE) staff found five occurrences of overflowing manure pits. One additional pit was being pumped onto a bare field adjacent to a stream known to support species at risk. While the nature of precipitation events in the fall of 2004 made it difficult for producers to access their land to reduce the level of manure in their pits, overflowing pits are not acceptable and are likely contraventions of the *EMA*. Producers need to practice a certain degree of due diligence which would include taking advantage of programs such as the Canada – British Columbia Environmental Farm Plan (EFP) program and taking measures to reduce the risk of pollution.

Twelve ground inspections were completed as follow-up to the occurrences that were observed to pose the highest risk to the environment and were likely contraventions of the *EMA*. Producers were informed of the legislative requirements, the availability of the advisories and the potential of various programs, such as the EFP program, to assist with remedying their non-compliance. Follow-up letters were sent to these producers requesting that MoE staff be notified of corrective actions that had been taken to prevent future instances of non-compliance. Given the feedback from the producers during these inspections and the reduced rate of compliance for spreading activities occurring prior to February 15, it is believed that approximately 12% of the producers are consistently not in compliance with legislative requirements.

This report makes several recommendations:

- Manure spreading advisories should continue to be released with the addition of one in late summer reminding producers to take every opportunity, consistent with legislative requirements, to reduce the levels of manure in their storage lagoons prior to the no spread period;
- Industry and government agencies should continue to encourage producers to take advantage of the various programs, such as the Canada – British Columbia Environmental Farm Plan Program, that are designed to improve farm practices;
- MoE and the Ministry of Agriculture and Lands should search for other ways to get the messages contained within the spreading advisories out to producers (E.g.: association newsletters);
- MoE staff should follow-up with those producers that received letters requesting corrective actions be taken prior to the onset of the no spread period in the fall of 2005;
- MoE staff should advise the Partnership Committee on Agriculture and the Environment of the findings of this report;
- MoE staff should concentrate their compliance and enforcement efforts on those producers who are consistently in non-compliance. Further assessment work should occur just prior to the release of the 2006 advisory which suggests that spreading of manure on grassland is acceptable.

Acknowledgements

The authors would like to acknowledge Mike Simpson (MoE Co-op student) for his assistance during the helicopter flights and with preparation of the flight maps and report figures. The participation of Orlando Schmidt and Geoff Hughes-Games (Ministry of Agriculture and Lands) on the helicopter flights as well as their reviews of draft manuscripts is greatly appreciated. This manuscript also benefited from reviews by Jennifer Tudhope and George Derksen. Cornelis Hertgers (B.C. Milk Producers Association) also assisted on a helicopter flight. The authors would also like to recognize the support and proactive involvement of the B.C. Agriculture Council with helping to promote improved manure application practices through the Canada-British Columbia Environmental Farm Plan Program.

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1. Introduction

1.1. Background

The Ministry of Environment (2001) conducted an aerial assessment of manure storage and application practices throughout the Fraser Valley from October 2000 to March 2001. Ground inspections were also completed to determine if farmers were complying with the *Agricultural Waste Control Regulation* (*AWCR*). The flight portion of the assessment found approximately 34 violations and the ground inspection found 109 infractions of the *AWCR* during the six month period. The ministry's response to the non-compliance included warning letters, directives and prosecutions. The report also recommended improved nutrient management planning and continued enforcement of regulatory requirements.

From October 2003 to February 2004, the Ministry of Environment (2005) carried out a compliance assessment of agricultural practices over two unconfined drinking water aquifers (Hopington and Abbotsford-Sumas aquifers). The purpose of this assessment was to determine the level of compliance with the *AWCR* of the *Environmental Management Act* (*EMA*). Since the study area used in the previous report did not provide ample opportunity to assess manure spreading practices, it was recommended that an additional assessment of manure spreading activities be completed in a different study area. The report presented here fulfills that recommendation.

1.2. Benefits of using manure

Manure and other agricultural byproducts have significant value when used as a fertilizer or soil conditioner as per the *AWCR*. Manures not only contain significant amounts of macronutrients such as nitrogen, phosphorus and potassium but also contain vital micronutrients, organic matter and metals. The nitrogen and phosphorus, found in manure, are present in the inorganic and organic forms. Approximately half to two thirds of nitrogen in liquid manure is in the inorganic ammonium form which is immobile in most soils, however, it is usually quickly nitrified to the nitrate form where it is susceptible to leaching. Solid manure has a larger organic nitrogen component where roughly two thirds is in the organic form. This larger organic nitrogen component reduces the potential for nitrate leaching. Some solid manures tend to have a higher carbon to nitrogen ratio which allows them to act more as a soil conditioner than liquid manures and help to increase soil organic matter.

The availability of the organic form of nutrients is dependent on the ability and rate that the soil microorganisms can break down organic matter and release plant available nutrients. Microorganisms are much less active during the winter when temperatures are colder. In this way, manure applied in the spring will be broken down over time with nutrients released slowly and assimilated by the crop as it is required. The portion of nutrients in the inorganic form and regular chemical fertilizers are immediately available to the crop but some compounds are also susceptible to leaching and runoff over the spring, fall and winter wet periods.

Different livestock systems produce manures with very different characteristics. For example, liquid dairy manure can contain approximately 0.3% total nitrogen by volume while broiler chicken manure can contain five times that amount.

The Ministry of Environment recognizes the agronomic benefits of manure and generally supports its use over chemical fertilizers where appropriate. The high animal density within the

Lower Fraser Valley leads to the production of large amounts of manure which would otherwise need disposing of by other means if it was not spread on the landbase. The beneficial use of manure, however, is dependent on its proper storage and land application at agronomic rates to minimize adverse impacts to the environment.

1.3. Environmental risks associated with manure application

Improper use of manure can result not only in damage to crops but can also cause negative impacts on the receiving soil, water, air or fish and wildlife habitats (BCAC 2004). Elevated nitrogen based compounds are a concern when found in drinking water as well as in waters used by terrestrial and aquatic species. Elevated nitrate concentrations in drinking water have been linked to clinical methaemoglobinaemia (blue baby syndrome) and various cancers. Elevated nitrite and ammonia levels are extremely toxic to several species of fish – particularly salmonids. The drinking water guideline for nitrate is 10 mg NO_3-N L^{-1} and the water quality criterion for nitrite has been established at 0.02 mg NO_2-N L^{-1}. Other compounds found in manure such as organic carbon and phosphorus can render water unfit for use as drinking water or livestock watering and can produce conditions that are toxic to aquatic species. Levels of pathogens (fecal coliform) in manure are extremely high and can pose a threat to consumers of shellfish harvested from contaminated waters and consumers of fresh ready-to-eat agricultural products that have been irrigated with contaminated water and not washed properly.

Elevated concentrations of nitrate nitrogen have been measured in drinking water aquifers such as the Abbotsford-Sumas aquifer and have been linked to agricultural practices (Cox and Kahle 1999). In addition, a 2002 water quality objective attainment monitoring report (Ministry of Environment 2002) found that watercourses within predominantly agricultural watersheds had an overall poorer water quality rating than did watersheds with a variety of land uses and that there were indications of worsening conditions.

Manure derived nutrients can find their way into surface water or ground water by a variety of pathways. Application of manures on saturated or frozen soils can lead to surface runoff from fields to ditches and streams. Leave strips or buffers along watercourses are important for intercepting and retaining contaminants, preventing them from reaching sensitive areas. Application of manures in excess of crop requirements can cause nutrients to remain in the soil profile after harvest which leaves them susceptible to leaching into the groundwater or run-off to surface water with the onset of winter rains. Manure worked into soils that are wet or will soon be wet will lead to denitrification and possibly result in adverse impacts to air quality.

Given the limited windows for application of manure to land, it is imperative that producers take every opportunity to apply their manure in an acceptable manner to their land. In the Lower Fraser Valley, it is recommended that producers maintain 6 months of storage for liquid manures in their storage facilities to ensure they can make it through the no spread period (BCAC 2004).

The Canada – British Columbia Environmental Farm Plan Reference Guide (BCAC 2004) contains excellent information regarding the benefits and risks associated with using manure as well as appropriate management practices. The MoE, Ministry of Agriculture and Lands (MAL) and British Columbia Agriculture Council (BCAC) encourage all producers to complete an environmental farm plan and take advantage of the cost sharing opportunities that are available to assist with funding improvements to their operations.

1.4. Complaints

The Ministry of the Environment continues to receive regular complaints from the public, producers and other groups regarding agricultural practices. These complaints have been tracked using a database since 1991. Information recorded in the database includes the nature of the complaint, the type of material being discharged, the location of the complaint, the type of agricultural operation, the environmental impact etc. Of the agricultural related complaints received since 1991, approximately 37% concern manure storage and another 21% concern manure application practices (Figure 1). The Ministry of Environment (2005) report assessing agricultural practices over two unconfined aquifers looked at many aspects of the *AWCR*. However, the report ended up focusing on manure storage pile practices as a result of the primary agricultural commodity being produced in the study area being poultry operations that typically have a solid manure system. As mentioned above, the report presented here focuses on manure application practices.

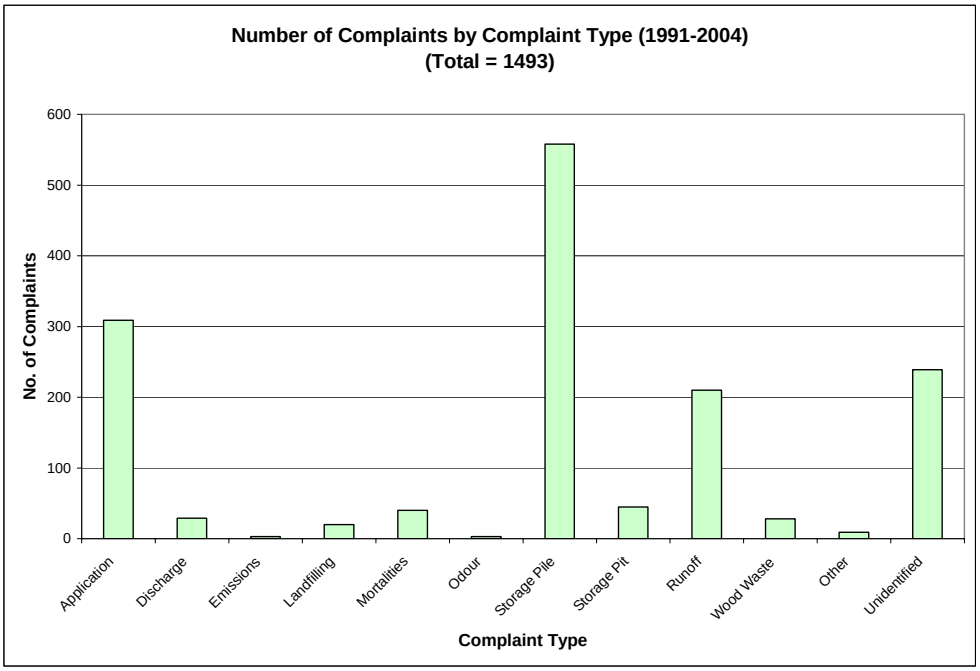

Figure 1: Type and number of complaints received by the Ministry of Environment (1991-2004).

The majority of complaints regarding manure spreading activities are received between November and early February. This is the period when spreading is not recommended because it is not consistent with the *AWCR* and is likely a violation of the *EMA*. In addition, the majority (62%) of complaints regarding manure application practices are associated with dairy farming operations (Figure 2). It is believed that this is more a reflection of the dairy industry's size and manure management system as opposed to overall industry performance. The dairy industry uses a predominantly liquid manure system and is also much larger than other liquid manure based systems such as hog producers in the Lower Fraser Valley. Solid manure based systems, such as those used by poultry operations, have the luxury of being able to store manure outside of a facility which provides greater flexibility for spreading but leads to the greater number of complaints regarding storage piles (Figure 1).

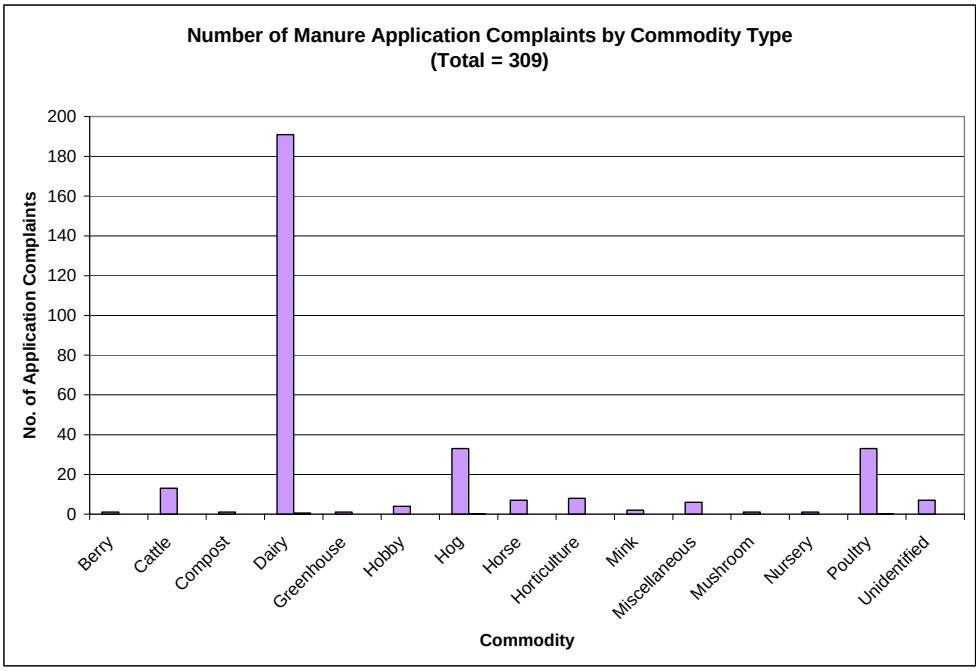

Figure 2: Manure application complaints by commodity type (1991-2004).

1.5. Manure Spreading Advisories

Ultimately, it is the producers' responsibility to ensure that all applicable legislation is being complied with. The *AWCR* is not a legislative requirement, rather, if followed, it provides the producer with relief from the *EMA*'s prohibition of unauthorized business waste discharge (Section 6(3)). It should be noted, however, that the likelihood of issuing an authorization (E.g.: permit) for an agricultural operation is small given the existence of the *AWCR* – no farms in this study held permits. Not following the *AWCR* does not necessarily mean that the producer is in contravention of *EMA*, however, the likelihood of a violation is far greater.

To assist producers with making appropriate decisions regarding their manure handling practices, the MoE and MAL produce a manure spreading advisory (Appendices 1-3) on several occasions throughout the year. These advisories are reviewed by the Nutrient Management Working Group (NMWG) prior to release. The NMWG was established as a subcommittee of the Partnership Committee on Agriculture and the Environment (www.agf.gov.bc.ca/resmgmt/partners/committee_info.htm) and consists of staff from various government agencies and industry commodity groups.

The advisory provides the farming community with information for producers to consider when contemplating spreading manure as well as best management practices and other information. Application of manure to bare or cropped land in the November to January period is not acceptable due to extreme risk to ground and surface waters. Application of manures to bare land in the fall or early spring is not recommended due to the increased risk of leaching and runoff. There is also little chance of crop uptake during this time period and the applications would be viewed by MoE as a violation of *EMA*. Application later in the spring to bare land at rates meeting crop nutrient uptake requirements with quick incorporation is recommended. Application to cropped land in the early spring and late fall is acceptable provided application

rates are consistent with crop uptake requirements. Pollution resulting from manure spreading practices is prohibited at all times.

The first advisory of 2005 (Appendix 1) was released on January 28 and advised against manure application due to continuing wet conditions. The second advisory (Appendix 2) was released on February 11. This advisory implied that manure application at light rates on well drained perennial grasslands or soils with established cover crops might be appropriate in limited circumstances. The advisory recognized that application conditions were far from ideal and suggested that only those producers with full manure pits should even be considering application. The third advisory (Appendix 3) was released on February 15, 2005 and implied that application to perennial grasslands and fields with established cover crops was likely consistent with the legislative requirements. The advisory recommended that manure be applied only on soils that were trafficable and that wet areas were to be avoided. Manure application to bare land was not advised unless application was required in support of early field crops or raspberries.

1.6. T-Sum

The manure spreading advisories base their guidance on a number of indicators including: the long range weather forecast information, the green-up of grasslands, soil moisture and temperature status, number of enquiries from producers and the T-Sum. It should be noted that the producers and government agencies agree that all indicators should be considered and none should be used in isolation, particularly the T-Sum.

The Farmwest website (www.farmwest.com) describes the T-Sum as a method to determine when to make the first application of nitrogen fertilizer in spring. The T-Sum value is the accumulated mean daily temperatures (in °C) above zero, starting on January 1 (below-zero temperatures are ignored). For example, if the mean daily temperatures for a 5-day period were 6, 3, 0, 1, and -4°C, the T-Sum is 10. The T-Sum concept assumes that the rate of spring growth is directly related to the sum of the accumulated mean above zero temperature.

Research carried out first in the Netherlands and the United Kingdom, later confirmed in coastal B.C., demonstrated that grass crops respond well to spring fertilizer that is applied when T-Sum is between 200 and 300. Although the research was not conducted with manure, it is expected that crop response to the inorganic nutrients in manure would be similar to that of inorganic fertilizers. In coastal B.C., T-Sum normally reaches 200 between early-February and mid-March (Figure 3).

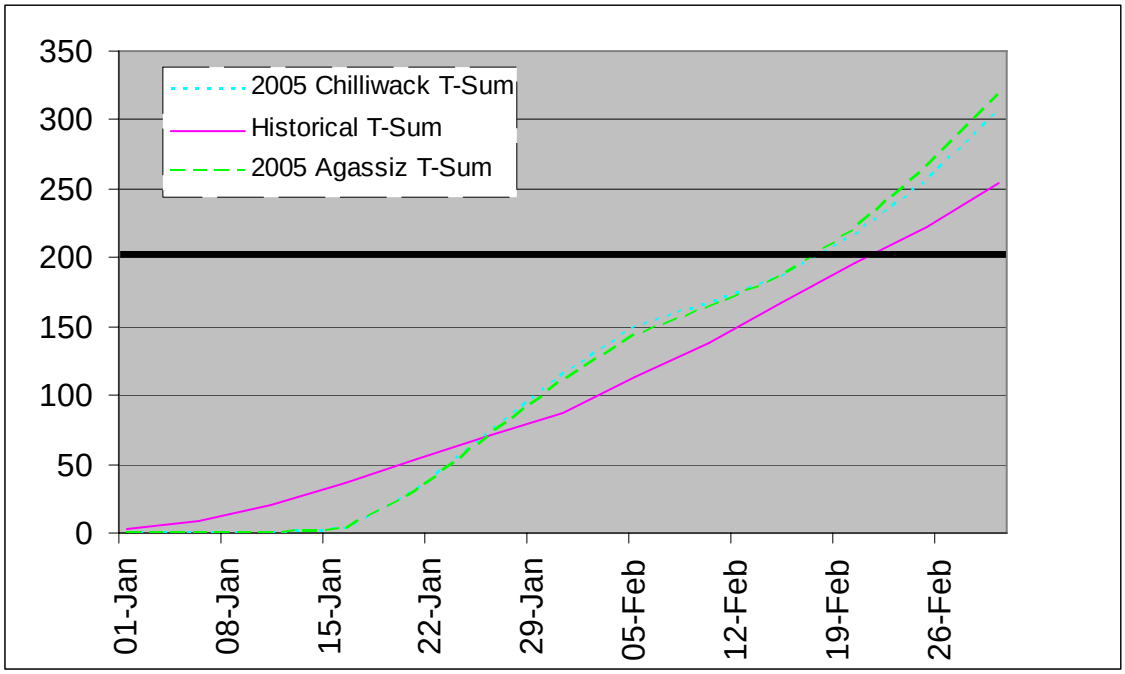

Figure 3: Historical and 2005 T-Sum values for Chilliwack and Agassiz.

The T-Sum reached 200 on approximately February 17, 2005, approximately 5 days earlier than the historical average (Figure 3) for both Chilliwack and Agassiz. Given other factors at that time, it was considered appropriate for the February 15, 2005 advisory to imply that manure application on established grassland was likely consistent with the *AWCR* and the *EMA*.

2. Objectives

The objectives of the compliance assessment were to:

- determine the level of compliance with selected sections of the *AWCR*;
- determine the level of compliance with the manure spreading advisories;
- engage producers with follow-up discussions on problems observed during the flights;
- identify options and opportunities for improving the degree of compliance with the *AWCR* and the manure spreading advisories; and
- to report on any additional environmental management issues.

3. Scope

This compliance assessment evaluated compliance with the following sections of the *AWCR*:

- Section 11: Agricultural waste must not be directly discharged into a watercourse or groundwater
- Section 12: Agricultural waste must be applied to land only as a fertilizer or a soil conditioner
- Section 13: Agricultural waste must not be applied to the land if, due to meteorological, topographical or soil conditions or the rate of application, runoff or the escape of agricultural waste causes pollution of a watercourse or groundwater
- Section 14: Agricultural wastes must not be applied
  (a) on frozen land,

(b) in diverting winds,
(c) on areas having standing water,
(d) on saturated soils, or
(e) at rates of application that exceed the amount required for crop growth, if runoff or escape of agricultural waste causes pollution of a watercourse or groundwater, or goes beyond the farm boundary.

This compliance assessment evaluated compliance with the following components of the manure spreading advisories:

- Implied timing for manure application
- Manure application on bare vs cropped land
- Maintenance of reasonable setbacks from watercourses

Although the assessment focused on areas where liquid manures are routinely applied, the study also included an assessment of any type of agricultural byproducts being spread during the observation period. The assessment did not include an assessment of storage piles nor did it include an assessment of fields that had been spread on prior to the flights. The assessment included some on the ground inspections of spreading operations in addition to the reconnaissance helicopter flights.

Enforcement was not within the scope of the assessment; however, any items of substantial non-compliance identified during the assessment will be addressed through the ministry's Compliance and Enforcement Policy and Procedure.

4. Study Area

The compliance assessment was limited to the Chilliwack and Agassiz areas for various reasons. These areas have a high concentration of dairy farms and they have significant groundwater and surface water resources. In addition, they are adjacent to one another which facilitated relatively rapid coverage by helicopter.

The Chilliwack portion of the study area was bound to the west by the Vedder Canal, to the south and east by the Skagit Range to the north by the Fraser River (Figure 4). The Agassiz or District of Kent portion of the study area is bound to the south by the Fraser River, on the east by the narrowing of the Fraser Valley where the mountains and the Fraser River converge, on the west by the Harrison River and on the north by Mount Woodside, Mount Kent, Bear Mountain and Hicks Lake (Figure 4).

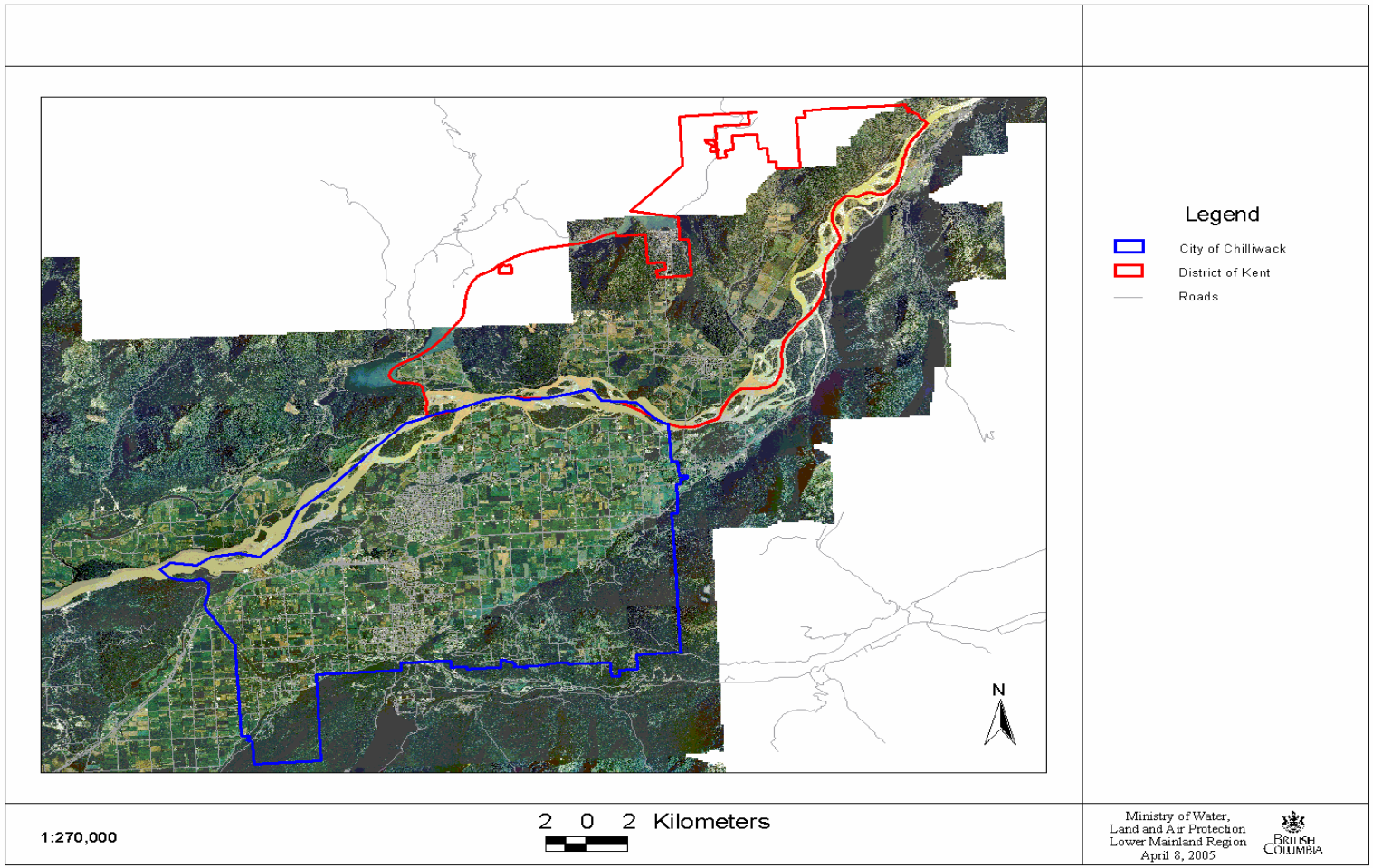

Figure 4: Map of study area showing Chilliwack and Agassiz (District of Kent) areas.

4.1. Geography, Climate, Soil and Water Resources

The agricultural areas within the study area lie mainly on the gently sloping lowlands of the Fraser River floodplain and associated areas along the bottoms of the valley walls. The agricultural soils of this area are developed on a range of surficial materials dominated by alluvial, lacustrine and glacial outwash (Luttmerding 1981). More recently, these materials have been modified by fluvial depositional processes related to the Fraser River and its tributaries. Elevations in the study area range from approximately 10-2100 metres above sea level (masl) (Figure 5), however, most farms lie below 20 masl.

Figure 5: Typical landscape of study area.

The climate of the study area is characterized as having mild, rainy winters and relatively cool, dry summers. Winter is dominated by a steady succession of low pressures systems which move onshore from the Pacific Ocean producing dull, mild, rainy weather (Luttmerding 1981). In contrast, summers have frequent long periods of sunny weather as high pressure cells extend over the coast. Mean annual temperature is approximately 10ºC and mean annual precipitation is approximately 1750 mm with the majority falling as rain between November and March (Figure 6).

There is a wide variety of soil series and soil management groups in the Chilliwack and Agassiz areas. Some of the more predominant soil management groups include the Fairfield, Monroe, Carvolth and Vedder groups (BCMAFF 1991). The majority of soils within the Fairfield and

Monroe soil management groups are medium textured, stone free, moderately to well drained and have developed from Fraser River floodplain deposits. Soils within the Carvolth and Vedder soil management group tend to be poorly drained soils which have developed on a broader range of parent materials. The large amounts of precipitation which fall in the winter months result in elevated groundwater tables which make vehicle access difficult. The extended dry periods in summer often lead to a soil moisture deficit situation during the growing season.

Both the Chilliwack and Agassiz areas are underlain by aquifers classified as IIIA which are highly vulnerable to land use activities but support relatively light demand (wlapwww.gov.bc.ca/wat/aquifers/index.html). These aquifers supply drinking water – much of the water is accessed from sand point wells (wells less than 15 m deep). While most of the Chilliwack area is serviced by municipal water, individual homes and farms in the Agassiz area have their own wells.

Agassiz has a relatively low number of streams dissecting the area and most have been channelized. The Chilliwack area has some high value fish streams, such as Elk Creek, flowing through the area although the streams tend to be channelized in the agricultural areas. Water quality has been observed to decrease rapidly as these streams flow from the predominantly forested hillsides to the gently sloping agricultural lands. Several species at risk, such as the Pacific Water Shrew and the Oregon Spotted Frog are known to depend on the riparian areas within the study area (Sylvia Letay pers. communication & http://srmwww.gov.bc.ca/atrisk/ims.htm).

4.2. Land use and agricultural commodities

Historically, land in the valley bottom areas of the Lower Fraser Valley has been used to support the production of many agricultural commodities. More recently, with the growth of cities such as Chilliwack and Agassiz, an increasing amount of land is being occupied by residential and associated commercial developments. The surrounding forested area continues to support an active forest industry.

After removing the upland forested area from consideration, approximately 69% of the study area is used to support agricultural production systems with Agassiz at 57% and Chilliwack at 73% in agricultural production (Table 1). There are approximately 46 and 264 dairy farms in the Agassiz and Chilliwack areas, respectively.

Table 1: Land use in the Agassiz and Chilliwack study areas (Baseline Thematic Mapping 2001).

Study Area	Urban	Agriculture	Forestry	Other	Total
			(hectares)		
Agassiz	445	5,092	12,313	3,453	21,303
Chilliwack	3,550	16,356	6,911	2,349	29,166

5. Methodology

The Agassiz and Chilliwack areas were chosen based on a review of complaints as discussed in Section 1.4. Once the areas had been chosen, flight maps were prepared using aerial

orthophotographs as a background. Occurrences of manure application observed from the helicopters were recorded on the maps with dots of different colours for each flight.

Three helicopter flights were made (February 7, 8 & 10) before the release of the February 15 manure spreading advisory that implied spreading on grassland was appropriate and three after (February 17, 23 and March 4) the February 15 advisory was released. In this regard, staff were in close contact with MAL staff who were preparing the advisories in consultation with MoE staff. Flights took approximately 1.5 hours to complete and took place between 10:30 and 15:00. In addition to the pilot, there were three other personnel on each flight – one observer, one navigator and one person recording information on datasheets (Appendix 4). MAL and industry personnel were present on three of the flights. On board GPS and video were taken during each flight. Videos were reviewed after each flight to confirm the accuracy of the information recorded on each datasheet. All information from the datasheets was transcribed to a spreadsheet which was developed to summarize the results for inclusion in this report (Appendix 6).

Aerial observations were followed up with ground inspections where producers were asked to answer questions (Appendix 5) regarding their manure management practices. Farms that underwent ground inspections were chosen based on risk to the environment as observed from the flights. Where a compliance issue was confirmed by the ground inspection, a follow-up letter was sent to the producer. These letters requested information on how the issue would be resolved and supplied the producer with information regarding the Canada – British Columbia Environmental Farm Plan Program which could prove useful for resolving the non-compliance.

Additional time was spent looking for manure spreading activities between the hours of 19:00 and 22:00 on February 7, 2005. These checks were done by vehicle and were made because, in past years, MoE staff has witnessed spreading activities occurring during the night.

6. Results and Discussion

6.1 2004-2005 Precipitation amounts

Precipitation affects manure, particularly liquid manure, handling practices in several ways. Precipitation adds to the volume of manure in uncovered manure pits. In addition, excess precipitation reduces the ability for farm machinery to access the fields and reduces the opportunities for spreading. Some of the results of this study need to be interpreted with the precipitation summary in mind. Figure 6 shows the precipitation received at the Abbotsford airport for the March 2004-March 2005 period as well as the 30 year average. Data from Abbotsford are presented due to a lack of available data from Chilliwack and incomplete data from Agassiz. Although the precipitation amounts may change slightly, there would be negligible differences in trends between the study area and Abbotsford.

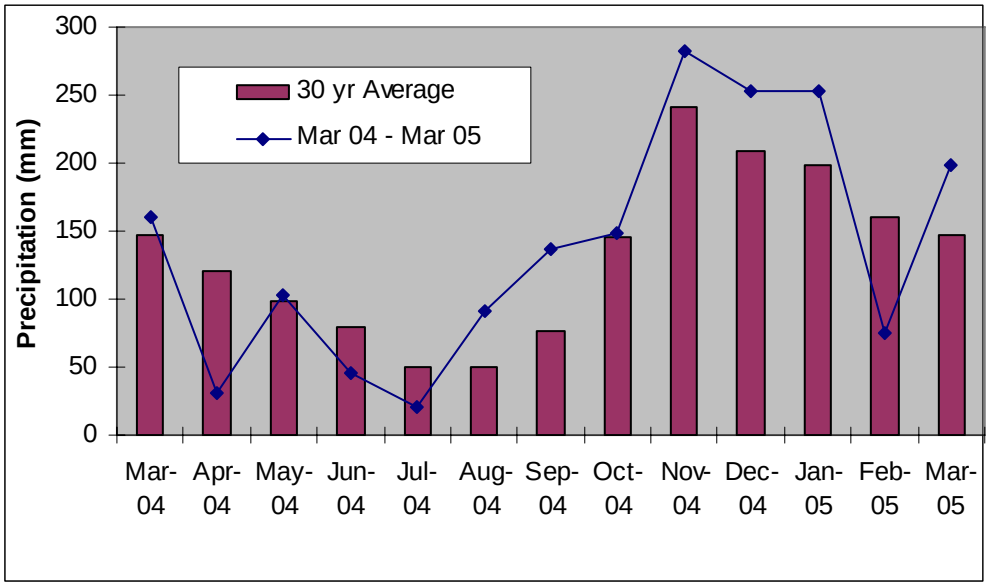

Figure 6: Comparison of monthly precipitation for the March 2004 to March 2005 period with the 30 year average precipitation for Abbotsford airport.

The March 2004 – August 2004 precipitation was approximately 83% of the 30 year average while the September 2004 – March 2005 precipitation was approximately 14% greater than the 30 year average. Typically, manure pits are recommended to be designed to hold 6 months of manure and associated wastes and the equivalent of the 25 year rainfall amount. It is reasonable to expect that the amount of rainfall received during the study would be able to be managed by a properly sized manure pit. An interesting observation is that the rainfall received during August and September of 2004 (Figure 7) likely had an impact on fall 2004 spreading activities.

Normally, August through September is a relatively dry period which allows producers to access their fields to spread manure in a manner consistent with legislation. In the fall of 2004, fields were already wetter than normal from the above average August precipitation amounts. To make matters worse, the frequent and relatively large precipitation events throughout September limited the available times for manure spreading (Figure 7). As a general guideline, spreading of manure is not recommended when greater than 10 mm of precipitation is forecast to occur within the following 5 days due to elevated risk of runoff and leaching. Following this guideline and allowing for trafficability, manure would have only been able to be spread during early and late September and perhaps mid to late October. These are the times when harvesting of silage corn is occurring and producers are extremely busy. Producers and custom manure applicators indicated that it was a challenge for manure to be spread in the fall of 2004 because of the nature of the precipitation events and, as a result, many farmers went into the no spread period with far more than the desired amount of manure in their pits (Larry Klassen pers. commun.).

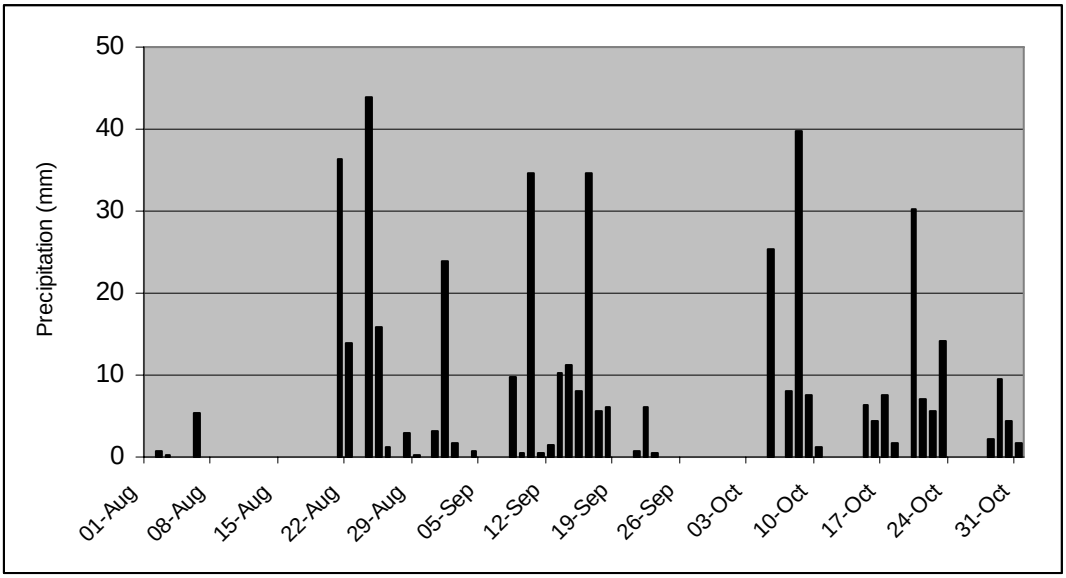

Figure 7: August – October 2004 precipitation for Chilliwack

6.2 Timing of observed manure spreading occurrences

Section 12 of the *AWCR* requires manure to be spread as a fertilizer or soil conditioner while sections 13 and 14 require manure not to be applied under conditions that result in pollution. For all intents and purposes, the manure spreading advisories dissuaded spreading of manure before February 15, 2005.

A total of 40 occurrences of manure spreading were observed – 19 before and 21 after the release of the February 15 advisory (Table 2). In addition, it was estimated on the first flight that at least 20 other occurrences of spreading had occurred shortly before the first flight – these are not reported on herein. All of the observed occurrences were at different farms – there were no repeat spreading occurrences observed at the same farm. There were no obvious differences between the number of spreading occurrences, and the nature of the spreading occurrences between the Agassiz and Chilliwack areas. With the exception of one, all spreading occurrences were on dairy farms. The spreading of liquid manure was observed in 93% of the occurrences (Table 2, Appendix 6).

Almost 50% (17 out of 37) of spreading occurrences took place before the release of the February 15 advisory (Table 2). It is likely that these occurrences could be considered inconsistent with the requirement of the *AWCR* and they certainly were not consistent with the advisories. Occurrences where solid manure was being spread were not included as they could be considered application of a soil conditioner and are likely not violations of *EMA*. Liquid manure does not have a high enough carbon to nitrogen ratio to be considered a soil conditioner and is more susceptible to leaching or runoff - possibly resulting in pollution.

All six producers found spreading on February 7 were interviewed after the flight. Four of the six were spreading liquid manure because their manure lagoons were full and they felt there was no other option. The other two were spreading solid manure which, as mentioned above, is likely not a violation of *EMA* although the likelihood is higher as they were spreading on bare

ground. At least two producers recognized they did not have the recommended 6 month storage capacity.

All of these farmers were provided with information regarding the EFP program in the hopes they would be able to remedy their storage problems. In addition, the producers were advised that there may be other options for times when the lagoon is full. Previously, producers have used neighbouring lagoons as temporary storage when their own lagoons were at capacity. As a last resort, producers need to exercise due diligence by choosing the opportunity which presents the lowest risk to the environment such as spreading at lighter rates on grass fields away from watercourses. Few of the spreading occurrences observed prior to the release of the February 15 advisory involved practices that could be seen as meeting the due diligence test.

It is recommended that a manure spreading advisory be released in the late summer as a reminder to producers that they should take every opportunity to reduce the level of manure in their lagoons in the fall as the weather presents too much of an uncertainty. This advisory should be careful to ensure that agronomic rates are being used preferably in tandem with cover crops for bare soil.

It is difficult to draw conclusions about the dairy industry as a whole without observing spreading practices for a much greater period of time. However, given that at least 37 spreading occurrences (liquid manure) were likely to have occurred prior to February 15 and that there are approximately 310 dairy farms in the Chilliwack and Agassiz areas, it would appear that up to 88% were spreading manure after the release of the February 15 advisory.

There was less than 10 mm of rain forecast within 3 days of all helicopter flights. This is important for minimizing the potential for leaching and runoff of nutrients contained within manure. Section 13 of the *AWCR* requires that manure must not be applied to land if, due to meteorological conditions, runoff of manure causes pollution of groundwater or watercourses. While it appeared that producers were paying attention to the weather forecast, there were manure spreading operations that were occurring in conditions that were obviously too wet (Figure 8). The advisories clearly suggest that wet areas are to be avoided when spreading manure. The most likely cases of non-compliance were associated with farms spreading manure before the release of the February 15, 2005 advisory.

As mentioned above, a check for manure spreading occurrences was made in the evening hours of February 7, 2005. In the past, MoE staff has received complaints of questionable spreading activities occurring during the night. There were no occurrences of manure spreading observed during the evening check.

Table 2: Summary of observed manure spreading occurrences

Flight Date		No. of Spreading Occurrences			Buffers		Application Rate			Manure Type		Comments
		Bare Land	Grass	Total	Yes	No	Low	Mod.	High	Liquid	Solid	
Pre-advisory	Feb 7	3	3	6	0	2	0	4	2	4	2	• 2 occurrences of overflowing manure pits • 1 pit being pumped onto a bare field
	Feb 8	0	3	3	3	0	0	0	3	3	0	
	Feb 10	0	10	10	4	1	7	3	0	10	0	• 2 occurrences of overflowing manure pits
	Total	3	16	19	7	3	7	7	5	17	2	
Post advisory	Feb 17	0	4	4	3	0	0	4	0	3	1	
	Feb 23	1	9	10	7	0	8	1	0	10	0	• 1 occurrence of an overflowing manure pit
	Mar 4	0	7	7	7	0	2	4	1	7	0	
	Total	1	20	21	17	0	10	9	1	20	1	
Total		4	36	40	24	3	17	16	6	37	3	

Figure 8: Application of manure to a poorly established grass cover crop and during soil conditions that are too wet (Feb 7, 2005).

6.3 Riparian area buffers

BCAC (2004) defines buffers as special management areas used to separate farming activities from areas of sensitivity that could be adversely impacted by the farming activities. One objective of a buffer is to intercept and retain contaminants, preventing them from reaching sensitive areas. The Canada – British Columbia Environmental Farm Plan Program: Reference Guide (BCAC 2004) suggests that buffer widths of 5 m to 8 m should be used adjacent to watercourses depending on soil, topographic, seasonal, climatic, and several other factors. For the purposes of this report a buffer width of 5 m was considered adequate.

While buffers are not explicitly mentioned in the *AWCR*, Section 13 could be interpreted as suggesting that buffers are an appropriate measure to implement in order to restrict direct discharge of manure to watercourses. In addition, the establishment of buffers is recommended in the manure spreading advisories. Overall, buffers were established 89% of the time that they should have been in place – 70% and 100% before and after February 15, respectively (Table 2, Figure 9). Ground inspections were completed in all instances where buffers were lacking. While no pollution was obvious, producers were encouraged to maintain buffers as per BCAC (2004).

Figure 9: Establishment of a buffer adjacent to a watercourse during liquid manure spreading.

6.4 Manure spreading occurrences on bare versus cropped land

The *AWCR* requires that manures be spread as a soil conditioner or a fertilizer. This is reiterated in the advisories by suggesting that manure should only be applied to grasslands after the date when growth has commenced. The February 15 advisory advised against spreading of manure on bare land except for some instances. It could be argued that spreading of solid manure on bare land at this time of year could be considered a soil conditioning treatment and would thus not be considered inconsistent with the *AWCR*. Due diligence would suggest that the nutrient characteristics of the solid manure should be quantified prior to application. However, given the ability to store solid manure until a time when spreading is more appropriate, MoE does not promote spreading of solid manure in early spring on bare land. Liquid manure can not be considered a soil conditioner and can not be applied as a fertilizer if it is applied to bare soil and not incorporated with a crop planted fairly quickly thereafter. All of the advisories released in the spring of 2005 advised against spreading on bare land unless the field was going to be planted immediately after application to early field crops or the field was already planted to raspberries.

Manure spreading was occurring on established grassland approximately 90% of the time (Figure 10). There was no difference observed in the spreading occurrences before and after the release of the February 15 advisory when the two cases of solid manure spreading were removed from consideration. Although the ministry is encouraged with 90% of the occurrences taking place on grassland, it remains concerned that a significant number were occurring prior to the release of the February 15 advisory where, combined with soil and climatic conditions, a greater likelihood of adverse environmental impacts exists.

Figure 10: Application of liquid manure to bare land in the foreground and grassland in the background.

6.5 Rates of manure application

Determining application rates is difficult - particularly from the air. Nevertheless, an attempt was made to determine whether the manure was applied at heavy, moderate or light rates of application. Sections 13 and 14 of the *AWCR* require that rates of application should not cause pollution and should not exceed the amount required for crop growth, respectively. The February 11 (Appendix 2) and February 15 (Appendix 3) manure spreading advisories also suggest that rates of application should be light (if absolutely required to lower lagoon levels) or matched to meet crop nutrient requirements, respectively. For the purposes of this assessment, an acceptable rate of application was light or moderate when used on grassland; applications to bare land were not considered appropriate at any rate.

Overall, a light or moderate rate of application was observed in 89% of the occurrences with light or moderate rates being used 81% and 95% of the time before and after the release of the February 15 advisory, respectively (Appendix 6). While this suggests that producers seem to be applying manure at appropriate rates for the time of year, there is an indication that producers spreading before the release of the February 15 advisory were not as cautious with their rates of application. This may be a function of undersized manure storage lagoons.

6.6 Ground inspections

As discussed above, ground inspections were carried out on 12 farms. The farms were chosen based on the potential risk to the environment posed by the practices observed from the air. It is fair to say that all twelve farms inspected were likely in non-compliance with the *EMA*, the *AWCR* or the manure spreading advisories. Producers were invited to answer a variety of questions (Appendix 5).

Of particular interest was the producers' awareness of the *AWCR* requirements and manure spreading advisories. Only 42% of the twelve interviewed producers were aware of the manure spreading advisories while only 25% of the interviewed producers were familiar with the *AWCR* and its requirements. These low numbers are discouraging considering the *AWCR* came into effect in 1992 but are not unexpected given the degree of non-compliance in these situations. It is unclear why these producers are not aware of the advisories when other information such as website hits and farmer enquiries indicates that the advisories are well known by most producers.

6.7 Other environmental management concerns

Another disturbing finding of this compliance assessment was the number of lagoons that were either overflowing or were being pumped onto adjacent fields with the manure being allowed to escape into any depressions. There were five occurrences of manure pits overflowing (Figure 11), and one additional pit that was being pumped on to a harvested corn field (Figure 12). While the wet weather may have made emptying pits difficult in the fall of 2004, the practice of letting manure pits overflow onto fields and potentially into ditches and streams is a clear violation of *EMA*.

MoE staff followed up the aerial observations with a ground inspection in each of the six occurrences of pits spilling onto fields. While no contamination of surface waters was immediately obvious, these uncontrolled discharges pose a significant threat to surface and groundwater resources and fish and wildlife that depend on these resources. Follow-up advisory letters were sent to the producers responsible for each of these overflow occurrences and included requests for corrective actions to be taken. It is recommended that staff contact the producers in late summer of 2005 to determine what corrective actions have been taken and to reiterate the need to go into the rainy period with minimal quantities of manure in their lagoon. Producers should also be made aware that monitoring will be done over the next year and that appropriate action under the ministry's Compliance and Enforcement Policy and Procedure will be taken.

It is also recommended that MoE staff take every opportunity to speak with producers about the importance of avoiding these overflow situations. MoE staff have worked with producers in similar situations and have avoided these overflow situations by implementing measures that pose a lower risk to the environment. Producers need to exercise due diligence in their manure management practices and take advantage of programs, such as the EFP program, that are designed to avoid these situations.

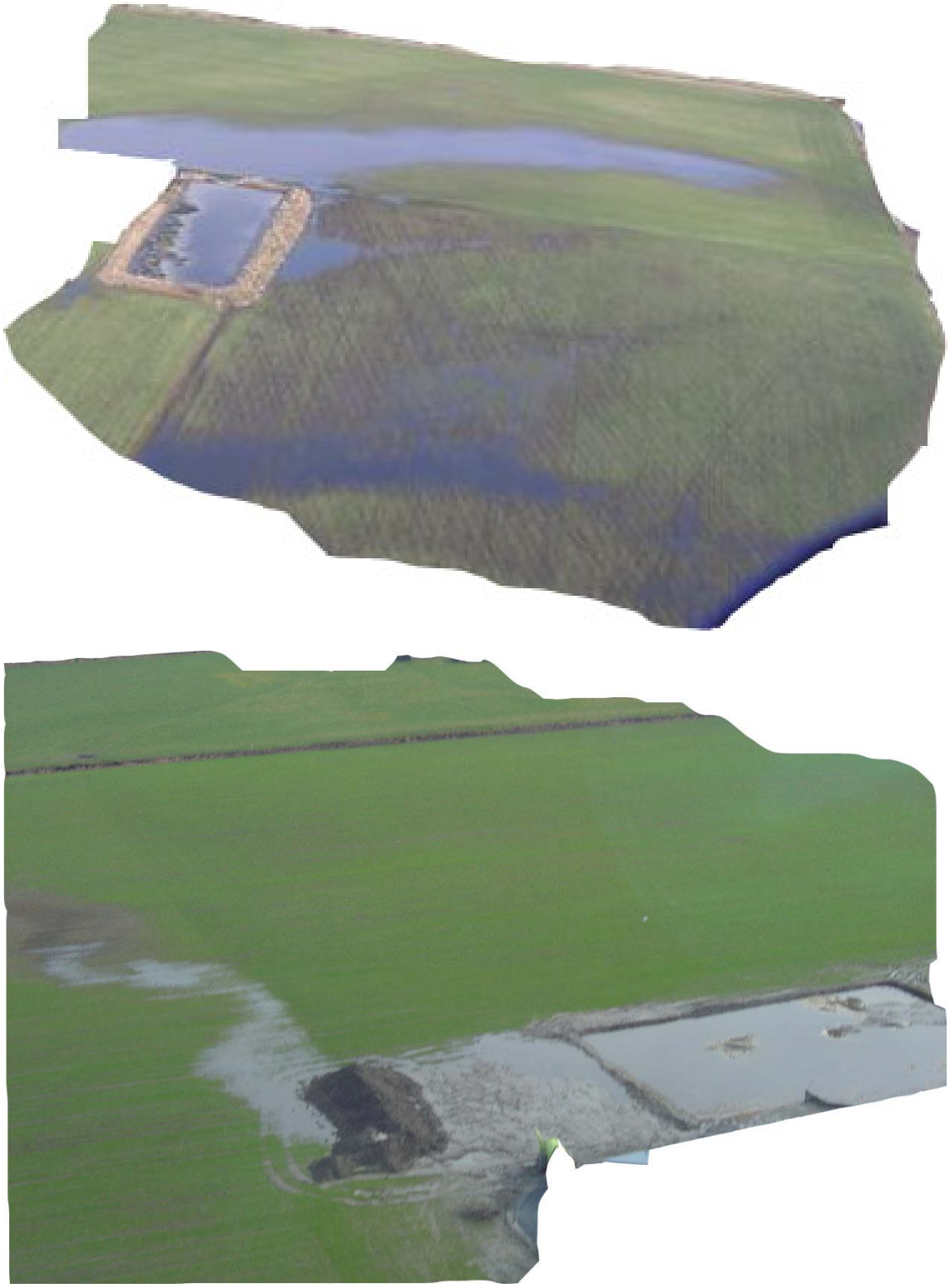

Figure 11: Examples of overflowing manure pits.

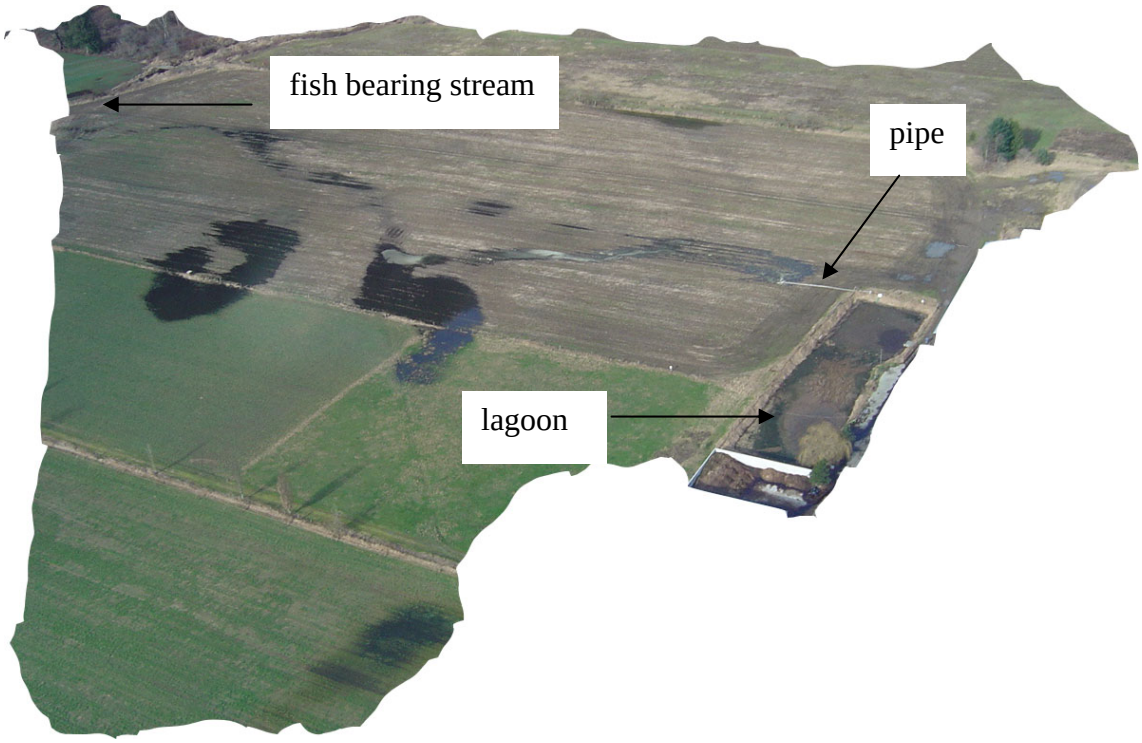

Figure 12: Manure being pumped out of a lagoon to a harvested corn field with potential runoff to a fish bearing stream.

7. Findings and Recommendations

This report has presented several findings and provides a number of recommendations for MoE staff to follow-up. In general, manure needs to be utilized as a fertilizer and managed in a manner that does not cause pollution. This typically requires that manure be spread on grassland when the grass is growing, at application rates that do not exceed crop nutrient uptake requirements, away from watercourses and avoiding wet or saturated soils.

The February 15 advisory indicated that the spreading of manure on grassland was considered acceptable given that the grass was likely beginning to grow in response to warmer conditions. The advisory contained other suggestions that were based on requirements in the *AWCR* and the *EMA*. Nineteen producers were observed to be spreading prior to the release of the February 15 manure spreading advisory. The observations made on the first flight indicated that manure spreading had occurred on at least 20 other farms shortly before the first flight took place. Twenty-one producers were observed to be spreading manure during the three flights that took place following the release of the February 15 advisory. The source of the manure was dairy farms in all but one of the occurrences.

Given that there are approximately 310 dairy farms in the study area, it appears up to 88% of the dairy farms are spreading manure at times that are consistent with the advisory in terms of appropriate timing for the first manure application in the spring. This high rate of compliance is consistent with MoE's and MAL's understanding that the manure spreading advisory is a widely

used tool throughout the dairy industry. It also suggests that there is likely no reason for a producer to be unaware of the manure spreading advisories.

Those producers found to be spreading prior to February 15th indicated that their manure storage lagoons were full and they had no choice but to spread. Some also indicated that they knew they did not have adequate storage. Given the nature of the precipitation in the fall of 2004, it was difficult for producers to get on their fields to empty their lagoons. Nevertheless, there are certain levels of due diligence that producers can implement to reduce the risk to the environment should their lagoons become full prior to the appropriate time to spread manure on grassland. For example, some producers have been able to store manure temporarily in a neighbour's lagoon and producers should be taking advantage of programs such as the EFP to improve storage capacity. If spreading is the only option, manure can be spread at light rates on grass fields that are higher in elevation and lack watercourses. These risk reducing measures were not observed in the situations where lagoons were overflowing.

MoE staff found that 90% of the spreading occurrences were on grass fields as per the recommendation of the advisory and as required by the *AWCR* and the *EMA*. Liquid manure was being spread in 37 of the 40 occurrences. Since liquid manure can not be considered a soil conditioner, it needs to be spread on ground where it can act as a fertilizer in a manner consistent with the *AWCR* and the *EMA*. Although three occurrences of manure spreading were on bare land, two of them involved solid manure. Because of its higher carbon to nitrogen ration, solid manure would be considered a soil conditioner in these instances and therefore would likely have been consistent with the *AWCR* and the *EMA*.

MoE staff also found that buffers were being used approximately 89% of the time – 100% of the time when producers were spreading after February 15 but only 70% of the time prior to February 15. Overall, a light or moderate rate of application was observed in 89% of the occurrences – 81% before and 95% after February 15.

Twelve ground inspections were completed based on the potential risk to the environment posed by manure spreading practices observed from the air. All twelve were likely in non-compliance with the *AWCR* and the *EMA*. Not surprisingly, only 42% and 25% of the interviewed producers were aware of the manure spreading advisories and the requirements of the *AWCR*, respectively. The non-compliance issues were discussed with the producer and a follow-up letter was sent requesting that MoE staff be notified of the corrective actions taken to remedy the non-compliance. The producers were also made aware of the Canada – British Columbia Environmental Farm Plan Program and encouraged to contact the program's representatives to determine if the program could help with their non-compliance problems. It is recommended that staff do additional follow-up with these producers prior to the end of the spreading period this fall.

Of significant concern to MoE staff was the five occurrences of overflowing manure pits. There was also one occurrence of a pit being pumped onto a bare field where the runoff had the potential to reach a stream which supported several species at risk. As discussed above, it is recognized that spreading conditions were not ideal in the fall of 2004 which led to pits that had greater than desired amounts of manure remaining in the pits at the start of the no spread season. Nevertheless, MoE would view overflowing manure pits as a contravention of *EMA* and there is

a certain degree of due diligence that needs to be practiced by producers prior to getting into an overflow situation. It is recommended that a manure spreading advisory be released in late summer to remind people that the fall weather is uncertain and every opportunity to reduce the level of manure stored in lagoons needs to be taken in the late summer and fall provided it is done in a manner consistent with the *AWCR*. In addition, it is recommended that staff contact the producers, with the overflowing lagoons, to ensure that appropriate action is being taken this fall to prevent a similar occurrence from occurring in the spring of 2006.

There are indications that levels of non-compliance with all aspects of the advisories, the *AWCR* and the *EMA* are higher for those producers spreading manure prior to the release of the February 15 advisory. For example, more spreading was occurring on bare land, more overflowing manure pits were observed, more spreading was occurring on wet soils, buffers were less likely to be used and application rates tended to be higher. It is unclear why this is although there is always a portion, in this case approximately 12%, of any industry that is consistently in non-compliance with regulatory requirements. It is recommended that, next year, MoE staff concentrate their compliance and enforcement efforts on spreading activities that may be occurring just prior to the release of the advisory that suggests spreading on grassland is appropriate. The Compliance and Enforcement Policy and Procedure will guide the response to observed instances of non-compliance.

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Appendix 1
Manure Spreading Advisory #1 - January 28, 2005
South Coastal Region

DISCLAIMER: The following advisory is produced by government, in partnership with industry, to provide guidance to farmers regarding the Agricultural Waste Control Regulation. If a discrepancy arises between this document and the legislation, the legislation takes precedence. Following this advisory does not relieve anyone from their obligations under the regulation. The Province of British Columbia does not guarantee the accuracy or completeness of the information referenced here from legislation, and in no event is the Province liable or responsible for damages of any kind arising out of its use.

The rain and mild weather in the past 2 weeks has resulted in the thawing of frozen fields and the "greening up" to some degree of grass fields. Many fields have standing water in them and soils range from being very wet to saturated. With current conditions, the fertilizer potential of manure is considered poor to moderate and the environmental risk (primarily due to runoff and secondarily to leaching) is still high.

In general, manure application is NOT ADVISED at this time due to very wet soil conditions. Manure application should only be considered on well-drained grass fields or well-established cover crop fields that are trafficable. Furthermore, application must be done in a manner that does not cause pollution. The Manure Application Risk Assessment Factsheet is one tool that producers can use to assist with making decisions regarding spreading activities.

All field stored solid manure must be covered from October 1 to April 1 inclusive in the South Coastal Region (areas with greater than 600 mm total average precipitation during this period).
The "Manure Spreading Advisory Committee" (consisting of industry and government representatives) will be monitoring weather and soil conditions and will issue further advisories as considered necessary.

Weblink of interest:
Agricultural Waste Control Regulation

For further information, please contact:
Orlando Schmidt, P.Ag. 604-556-3101
Rick Van Kleeck, P.Eng. 604-556-3108
Geoff Hughes-Games, P.Ag. 604-556-3102
For questions of a regulatory nature, please contact:
B.C. Ministry of Environment, Attn: George Rushworth 604-582-5308

Appendix 2
Manure Spreading Advisory #2 - February 11, 2005
South Coastal Region

DISCLAIMER: The following advisory is produced by government, in partnership with industry, to provide guidance to farmers regarding the Agricultural Waste Control Regulation. If a discrepancy arises between this document and the legislation, the legislation takes precedence. Following this advisory does not relieve anyone from their obligations under the regulation. The Province of British Columbia does not guarantee the accuracy or completeness of the information referenced here from legislation, and in no event is the Province liable or responsible for damages of any kind arising out of its use.

Manure application conditions are improving but still far from ideal in many locations. At this point, manure application should still only be considered on well-drained grass fields or well-established cover crop fields that are trafficable. Furthermore, application must be done in a manner that does not cause pollution.

Many fields have standing water in them and soils are still generally very wet. With current conditions, crop fertilizer needs are minimal, and the environmental risk (primarily due to runoff and secondarily to leaching) is still high.

It is recognized that some producers have very full manure storage facilities, due in part to the heavy rains in January. For producers in this situation, the most reasonable strategy in the short term is to spread a minimal amount of manure on the most well-drained grass fields (maintaining ample setbacks to watercourses), and then wait for further improvements in soil and cropping conditions before any major applications. Ultimately each producer is responsible to monitor soil, crop and weather conditions in order to determine the best time for manure application on their farm.

Keep in mind that all field stored manure must be covered from October 1 to April 1 inclusive in the South Coastal Region (areas with greater than 600 mm total average precipitation during this period). For producers who found their manure storage capacity inadequate this past winter, this is a great time to consider doing an Environmental Farm Plan as new funding opportunities are now available to assist farmers in implementing a wide variety of Beneficial Management Practices. See web link below for further information.

The "Manure Spreading Advisory Committee" (consisting of industry and government representatives) will be monitoring weather and soil conditions and will issue further advisories as considered necessary.

Weblinks of interest:
B.C. Environmental Farm Plan Program
Agricultural Waste Control Regulation

For further information, please contact:
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For questions of a regulatory nature, please contact:
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Appendix 3
Manure Spreading Advisory #3 - February 15, 2005
South Coastal Region

DISCLAIMER: The following advisory is produced by government, in partnership with industry, to provide guidance to farmers regarding the Agricultural Waste Control Regulation. If a discrepancy arises between this document and the legislation, the legislation takes precedence. Following this advisory does not relieve anyone from their obligations under the regulation. The Province of British Columbia does not guarantee the accuracy or completeness of the information referenced here from legislation, and in no event is the Province liable or responsible for damages of any kind arising out of its use.

With a forecast for sunshine and warmer temperatures towards the end of the week, manure application conditions should steadily improve. As long as fields are trafficable and wet areas are avoided, manure application to perennial grassland and well-established cover crops is considered acceptable.

Manure application to bare land is not advised at this time for most circumstances. Application to bare land may be considered acceptable for fertilization of early field crops, if the manure is incorporated as soon as possible after application and immediate planting of the crop is planned.

Manure application to established berry crops (i.e. raspberries) is also considered acceptable. Rates of application should follow berry industry guidelines (less than 100 kg total manure N/ha).

Keep in mind that application must be done in a manner that does not cause pollution. At this time of year, the greatest risk of pollution is due to surface runoff following heavy rains that may follow manure application. To minimize this risk, producers are advised to maintain reasonable setbacks to watercourses and only apply manure at rates matched to crop nutrient requirements.

Ultimately, each producer is responsible to monitor soil, crop and weather conditions in order to determine the best time and rate for manure application on their farm.

All field stored solid manure must be covered from October 1 to April 1 inclusive in the South Coastal Region (areas with greater than 600 mm total average precipitation during this period).
The "Manure Spreading Advisory Committee" (consisting of industry and government representatives) will be monitoring weather and soil conditions and will issue further advisories as considered necessary.

Weblinks of interest:
B.C. Environmental Farm Plan Program
Agricultural Waste Control Regulation

For further information, please contact:
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For questions of a regulatory nature, please contact:
B.C. Ministry of Environment, Attn: George Rushworth 604-582-5308

Appendix 4
Ministry of Environment
Winter Manure Spreading Assessment Flight Record Form

Date (yy/mm/dd):		**Time:**	
Recorder:			
Weather			
Farm Type:	**Dairy Hog Poultry Other**		
Approx. Farm Location:			
GPS Coords:			
Application Method	**Irrigation Gun** ☐	**Injector** ☐	**Vacuum Tanker** ☐
	Custom Spreader ☐	**Solid Spreader** ☐	**Other :**
Rate of Spreading:	**Heavy Mod Light**	**Type of Manure**	**Liquid Solid**
Crop Type:	**Grass Bare Other**		
Buffers Maintained:	**Yes No**		
General Comments:	**# barns; # lagoons; crops, colour of tractor**		

Appendix 5
Ministry of Environment
Winter Manure Spreading Assessment Questionnaire Form

Date (yy/mm/dd):		**Time:**	
Farm Type:		**Years in Operation:**	
Farm Name:		**Farm Address:**	
Farm Mailing Address:			
Name of Owner/Operator		**Phone No.:**	
Name of Assessment Participant		**Phone No.:**	
Ministry Representative:		**Weather Conditions:**	
Aquifer:		**Watershed:**	
Are there any wells on the property?		**Well depth**	
Total Area of Farm:			

I. Farm Inventory

Dairy			**Hog**			**Other**	
Livestock Type	**No. of Animals**		**Livestock Type**	**No. of Animals**		**Livestock Type**	**No. of Animals**
Milking Cows			**Sows**				
Dry Cows			**Nursing**				
Heifers			**Weaners**				
Calves			**Growers**				

II. Crop Inventory

Crop Type	**Crop Area**	**Tile Drained (Y/N)**	**Adjacent Watercourse (Y/N)**	**Last Date Spread On**	**Owned or Leased**

Total Crop Area: **Owned:** _____ **Leased:** _____

III. Nutrient Management

Does the farm have a nutrient management plan of any type in place?			**Yes**		**No**		
If Yes:	**Who developed the plan?**			**When was it developed?**			
Is soil tested for nutrient content?		**Yes**		**No**			
Is manure tested for nutrient content?		**Yes**		**No**			
Frequency of sampling:	**Manure:**		**Soil:**				
Crop requirements determined by:		**Application rate determined by:**					

IV. Manure Storage

Liquid Manure Storage							
Storage Type:	**Earthen Lagoon:**		**Cement Pit:**		**Other:**		
	If earthen, is it lined?		**Yes**		**No**		
Is the Storage facility covered?		**Yes**		**No**			
Is rainwater entry prevented?		**Yes**		**No**			
Maximum storage capacity (m^3 or days):		**Minimum freeboard (m):**					
Solid Manure Storage							
Field Storage:	**Yes**						
Is field stored manure covered?		**Yes**		**No**			
Storage Facility*:	**Yes**						
Is storage facility contained to prevent discharge?		**Yes**		**No**			
Other:							

*** A storage facility includes a structure, reservoir, lagoon, cistern, gutter tank or bermed area for containing agricultural waste prior to its use or disposal.**

V. Manure Application at the Time of Inspection

Application Method	**Irrigation Gun**		**Injector**		**Vacuum Tanker**		
	Custom Spreader		**Solid Spreader**		**Other:**		
Crop Spread on:		**Application Rate:**					
Soil Conditions							
Does the field have a history of flooding or runoff during this time period?				**Yes**		**No**	
Is the field frozen?		**Yes**		**No**			
Is the field saturated?		**Yes**		**No**			
Is the soil trafficable?		**Yes**		**No**			
Are there areas having standing water?		**Yes**		**No**			

Management Considerations						
Is there a buffer between the area where manure is applied and all watercourses (suggested minimum - 8 metres)?	☐	**Yes**	☐	**No**	☐	**NA**
Manure Application Rate						
Will the manure application rate provide 60 kg/ha of total manure nitrogen or less? *This is equivalent to about 2000 imperial gallons per acre with typical dairy manure.	☐	**Yes**	☐	**No**		
Weather Conditions						
Is significant precipitation forecast within the next 5 days?	☐	**Yes**	☐	**No**		

Is manure being applied in diverting winds? ☐ **Yes** ☐ **No**

Weather conditions during application: _____

Is farmer aware of the Manure Spreading Advisory?	☐	**Yes**	☐	**No**
Is farmer aware of the requirements of the AWCR?	☐	**Yes**	☐	**No**

Additional Comments:	

Appendix 6

Observed occurrences of manure spreading – February 7, 8, 10, 17, 23 and March 4, 2005

Flight Date	Site Number	Farm Type	App Meth	Manure Type	App Rate	Crop Type	Buffers	Comments
Feb 7	1	Dairy	Injector	Liquid	Heavy	Bare ground	n/a	no drain ditches apparent in area.
Feb 7	5	Other	Solid Sp	Solid	Mod	Bare ground	n/a	no drain ditches apparent in area.
Feb 7	12	Dairy	Side dis	Solid	Heavy	Bare ground	N	
Feb 7	13	Dairy	Vac Tank	Liquid	Mod	Grass	n/a	no drain ditches apparent in area.
Feb 7	16	Dairy	Vac Tank	Liquid	Mod	Grass	n/a	no drain ditches apparent in area.
Feb 7	17	Dairy	Vac Tank	Liquid	Mod	Grass	N	
Feb 8	1	Dairy	Vac Tank	Liquid	Heavy	Grass	Y	
Feb 8	2	Dairy	Injector	Liquid	Heavy	Grass	Y	
Feb 8	3	Dairy	Vac Tank	Liquid	Heavy	Grass	Y	Dragline/injector (partially on poor grass)
Feb 10	1	Dairy	Vac Tank	Liquid	Mod	Grass	n/a	no drain ditches apparent in area.
Feb 10	3	Dairy	Vac Tank	Liquid	Light	Grass	Y	
Feb 10	4	Dairy	Vac Tank	Liquid	Light	Grass	n/a	no drain ditches apparent in area.
Feb 10	5	Dairy	Vac Tank	Liquid	Mod	Grass	n/a	no drain ditches apparent in area.
Feb 10	6	Dairy	Vac Tank	Liquid	Mod	Grass	Y	
Feb 10	7	Dairy	Vac Tank	Liquid	Light	Grass	n/a	no drain ditches apparent in area.
Feb 10	8	Dairy	Vac Tank	Liquid	Light	Grass	n/a	no drain ditches apparent in area.
Feb 10	9	Dairy	Vac Tank	Liquid	Light	Grass	Y	good photo showing buffers
Feb 10	10	Dairy	Vac Tank	Liquid	Light	Grass	Y	
Feb 10	11	Dairy	Vac Tank	Liquid	Light	Grass	N	
Feb 17	1	Dairy	Solid Sp	Solid	Mod	Grass	Y	
Feb 17	2	Dairy	Vac Tank	Liquid	Mod	Grass	Y	
Feb 17	3	Dairy	Vac Tank	Liquid	Mod	Grass	n/a	
Feb 17	4	Dairy	Vac Tank	Liquid	Mod	Grass	Y	approximately10 m from ditch
Feb 23	1	Dairy	Vac Tank	Liquid	Light	Grass	n/a	no drain ditches apparent in area.
Feb 23	2	Dairy	Vac Tank	Liquid	Light	Grass	Y	
Feb 23	3	Dairy	Vac Tank	Liquid	Light	Grass	n/a	no drain ditches apparent in area.
Feb 23	4	Dairy	Vac Tank	Liquid	Light	Grass	Y	
Feb 23	5	Dairy	Vac Tank	Liquid	Light	Grass	Y	
Feb 23	6	Dairy	Vac Tank	Liquid	Light	Grass	Y	Manure spray into watercourse
Feb 23	7	Dairy	Vac Tank	Liquid	Mod	Grass	Y	Good example of buffers
Feb 23	8	Dairy	Vac Tank	Liquid	Light	Bare ground	Y	

Flight Date	Site Number	Farm Type	App Meth	Manure Type	App Rate	Crop Type	Buffers	Comments
Feb 23	9	Dairy	Vac Tank	Liquid	U/K	Grass	Y	Spreading rate U/K - injecting into soil
Feb 23	10	Dairy	Vac Tank	Liquid	Light	Grass	n/a	no drain ditches apparent in area.
Mar 4	1	Dairy	Vac Tank	Liquid	Mod	Grass	Y	
Mar 4	2	Dairy	Vac Tank	Liquid	Mod	Grass	Y	
Mar 4	4	Dairy	Vac Tank	Liquid	Mod	Grass	Y	
Mar 4	7	Dairy	Vac Tank	Liquid	Mod	Grass	Y	
Mar 4	8	Dairy	Vac Tank	Liquid	Light	Grass	Y	
Mar 4	9	Dairy	Vac Tank	Liquid	Light	Grass	Y	
Mar 4	10	Dairy	Vac Tank	Liquid	Heavy	Grass	Y	Very heavy application rate.