

Manure Nutrient Market Project Report

Prepared for the
Agri-Environmental Partnership of Alberta

June 16, 2009

Executive Summary

The Agri-Environmental Partnership of Alberta's vision is that Alberta's agriculture industry is profitable, accountable and recognized for its proactive, responsible environmental stewardship. In order to achieve this vision and with goal of ***optimal agriculture producer use of technology and nutrients, but adding value, saving costs and minimizing negative impacts on air, land and water*** in mind, a Manure Nutrient Market project team was initiated.

The strategic intent for the Manure Nutrient Market Project Team is to provide policy recommendations that will create an environment for effective utilization of livestock nutrient sources through viable, rural community-based, nutrient markets. The Project Team used the Agri-Environmental Partnership of Alberta's process of investigation of the issue, dialogue and consultation to reach consensus on the following recommendations.

The Agri-Environmental Partnership of Alberta (AEPA) recommends the following;

1. Alberta research funding agencies such as Alberta Advanced Education & Technology, Alberta Crop Industry Development Fund, Alberta Livestock and Meat Agency (ALMA), and Alberta Agricultural Research Institute consider the following activities as part of their strategic priorities:
 - Determine the value of organic matter through yield trials including raw and composted manure, as well as study water retention, efficiency and supply. Consider incorporation of the valuation of organic matter into existing studies. Access available or existing data from other jurisdictions.
 - Address gaps in nitrification and Greenhouse Gas (GHG) emissions, and determine the impacts of manure on GHG emissions. This research may lead to the protocol development in Alberta's Carbon Offset/Credit system. The research may include manure in various forms, timing of application, combinations with other nutrients (various percentage of fertilizer content) and/or manure as a soil amendment versus commercial fertilizers.
2. Industry organization(s) and/or AEPA will approach ARD and/or ALMA for funding and other resource support to conduct an economic analysis that would determine manure market options based on a cost/benefit analysis using variables such as:
 - Nitrogen limits & under phosphorus limits – assess regulatory impact
 - Raw manure (liquid – dairy & pork, solid – chicken & beef) & processed manure – compost, pellets/granular/prill
 - Suitable location based on nutrient loading in region, also access organic matter information
 - Assess backhauling opportunities to reduce producer transportation costs (i.e. haul cereal to feedlot, backhaul compost or pelleted product)
 - Explore alternative modes of transportation for manure hauling (i.e. pipeline for liquid, railcar for solid)
3. Alberta Agriculture and Rural Development work with Olds College or University of Lethbridge, local municipalities, and local industry partners to develop a pilot model for a manure exchange near Lethbridge or Lacombe/Ponoka that;
 - Brings together buyers, sellers, and applicators of manure
 - Could be a virtual or physical structure
 - Acts as a clearing house of information on manure management
 - Provides assistance on business planning/agreements

- Facilitates discussions, education, engagement with producers
 - Identifies collection points
 - Identifies regulatory issues in conjunction with the Natural Resource Conservation Board to identify regulatory issues
4. Industry organizations advance the understanding at the grass-roots (buyers, sellers, and applicators), the value and benefit of manure, promoting the manure exchange concept.
 5. To enhance the adoption of environmentally sound systems and technology, the Growing Forward policy framework, technologies and practices involving manure transportation, processing, and application be eligible for incentives in the area of Lean Manufacturing and Automation under 'Business Competitiveness'. Examples include:
 - Retrofitting equipment that would improve manure management efficiency
 - Funds to help move manure further distance, allowing better distribution of manure
 6. AEPA and Government of Alberta to work with Alberta Association of Municipalities and Counties to explore ways municipalities and counties can reduce impacts of moving manure such as initiatives that would provide and enhance infrastructure support.
 7. Alberta Agriculture and Rural Development in consultation with AEPA, investigates, reports on and potentially propose taxation changes that would enable a manure market. Report would focus on provincial taxation structures, identifies barriers and gaps and include:
 - Refundable investment tax credits that could apply to existing and new operations.
 - Incentives for smaller producers could qualify to purchase larger equipment to haul further distances
 - Incentives that consider differential cost to haul between shorter and longer distances
 8. Institute for Agriculture, Forestry and Environment (IAFE) consider *Renewable Fertilizer Policy* statements and manure-market based instruments in an ecosystem services policy framework. Policy may include standards similar to the *Renewable Fuel Standard* (RFS).
 9. Ensure that Government of Alberta considers any regulation and policy dealing with phosphorus limits (i.e. through cumulative effects management or regional planning in Land-use Framework) will:
 - Allow a three to five year window for the agriculture industry to comply with implementation
 - Be practical and feasible to implement for producers at a farm management level
 - Base decisions on science (i.e. limits based on scientific evidence of manure impacts to water)
 - Focus on areas in the province where manure management is an issue rather than using a 'blanket' provincial approach

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1. Introduction

Alberta has a significant volume of manure that could provide nutrients to the crop industry and enhance soil quality, with the potential to achieve economic and environmental outcomes. Efficient use of manure nutrients for crop production offers the best on-farm opportunity. A manure nutrient market would enable this integration of livestock and cropping systems, creating a demand for manure nutrients.

Currently in the province, livestock manure nutrient management is limited by land base requirements and land location. The potential of a manure nutrient market is dependent upon the competitiveness with fertilizer nutrients, reliable technologies, cost of application, control of nutrient losses, regulatory streamlining, labor/technical infrastructure supports, and effective policies to enable successful commercialization.

Localized manure markets between the livestock and cropping sectors exist in the province, with the trading/purchase of manure and compost as a fertilizer in various locations. To help expand and further develop a manure nutrient market in the province, the Agri-Environmental Partnership of Alberta (AEPA) established the Manure Nutrient Market Project Team (Appendix A) to develop recommendations to create the environment for Alberta to be recognized as a world leader for effective utilization of livestock nutrient sources through a viable, nutrient market.

The nine recommendations and conclusions drawn align with the following principles that; Government of Alberta and industry associations through their policies and programs recognize and acknowledge manure as a natural, renewable, recycled, and sustainable nutrient source and that confined feeding operations need to manage manure, which includes hauling/transportation.

The policy recommendations help address barriers and gaps to a manure nutrient market in Alberta, assist in market development, and address industry issues such as phosphorus loading in the soil. The recommendations allow for more effective utilization and distribution of manure, which benefits both the environment and the agriculture industry, and helps producers utilize manure economically and agronomically. The recommendations also assist the agricultural industry to address legislative policy, such as cumulative effects management in the Land-use Framework. AEPA members understand that at regional and provincial levels cumulative effects management will be used and thresholds will be established as part of a suite of policy and planning tools to manage impacts on air, land and water.

The strategic goal of AEPA's Manure Nutrient Market Project Team is to develop comprehensive policy recommendations that create an environment for effective utilization of livestock nutrient sources through a viable, rural community-based, nutrient market. The objectives of the Project Team are:

1. To align regulations and policies that will allow for nutrient market development to occur in a systematic and timely manner.
2. Establish producer based incentives that enhance adoption of effective nutrient utilization and practices.
3. Establish crop producer based incentives that encourage use of manure nutrients.
4. Create clusters of community stakeholders to increase opportunities for localized use and access to manure nutrient sources.

2. Process

In order to help achieve the strategic goal of developing comprehensive policy recommendations, the team went through a process of assessment and investigation of issues relating to manure markets in the province. In a series of face-to-face meetings and conference calls, the project team invited experts to examine and discuss key barriers and gaps. Other information sources were also utilized in the collection and investigation of issues (Appendix B). Through this consensus process, policy recommendations were approved by the AEPA members, and begin to build a framework that addresses areas such as research, economic studies, extension models, and strategies and policies.

2.1 Identified Barriers and Gaps

Throughout the course of the project, members identified five key areas of barriers and gaps. They include value of organic matter, developing a marketable product, transportation, equipment costs and Greenhouse gas implications of manure application.

- The *value of organic matter* in manure should be considered when evaluating the worth of manure. Properties such as soil building, water retention, water and nutrient efficiency is often not accounted for when estimating value. Usually comparative costs of commercial fertilizer nutrients are used to determine the value of manure nutrients (primarily nitrogen, phosphorus, and potassium)
- To understand the *marketable product(s) from manure*, purchasers of manure want to know what they are buying in terms of consistency and nutrient release. The more comparable to commercial fertilizer may increase the demand for manure as the former increase in price. A clearer understanding of marketing manure products may be needed for a viable manure nutrient market in Alberta.
- *Cost of transportation*, including infrastructure and distance was identified by Project Team members as a major barrier to effective utilization of manure nutrient sources. The distance to travel and spread manure is often the single determining factor as to where the manure is applied. Increasing fuel prices magnifies this issue and could limit the potential to create a manure nutrient market. The perception of the public and actions by local governments can also create barriers to manure transportation by limiting road access.
- *Equipment cost* was also considered a challenge for new purchaser of manure, who typically applies commercial fertilizer. The economics for equipment conversion that will haul, spread and potentially store manure can be a significant barrier for a producer.
- *Greenhouse Gas (GHG) implications* for manure application versus commercial fertilizer is not well understood. There may be value in reducing GHG emissions and capturing carbon in the soil through manure application, and this may also lead to opportunities in the carbon market.

2.2. Key Findings

Expert knowledge, research and economic studies and practical, common sense input helped project team members build a common understanding of the opportunities for a viable manure market in Alberta.

2.2.1 Value of Manure

The value of manure is determined from nutrients, organic matter, state (solid or liquid), yields, water retention and any combination or all of the above. Project team members learned the following:

- Solid manure is more difficult to value than liquid manure, and determining a value for organic matter in manure is very challenging.
- To estimate the value of manure the least accurate way was determined to be comparing nutrient content to chemical fertilizer. A better option would be to assign a value based yield

increases from trials. However, the challenge is attributing nutrients or organic matter to the yield increase, as nutrients will become available over time.

- Phosphorus levels in manure should be amended with nitrogen from commercial fertilizer to meet the agronomic need of plants. Manure has good phosphorus levels, however. Blending with other fertilizers with higher nitrogen, such as poultry manure, is an option.
- Processing manure to reduce water content improves nutrient concentration and increases the feasibility of transporting the product further distances. Processing, such as biodigestion and composting, can also kill weed seeds through elevated temperatures. Keep in mind the more times manure is handled or processed, the higher the cost.
- Backhauling of processed product from a feedlot is an option for crop producers, however some have found storage and handling in the field a challenge.
- Biodigestate from biogas facilities has a nutrient value of approximately \$30-\$40/ton (August 2008). Nutrient composition is approximately 2-2-2.
- Reclamation companies (for oil and gas sites) require organic matter for remediation and reclamation, but are hesitant to use manure because of the introduction of weeds and increased levels of chlorides and salts. Companies prefer to use alfalfa pellets that do not introduce weeds and have a varying nutrient content (not as variable as manure).

2.2.2 Marketable Product(s) from Manure

The Manure Nutrient Market Project Team explored several processes to enhance manure to a marketable product including pelleting and composting. EarthRenew has a manure pelleting pilot facility at Cattleland Feedyards, 10 km north of Strathmore. They have three product forms; pellets, granular (works in airseeders) and prill (works in hydroseeders for turf application, slope stabilization, etc.) and are marketing the organic matter at 50 to 52% in their products. The process heats manure to a temperature of 600° for 30-60 seconds to destroy pathogens and weed seeds. EarthRenew has compared the nutrient value of their products per tonne four times more than compost and ten times more than raw cattle manure.

Generally, EarthRenew has focused its marketing on the oil and gas industry for reclamation and some higher value crops such as potatoes and organic. It is not economically feasible for cropping producers to use the EarthRenew products at \$400/ton bulk. Market analysis shows currently there is not a strong market demand for their product in Alberta. However, states that have stricter legislation regarding the use of chemicals and fertilizers, such as California appear to be promising.

To encourage use in the cropping sector, manure composting research has been conducted by Alberta Agriculture and Rural Development using various sizes of operations and using different types of manure. Results Understanding that producers prefer a practical, low cost option to composting key findings show that ccomposting at the farm level with a front-end loader is possible. However, the process must be managed properly to ensure moisture and temperature levels are suitable for proper composing that includes turning regulatory and, minimizing compaction. The biggest barrier to composting was found to be the time invested. Many researchers, government staff and industry feel there needs to be a change in thinking regarding manure as a quality product opposed to a waste, as well as a better understanding of benefits of organic matter on cropland.

The *Agricultural Operation Practices Act* (AOPA) and the Natural Resource and Conservation Board (NRCB), would apply to on-farm composing and any farmer co-op with only manure on a single pad. It is important to note, AOPA legislation and regulation treats compost the same as raw manure, and there are no specific guidelines for composting. If other stocks like food or municipal waste are included, it falls under Alberta Environment and a permit is required.

2.2.3 Transportation and Equipment Cost

ARD conducted an economic study on *'The Economics of Manure vs. Chemical Fertilizer'* and concluded that transporting manure long distances is expensive and difficult because of its high moisture content and relatively low nutrient content. Increased handling costs limit the distance manure can be economically transported. The price of fuel and labour has also increased along with fertilizer prices. Based on September 2008 fertilizer prices, estimated calculations indicate beef manure is worth approximately \$24.21 per tonne, hog manure \$45.84 per 1000 gallon, dairy manure \$31.48 per 1000 gallon, and poultry manure \$88.87 per tonne. Valuations are only estimates and can change dramatically if fertilizer prices change or if the nutrient content of manure is different.

Assuming a specific crop rotation in the dark-brown soil zone, a test version of ARD's Manure Transportation Calculator estimated in a five-year cost-benefit analysis that beef manure can be economically shipped nine miles, hog manure twenty-two miles, dairy manure seventeen miles, and poultry manure thirty miles. It was assumed most of the benefits of manure are realized within five years of application.

There is evidence of manure exchange activity in Alberta. Census data indicates manure is being transferred from some counties with higher livestock intensities to counties with a greater cropping focus. ARD recommends that agreements to spread manure should be in writing to enhance clarity, expectations, and to reduce legal liability of the parties involved.

2.2.4 GHG Implications to Manure Application

In its first year, the carbon market was considered a success and all three aspects of the market were functioning. Performance credits were designed so that large greenhouse gas (GHG) emitters could either bank or trade credits with another larger emitter, an Offset system was established so that credits could be obtained through an Alberta approved protocol system/provider, and a technology fund was created that collected a tax on GHG emissions at \$15/tonne of CO₂ equivalent.

Protocols, verifiers and aggregators are some of the tools developed for the Offset system. Protocols are for actions taken back as far as 2002, and establish a baseline from which to measure improvement. The emission reduction needs to be over and above business as usual and it must be quantified and verified. Therefore record keeping is essential to the Offset system.

Auditors such as Price Waterhouse Coopers, third party verify and account for emission savings, that equipment was purchased and/or the protocol satisfies the environmental need. Aggregators pool small contracts for the buyers who need large amounts of "credits".

Protocol development requires a 'technical seed document', which reviews the existing data on the topic. If there is a gap in the science, default values can be used however numbers will be conservative and impact the coefficients used in the calculations. Science for manure and GHG emissions is complex with a large number of variables associated with manure management such as type of animal, spreading and processing or treatment. Existing protocols for the livestock industry include beef feeding additives, improving beef slaughtering and number of days on feed and also pork production and manure storage, hauling and application. Currently a Nitrous Oxide Reduction Protocol (NERP) is being developed, which offers the same opportunities for manure application that apply to fertilizer management ("Right Product@ Right Rate, Right Time, Right Place").

2.2.4 Extension

Alberta Agriculture and Rural Development have various extension initiatives and manure management tools that include the Manure & Compost Directory, the Manure Transportation Calculator, the Southern Region Nutrient Management Initiative, and the Liquid Manure Application project with dairy producers in Central Alberta. A Tri-Provincial Manure Conference will also take place in Alberta in 2009 that facilitates discussion among researchers and extension professionals on manure management. More extension information is needed on the value of manure to address concerns from cropping producers regarding weed seeds in raw manure, understanding opportunities of composting and liquid versus solid nutrient values. More time should be spent working in smaller groups with producers to focus the discussion, share information and better engage the industry.

2.2.5 Business Arrangements/Taxation

Promoting broad based, refundable, investment tax credits could enable both existing and new operations to participate in a nutrient manure market and enhance manure management practices. Government incentives, such as provincial tax credits might help smaller producers purchase larger equipment to haul further distances. Another option the project team explored was making Alberta Farm Fuel adjustments that would allow commercial manure haulers to use farm fuel as an incentive to haul manure greater distances for agronomic reasons.

Project team members recognized the following gaps in information and business management tools:

- Licensing arrangements and creating franchises with existing companies to supply manure.
- Break-even points in a cost/benefit analysis.
- Long-term contracts with manure producers (i.e. feedlots) and cropping sector are renewed on an annual basis.
- Pricing models that account for organic matter value as well as nutrient value.
- Supply and demand for composting in a retail market

3. Recommendations

The Agri-Environmental Partnership of Alberta recommends the following for manure market research, economic studies, and extension and policy development.

3.1 Recommendation for Research

The most accurate method of determining the value of organic matter is through yield trials, with the increase in crop production giving a more accurate picture of how organic matter is attributed to the increased yield. In Alberta, comprehensive yield trials have not been conducted with raw manure and compost. Having this information would assist the cropping and livestock sectors, providing additional information to help determine the value of manure when being traded.

Researching the impact of manure on GHG emissions leading to protocol development will provide additional information on the value of manure in the carbon market.

Recommendation 1: Alberta research funding agencies such as Alberta Advanced Education & Technology, Alberta Crop Industry Development Fund, Alberta Livestock and Meat Agency (ALMA), and Alberta Agricultural Research Institute consider the following activities as part of their strategic priorities:

- Determine the value of organic matter through yield trials including raw and composted manure, as well as study water retention, efficiency and supply. Consider incorporation

- of the valuation of organic matter into existing studies. Access available or existing data from other jurisdictions.
- Address gaps in nitrification and Greenhouse Gas (GHG) emissions, and determine the impacts of manure on GHG emissions. This research may lead to the protocol development in Alberta's Carbon Offset/Credit system. The research may include manure in various forms, timing of application, combinations with other nutrients (various percentage of fertilizer content) and/or manure as a soil amendment versus commercial fertilizers.

3.2 Recommendation for Economic Studies

Economic studies would help identify market options for the various manure types and forms throughout the province. It would help identify market opportunities based on the supply and the demand, as well as identify suitable locations based on existing soil nutrients and soil characteristics. Having this information will help establish a manure market by determining if economically, manure processing and application is feasible in the long term. This will help better match manure production to application because the marketability will have been improved, which would increase manure distribution.

Economic studies may also identify research or information gaps, and could also lead to the development of manure pricing models for long-term contracts. Results from this analysis would assist the agriculture industry in developing a decision making tool that would help individual producers make land use and investment decisions in regards to manure management and protecting the environment.

Recommendation 2: Industry organization(s) and/or AEPA will approach ARD and/or ALMA for funding and other resource support to conduct an economic analysis that would determine manure market options based on a cost/benefit analysis using variables such as:

- Nitrogen limits & under phosphorus limits – assess regulatory impact
- Raw manure (liquid – dairy & pork, solid – chicken & beef) & processed manure – compost, pellets/granular/prill
- Suitable location based on nutrient loading in region, also access organic matter information
- Assess backhauling opportunities to reduce producer transportation costs (i.e. haul cereal to feedlot, backhaul compost or pelleted product)
- Explore alternative modes of transportation for manure hauling (i.e. pipeline for liquid, railcar for solid)

3.3 Recommendation for Extension Models

To increase implementation and practical application of beneficial management systems and technology, a manure exchange pilot model would be established to target the areas with higher livestock concentrations with information, and provide resources to help enable an exchange of manure. The cropping and livestock sectors would both benefit with the increased awareness and knowledge of business and agronomic information, which would support business decisions. Once the pilot has been successfully established, the same or similar process can be implemented in other areas of the province.

Recommendation 3: Alberta Agriculture and Rural Development work with Olds College or University of Lethbridge, local municipalities, and local industry partners to develop a pilot model for a manure exchange near Lethbridge or Lacombe/Ponoka that;

- Brings together buyers, sellers, and applicators of manure
- Could be a virtual or physical structure

- Acts as a clearing house of information on manure management
- Provides assistance on business planning/agreements
- Facilitates discussions, education, engagement with producers
- Identifies collection points
- identifies regulatory issues in conjunction with the Natural Resource Conservation Board.

Recommendation 4: Industry organizations advance the understanding at the grass-roots (buys, sellers, and applicators), the value and benefit of manure, promoting the manure exchange concept.

Providing financial assistance to producers and applicators would increase the manure application radius, thereby reducing nutrient concentration and potential for phosphorus accumulation in the soil.

Recommendation 5: To enhance the adoption of environmentally sound systems and technology, the Growing Forward policy framework, technologies and practices involving manure transportation, processing, and application be eligible for incentives in the area of Lean Manufacturing and Automation under 'Business Competitiveness'. Examples include:

- Retrofitting equipment that would improve manure management efficiency
- Funds to help move manure further distance, allowing better distribution of manure

3.4 Recommendation for Strategies and Policies:

There has been increased concern by municipalities regarding the impact of manure transportation on road infrastructure. As a result, there has been an increase in monitoring and enforcement resulting in an increase of fines, and potentially road bans.

By increasing infrastructure support to municipalities, the Government of Alberta will reduce barriers to a manure market by allowing timeliness of operations (critical to the cropping sector), and reduce environmental risks by allowing manure to be applied at appropriate times of the year.

Recommendation 6: AEPA and Government of Alberta to work with Alberta Association of Municipalities and Counties to explore ways municipalities and counties can reduce impacts of moving manure such as initiatives that provide and enhance infrastructure support.

Another way to increase the potential for a manure market is to create taxation incentives that would provide more financial benefits to those who are willing to invest in manure management (i.e. larger equipment to haul further distances). With the implementation of tax changes benefiting distribution of manure, environmental risks are reduced, and the integration between the cropping and livestock sectors is increased.

Recommendation 7: Alberta Agriculture and Rural Development in consultation with AEPA, investigates, reports on and potentially propose taxation changes that would enable a manure market. Report would focus on provincial taxation structures, identifies barriers and gaps and include:

- Refundable investment tax credits that could apply to existing and new operations.
- Incentives for smaller producers could qualify to purchase larger equipment to haul further distances
- Incentives that consider differential cost to haul between shorter and longer distances

A mandate of the IAFE is to: 'Develop a recommended policy framework to identify and commercialize coherent, coordinated approaches for using market-based instruments to encourage practices that provide environmental good and services and contribute to the objective of Alberta's

Land-use Framework'. A *Renewable Fertilizer Policy* (or *Standard*) maybe included as a market-based instrument.

Recommendation 8: Institute for Agriculture, Forestry and Environment (IAFE) consider *Renewable Fertilizer Policy* statements and manure-market based instruments in an ecosystem services policy framework. Policy may include standards similar to the *Renewable Fuel Standard* (RFS).

The agriculture industry is supportive of manure management that allows the agronomic needs of crops to be met while reducing environmental risks. Allowing the industry time to work with regulations and policy that are based on science and targeted would help producers integrate required changes into business decisions, reducing negative economic impacts associated with required technological and management modifications.

Regulations that are practical and feasible would also help producers reduce costs, while reducing unintended negative consequences to the environment. For example, if phosphorus application regulations were based on annual plant use, manure would have to be injected/spread over many acres every year, requiring crops to be supplemented with chemical nitrogen. This results in more costs to producers, more soil compaction and tillage. If manure was allowed to be applied to meet nitrogen requirements in the first year, the excess phosphorus could be used in subsequent years when only chemical fertilizer was applied.

Recommendation 9: Ensure that Government of Alberta considers any regulation and policy dealing with phosphorus limits (i.e. through cumulative effects management or regional planning in Land-use Framework) will:

- Allow a three to five year window for the agriculture industry to comply with implementation
- Be practical and feasible to implement for producers at a farm management level
- Base decisions on science (i.e. limits based on scientific evidence of manure impacts to water)
- Focus on areas in the province where manure management is an issue rather than using a 'blanket' provincial approach

4. Conclusion

The nine policy recommendations help expand and further develop a manure nutrient market in the province, helping create the environment for Alberta to be recognized as a world leader for effective utilization of livestock nutrient sources through a viable, nutrient market.

These recommendations are in alignment with the principle that recognize and acknowledge manure as a natural, renewable, recycled, and sustainable fertilizer/nutrient source and that confined feeding operations need to manage manure, which includes hauling/transportation.

The recommendations allow for more effective utilization and distribution of manure, which benefits both the environment, as well as the agriculture industry, and address future legislative policy such as the Land-use Framework.

Appendix A: Manure Nutrient Market Project Team

Name	Organization
Rich Smith	Alberta Beef Producers (co-chair)
John Wozniak	Alberta Barley Commission (co-chair)
Will Kingma	Alberta Pork
Graham Caskey	Alberta Canola Producer
Martin Van Diemen	Alberta Chicken Producers
Albert Kamps	Alberta Milk
Hugh Bailey	Agriculture and Agri-Food Canada
Donna Chaw	Alberta Environment
 Project Manager	
Janet Dietrich	Alberta Agriculture and Rural Development

Appendix B: Guest Speakers and Information Sources

Guest Speakers:

Value of Manure

Dr. Jeff Schoenau, Research Scientist - University of Saskatchewan

Marketable Products

Earl Jenson, Mechanical Engineer - Alberta Research Council

Peter Morrison, Owner - Roseburn Ranches

Virginia Nelson, Project Engineer - Alberta Agriculture and Rural Development

Equipment Limitations & Transportation

Chris Panter, Competitiveness Analyst - Alberta Agriculture and Rural Development
(author: 'The Economics of Manure vs. Chemical Fertilizer')

GHG Implications of Manure Application

Tom Goddard, Senior Manager, Environmental Policy - Agriculture & Rural Development

Len Kryzanowski, Section Lead, Land Use Management – Agriculture & Rural Development

Extension

Trevor Wallace, Nutrient Management Specialist - Alberta Agriculture and Rural Development

Business Arrangements/Taxation

Merle Good, Provincial Tax Specialist - Alberta Agriculture and Rural Development

Other Information Sources:

Manure Markets - Maryland

Doug Parker, Associate Professor, Department of Agricultural and Resource Economic
University of Maryland

Land-use Framework

Lori Enns, Senior Policy Analyst, Environmental/Land Use - Agriculture & Rural Development

Marketable Products

Troy Bulbuck, General Manager – EarthRenew

Marshall Eliason, Branch Head, Information Systems and Program Management - Alberta
Agriculture and Rural Development

Tanya McDonald, Research Associate - Olds College School of Innovation

Troy Bulbuck, General Manager – EarthRenew

Sunguno Wang, Program Leader, Waste Materials Engineering - Alberta Research Council