University of Manitoba Expert Panel Review of Measures to Protect Lake Winnipeg

April 2014

UNIVERSITY OF MANITOBA

Contents

1. Executive Summary

- Manitoba Agriculture, Food and Rural Development (MAFRD) and Manitoba Conservation and Water Stewardship (CWS) have developed infrastructure and environmental measures that are proposed to meet the definition of 'environmentally sound treatment' of hog manure under the Environment Act.
- The departments sought an external review of these measures.
- A panel of experts from Faculties of Science and Agricultural and Food Sciences was formed, coordinated by the Watershed Systems Research Program, bringing together expertise in soil science, land application of manure, best management practices to protect water quality and manure treatment, and water quality/limnology.
- The panel was given 4 weeks to carry out the review and write its report. Given the short timelines, the panel used its collective knowledge to make comments and recommendations, and no literature review was done.
- The proposals affect only new and expanding hog operations, so the impact on the industry is likely to be small and, given the large number of other sources of nutrient loading to Lake Winnipeg, the proposed measures will make little or any difference to the health of Lake Winnipeg.
- The existing and proposed regulations included infrastructure and manure treatment systems. The panel questioned the need for these where hog farmers had sufficient land area to apply manures at rates where nutrient application could be balanced with crop removal.
- The infrastructure measures focus on concentrating phosphorus in the solid fraction of the hog manure and making it more manageable for transporting further, which is a logical step.
- The existing and proposed infrastructure measures by themselves, do not determine the risk of manure nutrient loss from agricultural land. Therefore, even though these infrastructure measures may help some farms to address the challenge with balancing rates of manure nutrient application with nutrient removal by crops, the infrastructure on its own, will not provide protection for Lake Winnipeg.
- The panel agreed that management of manure application on agricultural land is key – proper placement is one of the '4Rs' in nutrient management, to reduce the risk of losses of phosphorus to water.
- The justification for 48 hours between spreading and incorporation seemed practical, and should reduce phosphorus losses to water.
- The land-based requirements, which intend to limit phosphorus accumulation in soils, are sound, and address another of the '4Rs' of nutrient management practices to reduce phosphorus losses.
- Proposals included changes to setbacks and the creation of no-development zones. These addressed the surplus phosphorus in the RMs of La Broquerie and Hanover, and are a logical step.

- Proposals to align the setbacks in the Livestock Manure and Mortalities Management Regulation with those in the Nutrient Management Regulations, will achieve legislative consistency, but make no practical difference to the risk of nutrient loss.
- By raising the standards for the way that manure nutrients are applied on agricultural land, the proposed measures are more comprehensive than the existing requirement for anaerobic digestion, alone. Therefore, the proposed measures represent beneficial management practices that are more "environmentally sound" than those currently in place and which will minimize the environmental impact of any increase in pork production on Lake Winnipeg.

2. Recommendations

I. The panel recommends that communication to the public and stakeholders should highlight the good work that has already been done to reduce phosphorus losses from hog operations to waterways.

II. The panel recommends that all technical terms are clearly defined in the communications to public and stakeholders, and their application is clear.

III. The panel recommends that provision is made within the regulations to enable hog farms to expand without the need for manure infrastructure and treatment where they can meet the land availability requirements.

IV. The panel recommends that a full review of the infrastructure options for manure separation and their costs and benefits is completed and published (the panel acknowledges that much of this work has nearly been completed by the Manitoba Livestock Manure Management Initiative).

V. The panel recommends research into the methods for injection, or broadcast and incorporation for their effectiveness at reducing losses of phosphorus to water.

VI. The panel recommends that communications on these proposals to the public and stakeholders includes maps that show the likely areas where these more stringent regulatory phosphorus thresholds could apply.

VII. The panel recommends that communications on these proposals to the public and stakeholders includes maps that show the likely areas where these no development zones are anticipated.

VIII. The panel recommends that in the longer term, a risk-based approach to defining setbacks that considers site-specific connectivity and other factors rather than just proximity is researched and considered for regulations.

3. Expert panel terms of reference

Background

Manitoba Agriculture, Food and Rural Development (MAFRD) and Manitoba Conservation and Water Stewardship (CWS) have developed infrastructure and environmental management measures that are proposed to meet the definition of "environmentally sound treatment" of hog manure under *The Environment Act*. The concept of "environmentally sound treatment" was included under *The Save Lake Winnipeg Act* to improve protection of Lake Winnipeg from nutrient enrichment. The departments have requested a brief external review to ensure that the proposed infrastructure and environmental management measures for the hog sector will protect Lake Winnipeg.

Expert panel

A panel of experts from Faculties of Science and Agricultural and Food Sciences formed a review panel. These included the following representatives, who brought together expertise in soil science, land application of manure, best management practices to protect water quality and for manure treatment, and water quality/limnology:

Dr Selena Randall	-	Research Development Coordinator, Watershed Systems Research Program
Dr Don Flaten	-	Professor, Soil Science
Dr Wole Akinremi	-	Professor, Soil Science
Dr Gordon Goldsborough		Professor, Biological Sciences

The panel was provided with the proposals on February 25 2014, and given a deadline of March 24 2014 to provide a completed review.

The time given for the review was extremely short. The information provided to the panel was limited to the proposed changes, with some comments on the management aspects (Section 3). The panel was asked to comment on whether the proposals were the best approach. The comments made in this document are based on the knowledge of the panel members, and readily available documentation known to them. It is not based on any literature review.

Expert panel terms of reference

The terms of reference of the panel were as follows:

(i) To provide informed and impartial opinion on the measures set out in the proposed infrastructure and environmental management measures, based on the knowledge and experience of the panel members and others who they are able to consult in the time available.

(ii) To review the document provided by MAFRD and CWS on the proposed technical infrastructure solutions and environmental management requirements for the environmentally sound treatment of hog manure.

(iii) To provide an assessment of the effectiveness of the proposed infrastructure solutions and environmental management practices in relation to the health of Lake Winnipeg based on professional opinion.

(iv) To provide professional opinion on the proposed infrastructure solutions and environmental management practices and whether they are best practices for the protection of Lake Winnipeg and other surface waters.

(v) To provide advice on additional measures that could be considered as “environmentally sound treatment".

(vi) To provide an assessment of the effectiveness of the proposed options for setback and no development zones around Lake Winnipeg.

(vii) To provide professional opinion on the proposed setback and no development zones around Lake Winnipeg and provide advice on whether they are best practices for the protection of Lake Winnipeg and other surface waters.

(viii) To provide comparisons of the measures proposed with measures already in place in other jurisdictions, where appropriate.

(ix) To comment publicly on the review and on the proposed measures as required.

4. Proposed measures to save Lake Winnipeg

Overview document **February 24, 2014**

1) Environmentally Sound Treatment Necessary to Expand Pig Inventory

The Environment Act requires pig producers to implement environmentally sound treatment to expand the number of animal units. The concept of environmentally sound treatment was included under *The Save Lake Winnipeg Act* to improve protection of Lake Winnipeg from nutrient enrichment. This requirement is exclusive to pigs Manitoba Agriculture, Food and Rural Development (MAFRD) and Manitoba Conservation and Water Stewardship (CWS) have developed infrastructure and environmental management measures that in combination are proposed to meet the definition of environmentally sound treatment of hog manure which is similar to or better than anaerobic digestion under *The Environment Act*.

A) Infrastructure

Solid-liquid separation results in the concentration of solids (and consequently phosphorus) to allow for better nutrient management, specifically in providing reduced transportation costs to take the phosphorus-rich solids further away. Local conditions, such as livestock density, must be considered in the selection of treatment. The treatment infrastructure should be capable of meeting the requirements of the Evaluation of Manure Treatment Infrastructure guideline provided in Appendix 1.

The following treatment options for liquid and semi-solid manure are proposed:

- **Additional Cell(s)** on manure storage facilities to facilitate gravity separation (passive treatment)
- **Settling Basin(s)** (passive treatment)
- **Mechanical Technologies**, such as the screw press, rotary press, air flotation system, centrifuge etc. which may or may not include flocculants.

Solid manures can be composted to concentrate nutrients (including phosphorus) and reduce volume thereby reducing transportation costs and allowing better nutrient management.

Composting in a permitted manure storage facility (engineered pad) is proposed as treatment for solid manure.

Management of the end products of treatment is key; reducing transportation cost does not specifically ensure that beneficial management practices will be implemented once infrastructure is approved. Therefore, environmental management requirements are provided below.

B) Management

Injection or incorporation within 48 hours, minimum land base requirements, a more stringent regulatory phosphorus threshold could, when combined with infrastructure described in (A), be considered environmentally sound treatment.

More discussion is provided below and in Appendix 2.

Injection/Incorporation

- Management would include either injection or incorporation within 48 hours of manure application on all annual crops during all seasons (excluding in-season application to a growing crop and no-till crops). More explanation and exemptions are provided in the appended table.

- *Land Base Requirements* The minimum land base requirement would be equal to the area necessary for a 1x crop removal of phosphorus. Only fields with spread agreements or those under control of the operator (leased or owned) would be eligible.

  Proponents of livestock operations must identify sufficient suitable land to implement an appropriate manure management plan. This is part of the site assessment form for municipal approvals of operations greater than 300 animal units. It is also required for a permit to construct or expand a manure storage facility. Lands located in areas where nutrient application is prohibited, fields with soil test phosphorus greater than 60 ppm Olsen P, and land recently identified by other operators who spread manure are considered ineligible.

- *More Stringent Regulatory Phosphorus Thresholds* New and expanding pig operations would be subject to a more stringent regulatory phosphorus threshold. It is recommended that the application of manure be prohibited on fields with soil test phosphorus of ≥60 ppm Olsen P. Manure application is currently allowed on soils up to 180 ppm Olsen P.

2) Proposed options for increasing setbacks and/or creating no development zones

Manitoba Conservation and Water Stewardship and Manitoba Agriculture, Food and Rural Development have developed options for increasing setbacks and/or creating no development zones that may further protect water quality and the health of Lake Winnipeg. There are also several existing no development zones (Nutrient Management Zone N4 for example) that provide existing protection to water quality.

Current and proposed no-development zones and setbacks are as follows:

1. <u>No development zones based on areas of intensive existing development</u>

a) Currently, new and expanding pig operations must identify either adequate land base or propose manure treatment infrastructure to obtain provincial approvals. Provincial approvals are also required for construction/expansion of a manure storage facility or confined livestock area.

Adequate land base for manure application currently depends on livestock density. In low density areas proponents must identify enough land to apply manure at a rate equivalent to 2x crop removal rate. In RMs of Hanover and La Broquerie (certain areas where phosphorus is in surplus) proponents must identify adequate land base to apply manure at a rate equivalent to the crop removal rate of phosphorus (1x).

b) It is proposed that no new pig operations be granted approval to establish in RMs of Hanover or La Broquerie. Recent Census of Agriculture data by municipality were used to calculate phosphorus balances. Only the RMs of Hanover and La Broquerie were determined to have a phosphorus surplus in excess of 25 kg P2O5/ha (Loro et al., 2013).

Existing operations in Hanover and La Broquerie will be allowed to expand provided they can identify adequate land base to apply manure at a rate equivalent to the crop removal rate of phosphorus (1x).

It is also proposed that all new and expanding pig operations (regardless of location) be required to identify adequate land base to apply manure at a rate equivalent to the crop removal rate of phosphorus (1x). The proposed 1x land base for phosphorus will, in small pockets of intensively developed areas, limit establishment and expansion as adequate spread fields may not be available for new and expanding pig operations.

2. No development zones based on areas where soil test phosphorus >60 ppm

a) Currently, manure may only be applied to fields with <180 ppm Olsen phosphorus. The proponent is required to provide soil test results during the infrastructure construction/expansion permitting process and as part of the annual manure management plan. A manure management plan will not be registered if soil test phosphorus ≥180 ppm phosphorus.

b) It is proposed that all fields with 60 ppm phosphorus or greater not be used for application of manure from a new or expanding pig operation. Scientific research has shown that phosphorus runoff is correlated to soil test phosphorus concentrations (Sawka, 2009 and Rheault, 2012). This proposed change will result in a reduced risk of phosphorus runoff and thereby help protect water quality.

3. No development zones based on sensitive areas for groundwater and surface water protection

a) Currently, the application of manure and siting of manure storage facilities and confined livestock areas on Nutrient Management Zone N4 soils is prohibited under the Nutrient Management Regulation. Zone N4 soils have severe limitations with respect to crop production and have an agriculture capability rating of class 6, 7, or unimproved organics. These no go zones include steeply sloping lands, surface bedrock outcrops, inundated soils, stabilized or active sand dunes, marshes, swamps, bogs, and fens.

No changes are proposed to this provision.

4. No development zones based on land use planning

a) Currently, livestock operation policies within development plans allow municipalities to delineate areas where livestock operations are prohibited. Livestock operation policies are intended to address the non-environmental public concerns associated with livestock development and not necessarily to protect water quality. However, some development plans may include provisions to protect water quality.

No changes are proposed to this provision.

5. Manure application setbacks to groundwater and surface water features

Manure application setbacks are currently included in existing legislation but additional setbacks are recommended. The Livestock Manure and Mortalities Management Regulation would be amended to incorporate setbacks from groundwater features, vulnerable water bodies,

as well as major marshes, bogs, or swamps, consistent with the existing restrictions in the Nutrient Management Regulation.

6. Manure storage setbacks to groundwater and surface water features

The existing Livestock Manure and Mortalities Management Regulation requires that all new manure storage facilities and confined livestock areas shall be 100 metres from a surface or groundwater feature.

No changes are proposed to this provision.

References

Loro, Petra, Mehdi Arzandah, Derek Brewin, Wole Akinremi, Collin Gyles and Dupe Ige. 2013. Estimating Soil Phosphorus Budgets For Rural Municipalities in Manitoba. Manitoba Livestock Manure Management Initiative Project # MLMMI 2010-19-L. [Online] Available: http://manure.mb.ca/projects/pdfs/Final%20Report%202010-19-L%20Estimating%20Soil%20Phosphorus%20Budgets%20by%20Municipality.pdf. [18 February 2014].

Rheault, D.G. 2012. Relationship between soil phosphorus and runoff phosphorus losses from plot scale rainfall simulations on Manitoba soils. A Thesis submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfilment of the requirements of the degree of Master of Science. 197 pp. [Online] Available: http://mspace.lib.umanitoba.ca/bitstream/1993/8765/1/Rheault_Daniel.pdf. [18 February 2014].

Sawka, C.A.D. 2009. Relationship between chemical analyses of P in soil and P loss in simulated runoff. M.Sc. thesis submitted at the University of Manitoba, Winnipeg. 164 pp. [Online] Available: http://mspace.lib.umanitoba.ca/bitstream/1993/21586/1/Sawka_Relationship_between.pdf. [18 February 2014].

Appendix 1

Evaluation of Manure Treatment Infrastructure

Intent:

The intent is to establish principles that are to be used by the Director to evaluate the infrastructure component of another environmentally sound treatment that is similar to or better than anaerobic digestion for issuance of permits to construct new or expand a manure storage facility for pig as required by section 40.1(2)(a).

This is not intended to describe the additional management components for environmentally sound treatment required by section 40.1(2)(a).

Procedure:
The director shall consider the following principles when processing an application for a permit to construct or expand a manure storage facility for a proposed development or expansion of a pig operation. Each of the mandatory principles must be fulfilled to the satisfaction of the Director in order for an application to qualify for the issuance of a permit. Beneficial principles are not mandatory but would enhance the qualification.

Mandatory principles:
Shall include the following infrastructure: i) Permanent engineer designed composting pad (for solid manure only); ii) Additional Cell(s) to facilitate gravity separation (passive treatment); iii) Settling Basin(s) (passive treatment); or iv) mechanical technologies that may or may not be combined with a chemical process;

Shall enable effective concentration of solids into components of differing dry matter concentration (liquid or semi-solid manure only)

Shall enable concentration of nutrients;

Shall enable best utilization of nutrients to optimize crop requirements; and

Shall enable economical long distance transport of nutrients

Beneficial principles:
May reduce greenhouse gas emissions; and
May reduce water usage or facilitate significant recycling of water

Policy & Legislation Cross Reference: *The Environment Act* sections:
40.1(1)
40.1(2)

Appendix 2
Proposed Management to Accompany Infrastructure as Discussed under Environmentally Sound Treatment

Category	Requirement	Comments	Amendment MR 42/98	Administration
Injection/ Incorporation within 48 hours	Mandatory unless perennial, no till or in-season	Reduces direct contact of manure with precipitation and snowmelt. Exemption allows for expansion in low livestock density areas where the proportion of no-till and perennial crops may be significant. Does not address no-till and perennial losses. These losses may be particularly significant when manure is applied in late fall when the crop is no longer growing and removing nutrients. Extra passes of equipment required to incorporate manure will increase costs, soil compaction and greenhouse gas emissions.	Yes: 14.2	Method of manure application should be identified in initial municipal and provincial approvals. No manure management plan registration of fields where mandatory injection/incorporation cannot be achieved.
Land Base Requirements	Must identify 1 X land prior to approvals for construction/expansion.		Yes: 12.2	Required for respective municipal and provincial approvals to establish, expand an operation and manure storage facility.
More Stringent Regulatory Phosphorus Threshold	Allow manure application rates up to the annual nitrogen requirements of the crop on soils that have less than 60 ppm Olsen P. Prohibit application of manure on fields with 60 ppm Olsen P or greater.	Improves water protection as it eliminates the risk of soil test phosphorus building to the current 180ppm. Phosphorus could still accumulate in soils up to 60 ppm. Does not eliminate the risk of phosphorus loss in runoff.	Yes: 12.1	Fields in manure management plans with soil test phosphorus of 60 ppm or higher would not be registered.

5. Expert panel comments

General comments

The goal of the Save Lake Winnipeg Act is to reduce nutrient loading to the lake, and includes measures such as a ban on construction and expansion of the hog industry. The proposals set out environmentally sound treatment options that would enable the hog industry to expand without negatively impacting on Lake Winnipeg. They apply only to new or expanding farms.

The panel has considered these proposals as set out in section 4, and has focused its review on the relative differences between the regulations for existing hog operations, compared to the regulations proposed for new and expanding operations. The panel has not quantified the impact of these regulations on the industry or the costs of implementing them. The panel has also not quantified the likely impact of the proposals on nutrient loadings to Lake Winnipeg.

The regulatory measures proposed focus on the management and spreading of manures. The panel recognised that there are other beneficial management practices that are recommended to producers through extension and education that will also contribute to management of nutrients (especially phosphorus) in water. **The panel recommends that communication to the public and stakeholders should highlight the good work that has already been done to reduce phosphorus losses from hog operations to waterways.**

Information from MAFRD suggests that Manitoba pig processors have estimated there to be a 1.5-1.8M pig shortage, based on current slaughter capacity. This suggests a need to expand, although the panel did not consider where this expansion is needed or suited. **The panel recommends that an assessment of the likely industry expansion be carried out.**

The panel found some aspects of the proposals confusing until clarification was provided. **The panel recommends that all technical terms are clearly defined in the communications to public and stakeholders, and their application is clear.**

The measures proposed will minimize excess phosphorus loading on agricultural land associated with new and expanding hog operations. However, since this number of farms is relatively small and because there are many other small contributors to nutrient loading in Lake Winnipeg, the impact of these regulations on the overall health of Lake Winnipeg will make little, if any difference. However, these measures do allow for expansion of the hog industry and, in the opinion of the panel, and they include measures that are best management practices for reducing the risk of phosphorus losses to water.

Specific comments

1) Environmentally sound treatment necessary to expand pig inventory

The proposals are for all new and expanding pig farms to meet the manure treatment infrastructure and management requirements. However, in the view of the panel if the land availability requirement can be met without manure treatment, then elaborate and costly manure treatment is unnecessary. **The panel recommends that provision is made within the regulations to enable hog farms to expand without the need for manure treatment where they can meet the land availability requirements.**

However, the expert panel recognized that manure treatment may be beneficial in some situations. For example, all of these treatment options can help to concentrate the amount of P in specific fractions of liquid and solid manure and can therefore help enable longer distances for transporting manure P. This long distance transport is essential for moving more manure P further away from areas with a high density of livestock operations and onto larger areas of cropland, where it is easier to balance manure P application with crop removal.

a) Infrastructure

Several treatment options are given, which allows some flexibility for producers in areas where there is a high density of livestock operations. The techniques are not described or compared in detail, which means that the degree to which a specific type of treatment system will meet the principles set out in Appendix 1 is not known. However, the principles outlined in Appendix 1 of the proposals are sound in the opinion of the panel.

The manure treatment techniques are not described in any detail, and include just a few examples. Due the short time available for the review, the panel has not carried out its own analysis of all the possible options or attempted to carry out any comparisons on their effectiveness. However, the panel is aware that these techniques have recently been reviewed for the Livestock and Manure Management Initiative (MLMMI) and are available on the MLMMI website. Based on these reviews and other literature, the panel anticipates that each of these techniques will have different capital cost, management costs, operational challenges and different efficiencies for removing phosphorus. The panel is also aware that some of these techniques have been studied locally by the Prairie Agricultural Machinery Institute (PAMI); some of the results are also shared on the MLMMI website; and they are all techniques considered best available technique options for the Intensive Livestock sector in Europe (JRC, 2013).

The panel recommends that a full review of the infrastructure options for manure separation and their costs and benefits is completed and published.

The proposed manure treatment techniques will contribute to the management of the manure, to improve the practical transport options available to producers in situations where their land base would otherwise be insufficient. These treatments will enable manure phosphorus to be transported further to areas with lower concentrations of soil test P. However, the manure treatment infrastructure is not necessary where there is sufficient land-base, and adds extra costs to the producer for little environmental benefit. Also, the existing or proposed manure treatment measures on their own will not have any impact on the health of Lake Winnipeg, since they do not directly address phosphorus losses to water.

b) Management

The panel absolutely agrees that manure management in the field is most important issue for protecting water quality. Proper placement is one of the most important "4Rs" for nutrient management. Subsurface placement reduces the risk of "incidental" runoff losses of the raw manure and it also encourages more interaction between manure P and soil components that retain and stabilize manure P.

- *Injection of manures or incorporation within 48 hours –*

Information collected from Manure Management Plans by Manitoba Conservation and Water Stewardship indicates that 170,000 acres were spread by pig producers in 2012 (1/5 in Hanover and La Broquerie). Approximately 70-80% of pig producers inject or broadcast, then incorporate their manure. Most non-incorporated manure is applied to land that is in forages or permanent vegetative cover. Therefore, these proposals are unlikely to result in a change in practice.

The panel understands that these measures apply to liquid swine manure, separated solids or separated liquids. **The panel is not aware of any analysis of the methods for injection, or broadcast and incorporation for their effectiveness at reducing losses of phosphorus to water under Manitoba conditions, and highlights this as a research need.**

The panel assumed the 48-hour period between the spreading activity and the incorporation was chosen for practical reasons, and is directed mostly towards reducing the risk of incidental phosphorus losses to water, where in the opinion of the panel they are likely to be effective.

However, the panel noted that in warm weather, much of the ammonia-N will be lost within 24 hours, and the principle of incorporation is to get the nutrients in contact with soil as soon as possible to maximise what is available for plants. The EU, which takes an integrated approach to protect air, land and water, is considering incorporation of manures from intensive livestock operations within 4 hours (it's currently 24) as best practice to reduce nutrient losses through run-off as well as ammonia emissions and odour. The panel recognized that these proposals are primarily focused on phosphorus losses, in a semi-arid environment where rainfall driven run-off is of less of a concern, and where odour is managed through separate regulations.

Perennial and in-season situations are a sensible exclusion. Given the variety of ecological benefits of midseason applications, perennial forages and zero-till crop production systems, we don't want to discourage those practices simply for the purpose of injecting or incorporating manure (e.g., ploughing up grassland simply to enable manure application).

- *Land-base requirements* –

The land base requirement establishes the total amount of land that the operation would require for the long-term sustainability of the operation. New and expanding hog farmers will have to demonstrate that their operation has access to enough land to balance nutrient excretion with crop P removal. This requirement is a sound principle, which will reduce the phosphorus accumulation in soils from hog operations, which reduces the risk of losses to water.

- *More stringent regulatory phosphorus thresholds* –

Prohibiting application of manures on soils with more than 60 ppm Olsen P will reduce the increase in land area of soils that could release large amounts of phosphorus. It is a substantial reduction from the 180 ppm standard in place for existing operations; however, the panel understands that the amount of land with more than 60 ppm Olsen P is less than 5% of soils across Manitoba. Most of the soils where Olsen P is >60 ppm are in South East Manitoba, although it is likely to vary locally.

The panel recommends that communications on these proposals to the public and stakeholders includes maps that show the likely areas where these more stringent regulatory phosphorus thresholds could apply.

The selection of a 60 ppm threshold is based on an intensive literature review completed by the Province of Alberta by Allan Howard in 2001 which identified 60 ppm as the threshold over which agronomic responses to supplemental P were very unlikely with most crops.

2) Proposed options for increasing set-backs and/or creating no-development zones

1) No development zones based on area of intensive existing development

The proposal for no new pig operations in RMs of Hanover and La Broquerie due to the phosphorus surplus is a logical and practical step due to the existing substantial surplus of manure P in these two municipalities. Theoretically, a pig operation with elaborate manure treatment and zero emissions of P could be developed for this area without any risk of increasing P loss, but that possibility is not a practical one. Allowing expansion if the producer applies manure P at a rate of 1x crop removal appears like a practical way to facilitate growth in the industry throughout the Province. It is sound from a theoretical perspective; however, there is likely a low probability of this being possible, given the substantial manure P surplus in these two municipalities.

2) No development zones based on areas where soil test phosphorus exceeds 60ppm

The RMs of Hanover and La Broquerie are identified as areas where P is "in surplus", that is where the manure P produced is greater than the crop P exported.

This proposal reduces the phosphorus threshold to one third of that in the current regulations. This would reduce the risk of phosphorus run-off.

The panel recommends that communications on these proposals to the public and stakeholders includes maps that show the likely areas where these no development zones are anticipated.

3) No development zones based on sensitive areas for groundwater and surface water protection

No changes are proposed. The panel agreed that these are not good areas for applying manure or fertilizer nutrients.

4) No development zones based on land-use planning

No changes are proposed. The panel had no objection to this, but this is a local governance issue, not a science issue.

5) Manure application set-backs to groundwater and surface water features

The proposal is to make the set-backs the same as in the Nutrient Management Regulations. This makes the legislation consistent, but as the Nutrient Management Regulations apply to manures in these zones already it makes no practical change to the producer.

One of the concepts embedded in the set-back regulations is the perceived value for vegetated buffers. Indeed, vegetated buffers around groundwater and surface water features perform a variety of ecological services. However, the panel highlighted recent research and literature reviews that have questioned the effectiveness of vegetative buffers at intercepting and sequestering nutrients, especially dissolved P in our landscape and climate (Sheppard et al. 2006; Caley et al, 2012; Randall, 2011).

The use of a uniform system of set-backs is based on the assumption that proximity is the main transport related factor affecting the risk of pollution; and that physical distance between the activity or operation and the feature needing protection will reduce the risk. However, it is the site-specific connectivity, and the likelihood of an impact that raises or lowers the risk from an activity or operation, amongst other factors. For this reason, in other parts of the world, a P

index (based on factors such as soil P-content, erosion risk, runoff risk, proximity and other factors) has been developed to assess the risk of impact on water quality. However, the panel is aware that this is a complex issue and no indexes have yet been validated for our climate and landscape.

The panel recommends that in the longer term, a risk-based approach to defining setbacks that considers site-specific connectivity and other factors rather than just proximity is researched and considered for regulations. However, for the time being the investment in sound practices to reduce manure P loading and 1X crop removal within the manured areas is supported.

5) Manure storage set-backs to groundwater and surface water features

No changes are proposed. The panel agreed that no changes are necessary.

The proposals for no development zones and setbacks make no substantive changes to the current situation.

6. References:

Caley, K.A., Owens, P.N., Lobb, D.A. 2012. Decision Support Systems and Guidelines for Agricultural Buffer Design and Placement – A review. EC Project ref #1100077

Joint Research Centre. 2013. Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry and Pigs. European IPPC Bureau

Randall, S. 2011. Red Assiniboine Project - Technical Advisor Consultation Report. Agriculture, Agri-food Canada.

Sheppard, S.C., Sheppard, M.I., Long, J., Sanipelli, B., Tait, J., 2006. Runoff phosphorus retention in vegetated field margins on flat landscapes. Canadian Journal of Soil Science 86, 871-884.