REVIEW OF SAROS

A Sustainability-Based Review of the Ministry of Natural Resources 2009 *State of the Aggregate Resource in Ontario Study*

Photo by Richard and Christa Galloway

Prepared by

Tanya I. Markvart

For

Gravel Watch Ontario

http://gravelwatch.org/

July 19, 2010

Abstract

This report presents a sustainability-based review of the six papers that comprise the Ministry of Natural Resources (MNR) 2009 *State of the Aggregate Resource in Ontario Study* (SAROS). One major objective of SAROS is to inform strategic planning for aggregate resource management. Critical problems in the SAROS approach and methodologies diminish the capacity of the study to inform strategic planning and to contribute to sustainable aggregate resource management. The MNR and the consultancies that produced the six papers did not adopt a sustainability-based approach to assess the state of the aggregate resource. The MNR did not clarify the process by which SAROS will inform strategic planning, including any opportunities for public participation in this process. Finally, the conclusions and recommendations of the six papers too often rest on inaccurate and partial data. The consultancies should have adopted cradle-to-grave (life-cycle) or ecosystem-based methodological approaches. Instead, the methodologies applied were oriented towards generating findings that primarily address industry-economic concerns. Consequently, subsequent strategic planning informed by SAROS may give inappropriate priority to industry-economic interests at the expense of other significant economic, social and environmental stakeholder concerns. As SAROS stands now, the six papers cannot reasonably inform strategic planning and contribute to sustainability through better aggregate resource management and land use decision making. More research is needed in critical areas to correct the problems highlighted by our review. The SAROS initiative should be extended to incorporate a sustainability-based assessment of the state of the aggregate resource in Ontario.

Executive Summary

This report presents a sustainability-based review of the six papers that comprise the Ministry of Natural Resources (MNR) 2009 *State of the Aggregate Resource in Ontario Study* (SAROS). One major objective of SAROS is to inform strategic planning for aggregate resource management in the context of broader land use planning. SAROS findings thus carry potentially significant implications for a variety of stakeholders concerned with the impacts of the aggregate industry.

MNR's strategic directions framework for the management of natural resources rests on a vision for sustainable development (MNR, 2005). All MNR activities, including state of the resource reporting, are to be consistent with this vision. In light of this, we developed three questions to guide our review:

(Q1) Approach: *Did the MNR explicitly adopt a sustainability-based comprehensive and integrated approach to investigate the state of the resource?*

(Q2) Strategic Planning: *Did the MNR clarify the process by which SAROS will inform strategic planning, as well as the opportunities for public participation in this process?*

(Q3) Methodologies: *Did the consultancies, as the authors of the six SAROS papers, adopt appropriate methodologies?*

The three guiding questions represent key sustainability-based expectations for the six SAROS papers. These expectations are summarized, below, beginning with (Q1).

(Q1) Approach: The MNR should have explicitly adopted at the outset of the SAROS initiative the objective to ensure positive contributions to sustainability. Such an approach would incorporate consideration for all relevant sustainability and stakeholder concerns (social, economic and environmental). A diverse range of stakeholder interests and issues shape the state of the aggregate resource in Ontario. The MNR and consultancies should have undertaken an initial investigation of these stakeholder concerns and then incorporated them into the basis of the study. From this standpoint, SAROS would generate comprehensive findings while seeking progress towards sustainability in aggregate resource management.

(Q2) Strategic Planning: The MNR should have demonstrated a commitment to inclusiveness and transparency in state of the resource reporting. This means that the MNR should have defined what strategic planning is and clearly described the process by which SAROS will inform it. Additionally, the MNR should have clarified opportunities for public participation and sought input from the interested public during all phases of the study. These expectations are crucial in light of the goal of SAROS to inform strategic planning. SAROS may influence the orientation of many land use and natural resource management policies and, in turn, the balance of power among the stakeholders who rely on them for guidance.

(Q3) Methodologies: The consultancies should have adopted cradle-to-grave (life-cycle) or ecosystem-based methodological approaches. These approaches are comprehensive in their consideration of the life-cycle upstream and downstream effects of aggregate extraction and the

aggregate industry. For example, a life-cycle approach to investigate aggregate consumption and demand requires data collection and analyses that accurately represent the flow of aggregate materials, from extraction to end use. Similarly, investigating the impacts of the aggregate industry requires an ecosystem-based understanding of the impacts of pits and quarries, as well as the upstream and downstream economic, social and environmental effects of a variety of projects enabled by aggregate materials.

The three guiding questions helped to reveal critical problems affecting the capacity of SAROS to inform strategic planning and to contribute to sustainable aggregate resource management. The major findings of our review are summarized, below, beginning with Q1.

(Q1) Approach: The MNR did not explicitly adopt at the outset of the SAROS initiative the objective to contribute to sustainability. The six SAROS papers do not reflect an integrated consideration for all relevant sustainability and stakeholder concerns. SAROS primarily reflects the industry-economic issue of how aggregate producers can go about extracting more aggregate close to market. The six SAROS papers do not go far enough to inform (a) a provincial conservation strategy for aggregate resources, (b) a strategy to increase the supply and use of recycled aggregate materials, and (c) the development of incentives to encourage aggregate producers to avoid applying for licences to extract in and/or adjacent to environmentally significant lands.

(Q2) Strategic Planning: The MNR did not define for the interested public what strategic planning for the aggregate resource is and what it involves at the provincial and municipal levels. Nor did the MNR clarify the process by which SAROS will inform strategic planning. To date (July 2010), the flow of information generated by the six SAROS papers has been directed primarily towards two MNR-created committees. The MNR should be praised for consulting with relevant stakeholders through these committees. The broader interested public, however, has not been sufficiently informed and empowered to engage in the study.

(Q3) Methodologies: The consultancies did not adopt cradle-to-grave (life-cycle) or ecosystem-based methodological approaches to investigate the state of the aggregate resource. In Paper 1, *Aggregate Consumption and Demand,* the consultancy relied primarily on production statistics to predict future consumption. Precise end-use data were not analysed to illustrate the amount of aggregate used for specific purposes. In Paper 3, *The Value of Aggregates*, the consultancy did not adopt a life-cycle approach to investigate the economic, social and environmental cost and benefits of the aggregate industry. Nor did the consultancy adopt an ecosystems approach to evaluate the environmental impacts of extraction. In Paper 5, *Aggregate Reserves in Existing Operations*, the consultancy did not explore the quantity of all aggregate materials available in all identified aggregate producing regions in Ontario.

Other problems were found with respect to clarity and consistency, unsupported claims and ignored issues. Notably, Paper 1 is unclear about the base consumption figure used to predict future trends in per capita aggregate consumption. Moreover, the per capita calculations inappropriately assume a direct correlation between per capita aggregate consumption and population density. In Paper 2, *Future Aggregate Availability & Alternatives Analysis*, the consultant did not apply the same level of analysis to the transportation scenarios explored to supply aggregates to the Greater Toronto Area. Consequently, the findings were skewed towards

the close to market transportation option. In Paper 6, *Rehabilitation*, the consultant makes some unfounded claims, including, for example, that aggregate producers are largely adhering to the rehabilitation specifications set out in site plans. Finally, one major issue that was ignored was the high degree of interdependency among certain aggregate industry stakeholders and the consultancies hired to undertake the studies. There is the possibility that this interdependence could have influenced the work done by the consultancies hired to undertake the six papers.

Based on the above findings related to (Q1) Approach, (Q2) Strategic Planning and (Q3) Methodologies, we make the following recommendations:

i) Future SAROS initiatives and other state of the resource reporting should explicitly adopt a sustainability framework to guide research and analysis towards sustainability goals.
ii) Future SAROS initiatives and other state of the resource reporting should be accessible to all interested stakeholders at every stage.
iii) More research should be undertaken to develop a comprehensive dataset that would allow researchers to properly distinguish between production, consumption and demand. More research is also required to determine appropriate drivers of aggregate consumption and demand.
iv) Future research on aggregate consumption and demand, use of recycled materials, alternative scenarios for transporting aggregate, etc. should begin by describing the flow of aggregate materials from extraction to end use for a variety of end uses. Data should be collected from relevant points along the aggregate supply chain.
v) Future research into the state of the aggregate resource should assign dollar values to the life-cycle social, economic and environmental impacts of pits and quarries and the aggregate industry, considering a range of projects enabled by aggregate materials.
vi) Future research should be devoted to calculating the amount of all aggregate materials available in all identified aggregate producing geographic areas in Ontario.
vii) Future research should investigate the economic, social and environmental implications of comprehensive rehabilitation planning, considering the perspectives of private, public and community stakeholders.
viii) More research should be devoted to promoting better industry adherence to progressive and final rehabilitation requirements.

As SAROS stands now, the six papers may serve to protect and enhance the current haulage-based legislative framework that governs aggregate resource management in Ontario – at the expense of other policies that aim to protect communities and the environment from the adverse impacts of aggregate extraction. This legislative framework is comprised of some firmly entrenched norms in aggregate extraction practice, including, among others, (a) ready access to aggregate resources close to market; (b) a preoccupation with ensuring supply to meet all anticipated demand as opposed to conservation and efficient resource use; (c) industry-generated consumption projections that illustrate a shortage of supply; and (d) poor rehabilitation practices.

As SAROS stands now, the six papers cannot reasonably inform strategic planning and contribute to sustainability in aggregate resource management. More research is needed in the above-listed and other critical areas to correct the problems highlighted in our review. The SAROS initiative should be extended to incorporate a sustainability-based assessment of the state of the aggregate resource in Ontario.

Table of Contents

1.0 Introduction

This report presents a sustainability-based review of the Ministry of Natural Resources (MNR) *State of the Aggregate Resource in Ontario Study* (SAROS). In April 2009, the MNR commissioned six consultancies to complete six papers that comprise the study. The papers contain research pertinent to aggregate resource consumption and demand, quantity and accessibility of prime aggregate reserves, aggregate materials recycling, alternatives to close to market extraction, and rehabilitation practices, among other topics. A consolidated summary of the six papers was published by the MNR in February 2010.

The last major state of the aggregate resource study was undertaken in 1992. Similar to the 1992 study, the current SAROS 2009 aims to inform strategic planning for aggregate resources in the context of broader land use planning. This planning could include the development of a Provincial Aggregate Resource Strategy and an Aggregate Resource Conservation Strategy, as well as other management policies, such as the Provincial Policy Statement, that guide regional and municipal planning.

Gravel Watch Ontario

Gravel Watch Ontario, an environmental nongovernmental organization, commissioned this review of the six SAROS papers. Gravel Watch acts in the interests of residents and communities to protect the quality of life of Ontarians and the natural environment in matters related to aggregate resources.

Gravel Watch participated in SAROS through representation on the MNR-created Aggregate Resource Advisory Committee and Technical Expert Panel. These advisory committees were comprised of key industry, government and community stakeholders. They met periodically throughout the SAROS process in order to review the scope of the study and provide feedback to government. Meetings of the advisory committees provided valuable opportunities for input and learning about the economic, social and environmental stakeholder interests and issues that contribute to defining the state of the aggregate resource in Ontario.

Stakeholder Interests and Issues

A diverse range of stakeholders along with historic and contemporary interests and issues (economic, social and environmental) comprise the context within which aggregate extraction occurs in Ontario. Individually and collectively, these stakeholder interests and issues contribute to defining the state of the aggregate resource.

Many environmental nongovernmental organizations and community groups lobby municipal and provincial governments to protect citizens and the environment from the adverse impacts of extraction. These impacts include short- and long-term negative effects on farmland and food production, surface and groundwater supplies, other natural and cultural resources, biodiversity, local aesthetics and ambiance, and property values, among others. Community pressure to protect citizens and the environment has encouraged the development of provincial and municipal policies that discourage aggregate extraction in ecologically sensitive lands. These stakeholders have also advocated for increased conservation and recycling of aggregate, improved rehabilitation policies and practice, more stringent policies to protect valued natural

and cultural resources, and alternatives to close to market extraction norms.

A second set of stakeholders, aggregate producers and industry organizations, shape the state of the resource by lobbying provincial and municipal governments to protect and enhance a legislative framework that ensures the accessibility of aggregate resources close to demand. This legislative framework rests on an economic rationale for affordable aggregate facilitated by the minimization of haulage costs. In turn, the laws and policies that comprise Ontario's close to market philosophy rely, in part, on industry-generated consumption and demand projections that predict a critical need for aggregate and a subsequent shortage of supply. The primary concerns of this stakeholder group include identifying opportunities to maximize resource use, minimize transportation costs and establish licencing approval processes that are, by industry standards, cost effective and timely.

The final stakeholders considered here are government authorities. Provincial and municipal governments have financial interests in aggregate extraction operations for local employment opportunities, local and provincial economic growth, and affordable aggregate for residential and infrastructure construction and maintenance. However, these stakeholders must also be accountable to their constituents whose values may directly conflict with industry-government economic interests. These conflicting perspectives are perhaps most evident in municipal land use conflicts, where industry, government and community stakeholders may be divided in their support for a particular pit or quarry.

As a study that will inform strategic planning, SAROS may have potentially significant implications for the above-described stakeholders. Thus, SAROS should address a diverse range of stakeholder concerns in a comprehensive and integrated way.

A Vision for Sustainable Development

MNR's paper called *Our Sustainable Future* (MNR, 2005) describes MNR's strategic directions framework for the management of natural resources. The framework rests on the Ministry's vision statement, which emphasizes sustainable development: "The vision – sustainable development – sets out the overall long-term goal of the ministry and the desired end state for the use and management of our natural resources" (p. 4). All MNR policies, programs and activities, including state of the resource reporting, are to be consistent with this overarching vision for sustainable development (p. 5).

In *Sustainability Assessment: Criteria and Processes*, Gibson et al. (2005) describe how such exercises as state of the resource reporting and other types of analysis should be undertaken to contribute to sustainable development. Gibson et al. developed a set of sustainability principles to guide research and analysis, planning and decision making. They also set out a method for applying the principles in evaluations.

Gibson's sustainability-based approach to analysis underpins the three questions that we developed to guide this review. We introduce these questions in Figure 1, below, and then describe them in more detail in Subsection 2.3.

Figure 1. Three Guiding Questions

(Q1) Approach: *Did the MNR explicitly adopt a sustainability-based comprehensive and integrated approach to investigate the state of the resource?*

(Q2) Strategic Planning: *Did the MNR clarify the process by which SAROS will inform strategic planning, as well as the opportunities for public participation in this process?*

(Q3) Methodologies: *Did the consultancies, as the authors of the six SAROS papers, adopt appropriate methodologies?*

The three guiding questions represent our major expectations for the six SAROS papers. They focus attention on critical areas where SAROS research and analysis should be improved to enhance the study's capacity to inform strategic planning and to contribute to sustainable aggregate resource management. Our review also recognizes SAROS recommendations that reflect areas where further research and collaboration could benefit all stakeholders.

Section 2.0 elaborates on Gibson' sustainability-based framework for analysis and describes how it informed the three guiding questions. The review findings are then discussed in Section 3.0. Conclusions and recommendations are provided in Section 4.0.

2.0 Sustainability as the Basis for Reviewing SAROS

Gibson et al.'s (2005) sustainability-based approach to analysis underpins the three questions that we developed to guide the review of SAROS. This section provides a brief description of the sustainability principles that Gibson developed to guide research and analysis towards sustainability goals. Then, we present an appropriate method for applying them in evaluations.

2.1 Gibson's Sustainability Principles

Scholars and practitioners around the world have recognized Gibson's sustainability-based approach to evaluation and decision making (Mitchley et al., 2006; Pope, 2006; Sheate et al., 2008; Partidario et al., 2009). Recently, Gibson's sustainability principles were used by the Ontario Power Authority in the development of Ontario's *Integrated Power System Plan*, which was submitted to the Ontario Energy Board in 2008 (see Winfield et al., 2010).

Gibson's sustainability principles, which were synthesized from a broad review of the sustainability literature and application experience, represent core requirements for progress towards sustainability. See Appendix A for a detailed definition of each sustainability principle. Figure 2, below, presents a brief summary of the main emphasis of the principles.

Figure 2. Emphasis of Gibson's Sustainability Principles

(a)	Protection and enhancement of economic, social and environmental integrity;
(b)	Livelihood sufficiency and equity within and between present and future generations;
(c)	Efficient use of natural resources through conservation, waste reduction, and reducing extractive damage;
(d)	Democratic governance that fosters collective responsibility and reciprocal awareness,
(e)	Precaution and adaptation; and
(f)	Immediate and long-term integration of all sustainability principles at once.

As a foundation for evaluation, Gibson's sustainability principles recognize the connections within and between human and environmental systems and present and future generations. They devote attention to all areas of sustainability concern (economic, social and environmental). They were designed to be generic so they can be further specified with context-specific stakeholder concerns. Specification allows for an integrated consideration of the relevant stakeholder interests and issues in a given context. Such an integrated and comprehensive approach seeks to ensure that gains are made in all sustainability requirements simultaneously.

In their comprehensive and integrated attention to all areas of sustainability and stakeholder concern, Gibson's sustainability principles represent basic requirements that should be met by those assigned to assess the state of the aggregate resource in Ontario. Below, in Subsection 2.2, we describe how they can be applied in analysis.

2.2 Applying Gibson's Sustainability Principles in Analysis

In this section we briefly describe how Gibson's sustainability principles can be applied in analysis. A thorough description of how sustainability-based examinations can be undertaken can be found in Gibson et al.'s *Sustainability Assessment: Criteria and Processes*.

The first step in sustainability-based analysis is to adopt at the outset of research the objective to contribute to sustainable development. With respect to state of the resource reporting this involves recognizing that natural resource management must respect the interests of present and future generations, human and nonhuman. State of the resource reporting, then, must aim to generate research that helps decision makers to reverse the trends that are leading to the depletion and degradation of vital natural resources. It must also recognize the links within and between economic, social and environmental realms.

The first step of adopting the objective to contribute to sustainability necessitates embracing a set of generic sustainability principles to guide research and analysis. These principles should clarify what the sustainability objective entails. The principles should be comprehensive of all areas of sustainability concern (economic, social and environmental) and

integrative in their consideration for human and nonhuman worlds and present and future generations. As such, they should form a comprehensive and integrated foundation for research and analysis, planning and decision making.

Embracing a set of generic sustainability principles to guide research and evaluation ensures attention to the full suite of requirements for progress towards sustainability. It does not, however, incorporate the contextual factors in a particular research context. This means that the generic principles must be specified in order to ensure proper attention is devoted to the stakeholder interests and issues that influence how sustainability is pursued in a particular circumstance. These context-specific stakeholder concerns should be sorted under the appropriate generic principles. This creates a particular consolidated sustainability framework to guide research and examination. It ensures that researchers devote attention to all areas of sustainability and relevant stakeholder concern.

On the basis of the above-described sustainability-based approach to analysis, we developed three questions (see Figure 1) to guide our review. In Subsection 2.3, below, we discuss how Gibson's approach informed the three guiding questions.

2.3 How do Gibson's Sustainability Principles Inform the Three Guiding Questions?

In this section we clarify how Gibson's sustainability-based approach to analysis informed the three guiding questions. A description of the rationale for each question is provided in turn, beginning with Q1.

Rationale for (Q1) Approach: *Did the MNR explicitly adopt a sustainability-based comprehensive and integrated approach to investigate the state of the resource?*

This question concentrates on the overall approach adopted by the MNR and consultancies in their assessment of the state of the aggregate resource. Gibson's sustainability-based approach to analysis requires a comprehensive and integrated consideration of all areas of sustainability concern, as well as the relevant stakeholder interests and issues in a particular context. This means that the MNR should have adopted at the outset of research (a) the objective to contribute to sustainability, and (b) a comprehensive set of generic sustainability principles to guide the study. These generic principles should have been specified for the research context. For this purpose the MNR should have undertaken an initial exploration of the relevant stakeholder interests and issues that comprise the context within which aggregate extraction in Ontario occurs. These stakeholder concerns should have been sorted under the appropriate sustainability principle(s). The resulting specified set of sustainability principles should have been incorporated into the basis of SAROS. This would have ensured that the study objectives, research and analysis would be informed by all sustainability and stakeholder concerns. State of the resource reporting would thus avoid focusing on one set of interests over another. The design of SAROS should be based on a commitment to ensure that aggregate resource management aims to seek gains for all in all sustainability areas at once.

Rationale for (Q2) Strategic Planning: *Did the MNR clarify the process by which SAROS will inform strategic planning, as well as the opportunities for public participation in this process?*

This question concentrates on the MNR's treatment of the process by which SAROS will inform strategic planning. Gibson's sustainability principles stress collective governance through transparent and informed deliberations. Collective governance involves bringing stakeholders from public, private and voluntary sectors to the table. This fosters collective responsibility, shared understandings of problems and mutual respect for different perspectives.

A commitment to transparency and information-sharing in state of the resource reporting requires defining for the interested public (a) precisely what strategic planning for the aggregate resource is; (b) what it involves at the provincial, regional and municipal levels; and (c) the opportunities for public participation in this process. What stage(s) of strategic planning for the aggregate resource is SAROS supposed to inform? What stage is happening now? What are the next steps? How and when can stakeholders participate?

It is important for the interested public to understand the process by which state of the resource reporting will inform strategic planning. Strategic planning for the aggregate resource, for example, involves a range of provincial laws and policies that directly bear on regional and municipal natural resource management and land use planning. Notably, the Provincial Policy Statement has been modified on occasion in order to strengthen and/or diminish certain policies. Among other consequences, these modifications affect the balance of power among stakeholders and the priorities among land uses. This, in turn, has implications for pit and quarry applications, Ontario Municipal Board decisions, and economic, social and environmental well-being.

Many of Ontario's laws (e.g., Environmental Bill of Rights, Ontario Planning Act) provide for public participation in public decision making. Aside from these laws, Ontario has a strong tradition of public participation in all kinds of decision making. As a study that aims to inform strategic planning, SAROS raises important questions about how and when the interested public can participate in, for example, commenting on the six background papers. These questions entail critical ethical considerations with respect to how wide the public participation net should be cast and how soon it should be cast.

Collective governance through transparent and informed deliberations is especially crucial in light of current and upcoming reviews of key land use and natural resource management policies, such as the Provincial Policy Statement in 2010 and the Greenbelt Plan, Oak Ridges Moraine Conservation Plan, and Niagara Escarpment Plan in 2015. SAROS may affect the orientation of these policies and, in turn, the degree of protection currently provided to the economic, social and environmental interests over which they preside.

Rationale for (Q3) Methodologies: *Did the consultancies, as the authors of the six SAROS papers, adopt appropriate methodologies?*

This question focuses on the nature of the methodologies adopted by the consultancies to complete the six SAROS papers. These papers were carried out by industrial consultancies under contract to the MNR.

As previously described, Gibson et al. set out an integrated and comprehensive approach to research and analysis. In state of the resource reporting, this requires applying cradle-to-grave (life-cycle) or ecosystem-based methodological approaches. These holistic approaches can address the full suite of relevant economic, social and environmental stakeholder interests and issues in a given context in an integrated way.

For example, a cradle-to-grave (life-cycle) approach to state of the aggregate resource reporting should include data collection and analyses that accurately represent the flow of

aggregate materials, from extraction to demolition and possible re-use. An aggregate consumption and demand analysis, for instance, should involve collecting data from both extraction (in order to determine the amount of aggregate available to the marketplace in a given timeframe) and purchasing (in order to determine the actual amount of aggregate consumed within the same timeframe). Similarly, an analysis of the environmental impacts of the aggregate industry should consider all of the phases in aggregate extraction developments, from land use designation to rehabilitation. An ecosystem-based approach to investigating the environmental impacts of pits and quarries must extend beyond the boundaries of the extraction site to incorporate consideration for the relationship between the site and surrounding social and ecological systems.

2.4 Summary: Sustainability as the Basis for Reviewing SAROS

As stated in our introduction, MNR's paper called *Our Sustainable Future* (MNR, 2005) describes the MNR's strategic directions framework for the management of natural resources. The framework rests on the Ministry's vision statement, which emphasizes sustainable development: "The vision – sustainable development – sets out the overall long-term goal of the ministry and the desired end state for the use and management of our natural resources" (p. 4). All MNR policies, programs, and activities, including state of the resource reporting, are to be consistent with this overarching vision for sustainable development (p. 5).

In *Sustainability Assessment: Criteria and Processes*, Gibson et al. (2005) describe how such exercises as state of the resource reporting should be undertaken so they contribute to sustainability. Gibson's sustainability principles guide research and analysis, planning and decision making towards sustainability objectives. These principles represent essential requirements for progress towards sustainability.

Among other things, Gibson's principles require an integrated consideration for the full suite of sustainability concerns, as well as the economic, social, and environmental stakeholder interests and issues in research and analysis. As such, they represent basic requirements that should be met by any researcher that is assigned to assess the state of the aggregate resource in Ontario. On this basis, three questions (Q1, Q2, and Q3) were developed to guide the review (see Figure 1).

3.0 Review Findings and Discussion

This section presents the main findings of our review of the six SAROS papers. We use the three guiding questions (see Figure 1) to focus attention on critical areas where SAROS research and analysis should be improved. These improvements would enhance the capacity of SAROS to inform strategic planning and contribute to sustainable aggregate resource management. We also list some constructive SAROS recommendations. These constructive points reflect areas where further research and collaboration could benefit all stakeholders. Below, our findings are organized according to their respective questions.

3.1 (Q1) Approach

This section presents our findings about the MNR's and consultancies' overall approach to SAROS research and analysis. First, we reiterate the guiding question that we developed to investigate this topic. Then, we present the findings of our review.

(Q1) Approach: *Did the MNR explicitly adopt a sustainability-based comprehensive and integrated approach to investigate the state of the resource?*

The six SAROS papers acknowledge some of the economic, social and environmental stakeholder interests and issues that help to determine the state of the aggregate resource. Paper 2, *Future Aggregate Availability & Alternatives Analysis*, recognizes that local concerns regarding the environmental impacts of pit and quarry developments remain strong. Paper 3, *The Value of Aggregates*, investigates the social impacts of extraction operations. Paper 4, *Reuse and Recycling*, describes some of the barriers and opportunities to the use of recycled aggregate. Paper 5, *Aggregate Reserves in Existing Operations*, suggests a shortage of prime aggregate close to market. Paper 6, *Rehabilitation*, highlights that the aggregate industry has been criticized for an apparent lack of rehabilitation, among other problems.

Clearly, the MNR and consultancies possess some awareness of the range of stakeholder interests and issues that contribute to defining the state of the aggregate resource in Ontario. Altogether, however, the six SAROS papers do not reflect a sustainability-based approach, despite Ministry policy. First, the MNR did not explicitly adopt at the outset of the SAROS initiative the objective to contribute to sustainability. By extension, SAROS was not underpinned by a set of specified sustainability principles to guide research and analysis. Consequently, the six SAROS papers do not reflect an integrated consideration for all areas of relevant sustainability and stakeholder concern. Three broadly illustrative examples are provided, below, under the following headings: *(Q1) Paper 1: Aggregate Consumption and Demand, (Q1) Paper 2: Future Aggregate Availability & Alternatives Analysis* and *(Q1) Paper 4: Reuse and Recycling.*

(Q1) Paper 1: Aggregate Consumption and Demand

The MNR and consultancies did not adopt a sustainability-based comprehensive and integrated approach to research and analysis. This is evidenced by the consumption and demand calculations in Paper 1, *Aggregate Consumption and Demand.* We define consumption as the total amount of aggregate materials used annually for various purposes. A comprehensive portrayal of consumption requires end-use/purchasing data, which reveal how much aggregate was purchased by whom and for what purpose. "Demand" refers to the total amount of aggregate resources that consumers are willing to purchase. Demand projections should be based on a careful consideration of appropriate drivers (e.g., cost, economic growth, etc.).

The consultancy that undertook Paper 1 predicts future aggregate consumption only. An in-depth demand analysis is not provided. Moreover, the consumption calculations use data that only indicate the amount of aggregate available for use in the marketplace. In other words, the consultancy relied primarily on production data to calculate consumption. The consultancy did not collect and analyse end-use/purchasing data, which is required to calculate how much aggregate is actually used in a given timeframe. In effect, Paper 1 equates the amount of

aggregate produced (available for use in the marketplace) with the amount actually used or consumed.

It is important to note that Paper 1's consumption projections support subsequent papers that investigate how aggregate producers can go about extracting more aggregate. Paper 2, *Future Aggregate Availability & Alternatives Analysis*, explores the feasibility of alternative sources of aggregate (e.g., underground mining, dredging, mine tailings, mega-quarries, and manufactured sand). Paper 5, *Aggregate Reserves in Existing Operations*, investigates ways that producers can maximize resource use within existing licences (e.g., varying excavation setbacks, increasing excavation depth, extraction of road allowances, and varying standard rehabilitation requirements).

Paper 1, however, does not go far enough to acknowledge or inform other stakeholder interests and issues. Notably, because Paper 1 does not analyse end-use/purchasing information, it does not take significant steps to inform a provincial conservation strategy for the aggregate resource. Ideally, a provincial conservation strategy for aggregate resources would set out a framework for conservation informed by the aggregate supply chain, from extraction to purchasing to demolition. With detailed end-use/purchasing information, for example, the consultancy could begin to explain the demand for aggregates. Demand-side management goals, among others, could then be developed to encourage conservation.

In the consultancy's neglect to collect and analyse end-use/purchasing data, Paper 1 remains oriented primarily towards informing industry-centered concerns about the quantity and accessibility of aggregate resources. This means that subsequent strategic planning informed by SAROS may give priority to industry-economic interests at the expense of other significant economic, social and environmental stakeholder concerns. It is important to note that these industry-economic interests are already well represented in the current legislative framework governing aggregate resource management in Ontario.

The current legislative framework governing aggregate resource management in Ontario is based on a close to market extraction model. This model seeks to minimize the costs of haulage in order to ensure an affordable supply of aggregate close to demand. This, in turn, reflects and reinforces some well-established norms in aggregate extraction practice, namely, ready access to the resource close to market. These norms in practice rest, in part, on the industry's consumption projections, which are assumed to demonstrate an ever increasing need for aggregate materials and a critical shortage of supply.

(Q1) Paper 2: Future Aggregate Availability & Alternatives Analysis

A second example of the MNR's and consultancies' failure to adopt a comprehensive and integrated approach is the constraint analysis in Paper 2, *Future Aggregate Availability & Alternatives Analysis*. In Paper 2 the consultancy undertakes a constraint analysis for selected bedrock areas in Southern Ontario. It perceives the protective policies of the Provincial Policy Statement, Niagara Escarpment Plan, Greenbelt Plan, and other relevant factors (e.g., significant wildlife habitat, etc.) as "constraints" to aggregate resource availability. Among other findings, it concludes that 93% of the selected bedrock resource has overlapping planning, environmental and agricultural constraints.

In fact, these "constraints" reflect land uses that conflict with potential industrial land designations. They also represent valued natural and cultural assets that should be protected and enhanced. In choosing to view these protective policies as constraints, the consultancy does not

treat them as a legitimate basis for a genuine analysis of possibilities and options. Notably, these valued natural and cultural assets should form the basis for an in-depth analysis of (a) how to increase conservation of the aggregate resource, (b) how to improve recycling and reuse practice, and (c) incentive options to encourage aggregate producers to avoid applying for extraction licences in and/or adjacent to environmentally significant lands. This would generate findings that support a greater range of sustainability and stakeholder concerns.

The consultancy's choice to identify these valued natural and cultural assets and conflicting land uses as constraints illustrates the overall orientation of the six SAROS papers towards industry-centred interests. Again, Paper 2 supports the industry-centred notion that aggregate producers must be permitted to find ways to produce more aggregate within existing licences, through extraction of alternative sources, and by ensuring ready access to the resource.

(Q1) Paper 4: Reuse and Recycling

A final example of the MNR's and consultancies' failure to adopt a comprehensive and integrated approach is the investigation of the use of recycled aggregates in Paper 4, *Reuse and Recycling*. The consultancy adopts a consumption perspective, specifically in transportation infrastructure construction. This narrow focus on consumption excludes an in-depth analysis of current and potential sources of recycled aggregate materials. The consultancy should have described and investigated the flow of recycled aggregate materials in order to identify a variety of sources of supply. This would generate more information and support for a provincial conservation strategy for the aggregate resource. For example, it would facilitate the development of a feasible process for incorporating more recycled materials into the supply chain.

This completes the presentation of our findings for question (Q1) Approach. We now turn to our findings related to question (Q2) Strategic Planning.

3.2 (Q2) Strategic Planning

This section describes our findings about MNR's portrayal of the strategic planning process of which SAROS is a part. First, we reiterate the guiding question that we developed to investigate this topic. Then, we present the findings.

(Q2) Strategic Planning: *Did the MNR clarify the process by which SAROS will inform strategic planning, as well as the opportunities for public participation in this process?*

As described in the introduction, a major objective of SAROS is to inform strategic planning for aggregate resource management in Ontario. According to the MNR's strategic directions document, *Our Sustainable Future* (MNR, 2005), state of the resource reporting involves a commitment to transparency and accountability. It is meant to enable the public to better participate in resource management and decision-making (p. 20). This necessitates an explicit description of the strategic planning process and the place and role of SAROS and public participation in this process. The six SAROS papers, however, (a) do not clearly define what strategic planning is; (b) do not clarify the process by which SAROS will inform strategic planning; and (c) do not outline the opportunities for public participation in this process. The extent to which the six SAROS papers acknowledge the strategic planning process does not go

beyond a reference to it in the list of objectives:

> "The general objectives for SAROS, as summarized from the RFP, are to:
> - Provide updated base information about current licenced aggregate resources in Ontario;
> - Provide information to support provincial, regional and municipal strategic planning for aggregate supply to meet long term demand;
> - Provide a more definitive understanding of current supply and future aggregate resource constraints that may affect long term supply; and,
> - Provide a credible source book of information on aggregate resources available to the general public online" (Parkin et al., 2009).

The above-described vagueness surrounding the process by which SAROS will inform strategic planning has contributed to the restricted accessibility of the six SAROS papers. To date (July 2010), the flow of information generated by the SAROS papers has been narrowly directed towards the members of two committees created by MNR: the Aggregate Resource Advisory Committee and the Technical Expert Panel. These committees are comprised of a range of relevant industry, government and community stakeholders. The MNR should be praised for inviting them to participate in SAROS. However, the interested public beyond these committees has not been sufficiently informed and empowered to engage in SAROS and any subsequent strategic planning informed by the six papers.

Furthermore, the MNR's vagueness is especially significant in light of upcoming reviews of such critical policies as the Provincial Policy Statement, Greenbelt Plan, Niagara Escarpment Plan, and Oak Ridges Moraine Conservation Plan. It is unclear how SAROS conclusions and recommendations will inform such provincial strategic planning. Any changes to these policies informed by SAROS may have profound implications for many stakeholders, particularly those who seek to protect valued natural and cultural resources from aggregate extraction operations.

This ends the presentation of our findings for question Q2. We now turn to our findings related to question "(Q3) Methodologies".

3.3 (Q3) Methodologies

This section presents our findings about the methodologies utilized by the consultancies commissioned to produce the six SAROS papers. First, we reiterate the guiding question that we developed to investigate the methodologies.

(Q3) Methodologies: *Did the consultancies, as the authors of the six SAROS papers, adopt appropriate methodologies?*

In order to reasonably inform strategic planning and contribute to sustainability in aggregate resource management, the consultancies should have adopted cradle-to-grave (life-cycle) or ecosystem-based methodological approaches. As previously described in Subsection 2.3, these holistic types of approaches require data collection and analysis associated with points along the flow of aggregate materials, from extraction to final disposal, as well as from the licencing to final rehabilitation stages. Similarly, evaluating the environmental impacts of pits and quarries requires extending the boundaries of the investigation beyond the extraction site in

order to consider the relationship between the site and surrounding ecological systems. These holistic methodological approaches would generate the most comprehensive insights on the state of the aggregate resource.

Our presentation of the findings related to methodologies is organized, below, according to the following headings: *Paper 1: Aggregate Consumption and Demand, Paper 3: The Value of Aggregates, Paper 5: Aggregate Reserves in Existing Operations, Clarity and Consistency, Unsupported Claims*, and *Ignored Issues*.

(Q3) Paper 1: Aggregate Consumption and Demand

As previously described in Subsection 3.1, Paper 1, *Aggregate Consumption and Demand*, concentrates on calculating historic and future aggregate resource consumption. Despite the title of the paper, the consultancy did not undertake a much needed in-depth investigation of demand.

An analysis of aggregate resource consumption and demand should begin with a description of the flow of aggregate materials, from extraction to end use. Where does the aggregate go once it has been extracted? How is it stored? How is it purchased, picked up and delivered, and by whom? Moreover, how does the flow of aggregate materials vary according to specific end uses (e.g., commercial, residential, industrial, etc.)?

Once the above questions are answered, the next step should involve collecting data along the steps of the aggregate supply chain. In particular, end use data should be collected in order to illustrate the amount of aggregate used for specific purposes. Finally, hypotheses can be generated about both consumption and demand based on comprehensive, accurate data and appropriate assumptions about, for example, drivers of future demand.

In contrast, Paper 1 only estimates previous and future production, which it calls consumption. It is important to note that the consultancy's estimates are based on local primary production, use of recycling material and import-export data. These data illustrate how much aggregate is available in the marketplace. In other words, the consultancy did not collect and analyse data associated with appropriate points along the supply chain.

Paper 1 does provide a list of end uses of aggregate (e.g., asphalt, concrete, etc.). The consultancy also states, "Unfortunately, data is not available to quantify the amounts of aggregate that go into each of the specific end uses…" (Altus Group Economic Consulting, 2009). The consultancy tries to compensate for this unavailable data. For example, it discusses the relative amounts of aggregate that go into various end uses based on high-level data from Statistics Canada. The consultancy, however, cannot accurately calculate either consumption or demand without precise data on respective end uses. This requires an analysis of purchasing information.

Aside from critical gaps in data related to end uses, one major reason why Paper 1 cannot accurately calculate both consumption and demand is that the authors confuse the meaning of key terms. In effect, the consultancy equates production with consumption and end use by purchasers. The MNR and consultancies should note that the amount of aggregate extracted or available through recycling and imports is not a fair indication of the amount actually purchased and used. By equating production with consumption and end use, the authors skirt the critical issue of gaps in data with respect to how much aggregate is purchased for various purposes in a given timeframe.

(Q3) Paper 3: The Value of Aggregates

This section describes our findings related to the methodologies applied in Paper 3, *The Value of Aggregates*. We discuss these findings in two parts: (1) the consultancy's evaluation of the economic value of aggregates and (2) the environmental impact analysis.

(1) Economic value of aggregates. The consultancy calculates the economic value of aggregates by evaluating the upstream (i.e., the industry sector itself and the sectors that support it) and downstream (i.e., the industry sectors that use mineral aggregate in production) flows of the aggregate industry. This includes consideration of the value of projects enabled through the use of aggregate materials. The consultancy, however, does not investigate the social, economic and environmental costs of aggregates along the same upstream and downstream flows. The consultancy should have adopted a life-cycle approach to investigate the economic, social and environmental costs and benefits of the aggregate industry. Additionally, the consultancy should have evaluated the economic, social and environmental costs and benefits of a range of projects enabled through the use of aggregate materials.

The MNR and consultancies should note that there is growing interest in establishing standardized methods for carrying out life-cycle assessment. Guidelines and principles have been developed by the International Organization for Standardization (ISO, 2006). A comprehensive evaluation of the value of the aggregates should consider the economic, social and environmental costs and benefits associated with the following points in the life cycle of aggregate resources:

- land use designation (impacts of land use restrictions due to policies that protect aggregate resources from other land uses),
- licencing (expense, social conflicts, etc.),
- extraction operations (considering employment, financial profits, property values, noise, air pollution from dust and emissions, water quality and quantity, cultural and natural heritage, species of flora and fauna, energy consumption impacts, etc.),
- transportation (considering traffic volumes, road construction, maintenance, and repair; air pollution from dust and emission, noise, accidents, etc.),
- processing (of all products of aggregate),
- construction of a range of projects (nuclear power plants, highways, wind turbines, etc.),
- the economic, social, and environmental impacts of a range of projects enabled by aggregate materials,
- deconstruction of structures made from aggregate materials (emissions, air pollution from dust and emissions, noise, etc.),
- storage of recycling materials (amount of materials diverted from landfills, etc.), and
- rehabilitation (impacts on ecosystem services, community benefits, etc.).

Dollar values should be assigned to the costs and benefits in all three domains (social, economic and environmental). This would facilitate a more reasonable estimate of the economic value of aggregate resources. Moreover, it would provide the basis for an evaluation of the relative distribution of these costs and benefits across economic, social and environmental realms. For example, the total financial benefits of aggregate resources might outweigh the total

financial losses, but the total environmental gains may not outweigh the environmental losses. Similarly, the social gains may not be greater than the social losses, etc. We now describe some critical problems in the environmental impacts analysis.

(2) Environmental impact analysis. The environmental impact analysis narrowly focuses on aggregate extraction operations as opposed to the upstream and downstream flow approach taken in the evaluation of the economic value of aggregates. In contrast to the above described life-cycle approach, Paper 3 estimates environmental impacts by qualitatively investigating the ecological goods and services provided by existing land uses within 31 licences. These are then compared to the ecological goods and services that would be provided by hypothetical post rehabilitation land uses defined by the rehabilitation plans. There are three key problems associated with this approach to evaluating the environmental impacts of aggregate extraction.

The first problem is that the analysis does not appropriately adopt an ecosystem-based approach. In particular, it does not extend beyond the extraction boundaries of the chosen licences. Rather, the investigation is limited to site-based descriptions of the percent of landscape and environmental features affected by the licences. The MNR and consultancies should note that an ecosystem-based approach to research is emerging as the standard in environmental impact assessments and other analyses. In the Ontario Municipal Board decision on the Aikensville Pit in the Township of Puslinch, Ontario, for example, the licence to extract was denied in part because the proponent's groundwater and ecological studies did not adopt an ecosystems approach to assess potential impacts (Ontario Municipal Board, 2008).

The second problem is that the consultancy does not consider that aggregate extraction operations can go on for decades within one site. Among other things, this means that land use designations surrounding an extraction site may change over time, affecting the rehabilitation plans. Consequently, the hypothetical post rehabilitation land uses on which the environmental impacts analysis is based may never be realized. In effect, the consultancy's evaluation rests inappropriately on hypothetical scenarios. The consultancy should have investigated the actual environmental impacts of working pits and quarries from an ecosystems perspective.

The third problem is that Paper 3 does not assign dollar values to any ecosystem goods and services. The MNR and consultancies should note that the valuation of ecological goods and services is emerging as an accepted practice around the world (Emerton, 2005; Canadian Model Forest Network, 2008; World Wildlife Fund, 2009). Kennedy and Wilson (2009), for example, have calculated the economic value of the ecological goods and services provided by the Credit River Watershed in Ontario. Similarly, David Suzuki Foundation (2008) has quantified the value of ecosystem services provided by Ontario's Greenbelt.

Below is a list of various costs and impacts that are not addressed by Paper 3.

- Megatonnes of GHG emissions from cement production, trucks and equipment,
- Energy consumption,
- Deaths and injuries by industry trucks and equipment,
- Loss of value of property adjacent to extraction operations,
- Noise and dust,
- Cultural and natural heritage resources, and
- Surface and ground water quality and quantity.

(Q3) Paper 5: Aggregate Reserves in Existing Operations

This section describes our findings related to the methodologies applied in Paper 5, *Aggregate Reserves in Existing Operations*. The consultancy estimates the quantity of reserves of limestone/dolostone by investigating licenced aggregate operations in selected geographic areas. There are eight aggregate producing geographic areas in Ontario. These areas are numbered (1 to 8) and illustrated in Paper 1, *Aggregate Consumption and Demand*. It is important to note that in Paper 1 the consultancy estimates historic and future consumption based on TOARC production statistics (from all eight geographic areas), as well as data on available recycling material and import-export statistics.

In contrast to Paper 1, Paper 5 only estimates the amount of limestone/dolostone available in licenced aggregate operations in areas 2, 3, 4 and a portion of 5 that have a licenced area of 20 hectares or greater. Paper 5 only estimates the existing limestone/dolostone reserve base as opposed to all aggregate materials. Thus, Paper 5 has the potential to incorrectly demonstrate that the amount of limestone/dolostone in reserves is insufficient to meet future consumption projections. On this basis, aggregate industry stakeholders may warn of a shortage of supply.

Paper 5 proceeds to evaluate various ways that producers can maximize the reserves in existing licenced operations. The options discussed include minimizing excavation setbacks, increasing excavation depth, extraction of road allowances, the use of rehabilitation material as aggregate products, and varying standard rehabilitation requirements to allow for reduced slope requirements and imported materials, among other methods.

Paper 5's conclusions and recommendations, however, do not reflect a sufficiently thorough investigation of available aggregate materials. The consultancy should have investigated the quantity of all available aggregate materials in all of the eight geographic areas identified in Paper 1.

(Q3) Clarity and Consistency

This section describes our findings about the consultancy's methodologies, focusing on clarity and consistency. We begin with Paper 1, *Aggregate Consumption and Demand*.

Paper 1 is unclear about the base consumption figures used to predict future trends in per capita aggregate consumption. Appendix A to Paper 1 sets out the steps taken in the projection methodology. The first two steps consist of estimating historical total aggregate consumption and per capita consumption. Then a regression analysis is used to determine key drivers of trends in per capita aggregate consumption. From here, future trends in per capita consumption are projected. The actual equations and values used, however, were not clearly set out.

Additionally, Paper 1's per capita (per person) calculations of consumption are inherently confusing. Firstly, the per capita calculations rest on the assumption that the total amount of aggregate produced is the same as the total amount used. Secondly, per capita calculations of consumption will tend to depict lower aggregate consumption in regions where population density is greater (because the aggregate is distributed among more people) and higher where population density is lower. As Ontario's population density increases with population growth, therefore, it will appear that per capita aggregate consumption has decreased. In fact, the aggregate is just distributed among more people. In other words, the per capita calculations assume a direct correlation with population density and aggregate consumption. More research

should be undertaken to determine appropriate drivers of aggregate consumption. Winfield and Taylor (2005), for instance, found that trends in aggregate production appear to be correlated with provincial Gross Domestic Product and with the level of construction activity.

Paper 2, *Future Aggregate Availability & Alternatives Analysis,* undertakes a feasibility analysis of alternative modes of transportation systems to supply aggregates to the Greater Toronto Area. The paper examines long haul trucking from North Bay, rail from North Bay, marine from Manitoulin and close to market trucking. The purpose is to compare close to market transportation scenarios to alternative approaches. It considers the implications of a shift away from close to market supplies for the Greater Toronto Area.

The consultancy that undertook Paper 2 does not apply the same level of analysis to each transportation scenario. Specifically, the rail scenario analysis accounts for the operating costs of redistribution terminals while the close to market scenario does not. The rationale for this inconsistency rests on the consultancy's assertion that in the close to market scenario the material can usually be delivered directly from the pit or quarry to the job site. On the contrary, raw aggregate materials in some cases must travel from the extraction site to a cement plant where they are mixed into portland cement. The cement may then be stored before it is transported to concrete plants where concrete mixes are created for a variety of projects. In other words, the actual flow of aggregate from extraction to job site may vary according to end-use requirements.

To generate accurate conclusions, Paper 2's comparative analysis of alternative modes of transportation should be based on a clear illustration of the flow of aggregate materials (i.e., from extraction to manufacturing to end use) for each transportation scenario and for a variety of aggregate products and end uses.

(Q3) Unsupported Claims

Despite the qualitative and quantitative analyses provided by the consultancies, the papers make many unsupported claims. Some salient examples are found in Paper 6, *Rehabilitation*, in which the consultancy asserts the following:

- Diverse management goals can be realized in practice through comprehensive rehabilitation planning;
- Existing policies and legislations are generally well suited to prescribing approaches to rehabilitation; and
- Aggregate producers are largely adhering to the rehabilitation specifications set out in site plans.

Paper 6 emphasizes comprehensive rehabilitation planning as one of the most effective ways of meeting community end-use goals. Among other activities, comprehensive rehabilitation planning involves coordinating the extraction, progressive and final rehabilitation efforts of two or more sites separated by setbacks or otherwise within close proximity to each other. Such comprehensive rehabilitation planning could result in, for example, one large lake as opposed to two or three smaller lakes. While Paper 6 discusses other rehabilitation techniques and current rehabilitation science and methodology, satisfactory evidence is not provided to support the use of comprehensive rehabilitation planning over other techniques.

Additionally, Paper 6 reports an investigation of selected sites in exiting licences for effectiveness of progressive rehabilitation. The researchers were able to examine 49 of the 50

randomly chosen sites. Of these, 20 had not initiated progressive rehabilitation. It is reasonable to argue, then, that rehabilitation is not being sufficiently undertaken. In contrast to what Paper 6 concludes, the results of the site evaluations suggest that the current legislative framework and specifications should be improved in critical areas.

(Q3) Ignored Issues

The six papers ignore many issues worthy of note. For example, the consultancies do not consider the degree to which MNR is able to enforce existing laws and regulations in operating pits and quarries. They also do not consider the implications of many of the explored possibilities (e.g., extraction of road allowances and varying standard rehabilitation standards) for relevant stakeholders who may be significantly impacted by them. In particular, the consultancies responsible for Paper 2, *Future Aggregate Availability & Alternatives Analysis,* and Paper 5, *Aggregate Reserves in Existing Operations,* do not consider the implications of the identified alternatives and means to maximize resource use for current aggregate resource management laws and policies, as well as municipal government and community stakeholders. At the very least the consultancies should highlight areas in need of further research related to the implications of various possibilities for all stakeholders.

One important ignored issue to note is the high degree of interdependency among certain aggregate industry stakeholders and the consultancies hired to undertake the studies. The consultancies in some cases had interactions or previous contracts with the aggregate industry. For example, MHBC Planning Ltd. was contracted to undertake the future aggregate availability and alternatives analysis for Paper 2. The President and founder of MHBC also serves as Special Advisor to the board of the Ontario Stone, Sand and Gravel Association (OSSGA) – the aggregate industry's trade organization and registered lobbyist. Members of other consultancies that prepared SAROS papers also serve as Special Advisors to OSSGA. MHBC personnel were apparently involved in other papers as well. There is the possibility that this interdependence among the consultancies and the aggregate industry could have influenced the work done by the consultancies hired to undertake the six SAROS papers.

This completes the presentation of our findings related to methodologies. We now turn to our findings with respect to constructive SAROS recommendations.

3.4 Constructive SAROS Recommendations

Aside from the above critical problems, the six SAROS papers generate some constructive recommendations. They are highlighted here because they represent areas where further research and collaboration could benefit all stakeholders and enhance progress towards sustainable aggregate resource management. Notably, Paper 1, *Aggregate Consumption and Demand*; Paper 3, *The Value of Aggregates;* and Paper 4, *Recycling,* appropriately recommend some much needed data management initiatives. These initiatives could potentially track the movement of aggregates in Ontario and the use of recycled aggregate materials, improving our understanding of end uses.

Additionally, Paper 6, *Rehabilitation,* proposes building collaborative partnerships with environmental nongovernmental organizations, local communities, aggregate producers, MNR staff and academics in rehabilitation. It advises continued efforts towards the establishment of a rehabilitation incentive system, including market incentives and the former rehabilitation

security deposit system. It recommends that a formal data collection system should be developed and implemented to track progressive and final rehabilitation. It also asserts that best practice guidance documents should be created to facilitate the implementation of key rehabilitation policies and legislation.

More research is required to understand how best to develop and implement the above recommendations. Local and provincial governments, for example, may not have the financial and human resources to maintain databases over the long term. Partnerships between local and provincial governments and the aggregate industry may be required to ensure the long-term viability of data management initiatives. While a public-private partnership may help to secure capital for the development of much needed data collection systems, it may compromise the accessibility of the data to the public and bias future policy development informed by such systems. Appropriate legislation should be developed to ensure that database systems to track the movement of aggregate, use of recycled materials and rehabilitation are accessible to the public and maintained independently of the aggregate industry, regardless of how they are funded.

Below, Table 1 gives a list of constructive recommendations according to each SAROS paper. We also list the potential implications of these constructive points in order to emphasize areas for further research.

Table 1. Constructive SAROS Recommendations with Potential Implications

Paper 1: ***Aggregate Consumption and Demand***	**Recommendations:** - Further work should include a formal survey process to track the movements of aggregate within the eight geographic areas within Ontario - Projections of aggregate consumption should be monitored on a periodic basis
	Potential Implications: - Buy-in and support from provincial government, aggregate industry, and purchasers - Data should be readily accessible to the public - Data should be collected and analysed by an independent body - Data collection should adopt a “cradle-to-grave” perspective
Paper 3: ***The Value of Aggregates***	**Recommendations:** -Better cooperation and transparency of data between MNR and industry in order to communicate primary data to allow better monitoring of the flow of aggregate material - Future economic studies should include an understanding of the flow of aggregate to end users - Understanding the implications of raising aggregate costs to end users
	Potential Implications: - Corporate confidentiality issues - Demand-side conservation management programs would benefit from end-use data and a better understanding of the implications of raising aggregate costs - Lifecycle environmental costs should be subtracted from the value of aggregates

Paper 4: ***Reuse and Recycling***	**Recommendations:** - Database software should be developed to track the use of recycled aggregate
	Potential Implications: - Additional funding and staff required for implementation - Jurisdictional issues with respect to data collection and management - Data should be readily accessible to the public - Data should be collected and analysed by an independent body - Guidelines on what materials should be tracked may drive practice and policy
Paper 6: ***Rehabilitation***	**Recommendations:** - Collaborative partnerships with environmental nongovernmental organizations, local communities, aggregate industry, MNR and academics in rehabilitation efforts - Continued efforts towards establishing a rehabilitation incentive system, including reintroduction of former rehabilitation security deposit system and implementation of market incentives to encourage progressive and final rehabilitation - Development of detailed best practices guidance documents to facilitate the implementation of key policies and legislation - Development and implementation of formal data collection system to track progressive and final rehabilitation
	Potential Implications: - Financial, human resources and time costs associated with collaboration and data collection - Jurisdictional issues with respect to data collection and management - Conflicting interests and goals in rehabilitation techniques and end uses - Monitoring and enforcement issues - Best practice guidelines should be developed and vetted by independent organizations

4.0 Conclusions and Recommendations

We undertook a sustainability-based review of the six papers produced by MNR's 2009 SAROS initiative. A diverse range of stakeholders and economic, social and environmental interests and issues comprise the context within which aggregate extraction occurs in Ontario. Individually and collectively, these stakeholder concerns contribute to defining the state of the aggregate resource. We assert that the six SAROS papers should incorporate consideration for these stakeholder concerns in a comprehensive and integrated way, while seeking progress towards sustainable development. This would be consistent with the MNR's overarching vision for sustainable natural resource management (MNR, 2005).

Gibson et al.'s sustainability-centered approach to analysis informed the three questions that we developed to guide the review. Gibson et al. provide advice on how such exercises as

state of the resource reporting could contribute to sustainability goals. Following Gibson's sustainability principles and recommended process for applying them in evaluations, the three questions focused attention on (a) the overall approach adopted by the MNR and consultancies; (b) the MNR's treatment of the process by which SAROS will inform strategic planning; and (c) the methodologies applied by the consultancies.

We found that SAROS exhibits critical problems that diminish the capacity of the study to inform strategic planning and to contribute to sustainable aggregate resource management. Below, we summarize our conclusions and recommendations under the following headings: *Approach, Strategic Planning, Methodologies,* and *Constructive SAROS Recommendations*. Finally, we discuss the overall quality of SAROS 2009 as a consequence of the problems highlighted in the review.

4.1 Approach

Our review of the overall approach adopted by the MNR and consultancies revealed that SAROS does not reflect a sustainability-based orientation to analysis. MNR did not adopt at the outset of the SAROS initiative the objective to contribute to sustainability. By extension, SAROS was not underpinned by an appropriate set of specified sustainability principles to guide research and analysis towards sustainability goals. Consequently, the six SAROS papers do not reflect an integrated consideration for all areas of relevant sustainability and stakeholder concern (economic, social and environmental). We highlighted three especially illustrative examples, as follows.

First, the consultancy that undertook Paper 1, *Aggregate Consumption and Demand*, neglected to collect and analyze end-use/purchasing data. The consultancy calculated previous and future aggregate consumption only, relying primarily on extraction or production statistics. In effect, the consultancy equates the amount of aggregate available in the marketplace with the amount actually used. Paper 1's consumption projections support subsequent papers that explore industry-economic concerns about how aggregate producers can go about extracting more aggregate. It does not go far enough to inform other stakeholder interests. Notably, because Paper 1 did not analyse end-use/purchasing information, it does not take significant steps to inform a provincial conservation strategy for aggregate resources.

Second, in Paper 2, *Future Aggregate Availability & Alternatives Analysis*, the consultancy perceived the protective policies of the Provincial Policy Statement, Niagara Escarpment Plan and Greenbelt Plan as "constraints" to aggregate resource availability. In fact, these constraints reflect land uses that conflict with potential industrial land designations. They also represent valued natural and cultural assets that should be protected and enhanced. In choosing to view these protective policies as constraints, the consultancy did not treat them as a legitimate basis for a genuine analysis of possibilities and options. Notably, these constraints should have formed the basis for an in-depth analysis of (a) how to increase conservation, (b) how to improve recycling, and (c) incentive options to encourage aggregate producers to avoid applying for extraction licences in and/or adjacent to environmentally significant lands. This would generate findings that support a greater range of sustainability and stakeholder concerns. Instead, Paper 2 supports the industry-economic notion that aggregate producers must be permitted to find ways to produce more aggregate within existing licences, through extraction of alternative sources, and by ensuring ready access to the resource.

Third, in Paper 4, *Reuse and Recycling*, the consultancy adopted a consumption

perspective that excluded an in-depth analysis of current and potential sources of recycled aggregate materials. The consultancy should have investigated and described the flow of recycled aggregate materials in order to identify a variety of sources of supply. This would generate more information and support for a provincial conservation strategy for the aggregate resource. For example, it would facilitate the development of a feasible process for incorporating more recycled materials into the supply chain.

We recommend that future SAROS initiatives and other state of the resource reporting should adopt a sustainability framework to guide research and analysis towards sustainability goals. This would be consistent with the MNR's vision for sustainable development in natural resource management. As we described in Section 2.0, Gibson et al.'s (2005) sustainability-based approach to analysis is appropriate for this purpose.

4.2 Strategic Planning

With respect to the MNR's treatment of the process by which SAROS will inform strategic planning, our findings indicate that the MNR fell short of fulfilling some basic sustainability requirements. First, the MNR is to be commended for developing a strategic directions framework that aims to promote public participation in state of the resource reporting. The MNR is also to be praised for taking some unprecedented steps to include relevant stakeholders in SAROS by creating the Aggregate Resource Advisory Committee and the Technical Expert Panel. The MNR, however, did not clearly define for the interested public what strategic planning for the aggregate resource is and what it involves at the provincial and municipal levels. Nor did the MNR clarify the process by which SAROS findings will inform strategic planning, including opportunities for public participation.

The vagueness surrounding the process by which SAROS will inform strategic planning has contributed to the restricted accessibility of the six SAROS papers. To date (July 2010), the flow of information generated by the SAROS papers has been narrowly directed towards the members of two MNR-created SAROS committees. The interested public beyond these committees has not been sufficiently informed and empowered to engage in SAROS and any subsequent strategic planning.

The MNR's vagueness is especially significant in light of upcoming reviews of such policies as the Provincial Policy Statement, Greenbelt Plan, Niagara Escarpment Plan, and Oak Ridges Moraine Conservation Plan. It is unclear how SAROS will inform such provincial strategic planning. Any changes to these policies informed by SAROS may have profound implications for many stakeholders, particularly those who seek to protect valued natural and cultural resources from aggregate extraction operations.

We recommend that future SAROS initiatives and other state of the resource reporting should include greater and more diverse stakeholder participation at every stage. This would facilitate a much-needed shared understanding of the relevant stakeholder interests and issues that contribute to defining the state of the aggregate resource and other natural resources. It would also encourage more comprehensive and integrated analyses. By extension, this may help to avoid any interdependencies that may exist between the consultancies, MNR staff and members of the industries that benefit directly from natural resource extraction.

4.3 Methodologies

With respect to the methodologies adopted by the consultancies, we found that the consultancies did not apply appropriate cradle-to-grave (life-cycle) or ecosystem-based methodological approaches. Other problems were found with respect to clarity, consistency and ignored issues.

Paper 1, *Aggregate Consumption and Demand*, did not generate conclusive results on consumption. This is because the consultancy relied primarily on production or extraction statistics. In particular, the consultancy did not collect and analyse end-use data. End-use data is required to calculate how much aggregate is used for various purposes in a given timeframe. As it stands now, Paper 1 equates the total amount of aggregate produced with the total amount that is actually used.

Future analyses of aggregate resource consumption and demand should begin with a description of the flow of aggregate materials, from extraction to end use for a variety of relevant projects. The next step should involve collecting data along the steps of the aggregate supply chain. End use data should be collected in order to determine the amount of aggregate used for specific purposes in a given timeframe. Finally, hypotheses can be generated about consumption and demand based on comprehensive, accurate data and appropriate assumptions about, for example, drivers of future consumption and demand.

More research should be undertaken to develop a comprehensive dataset that would allow researchers to properly distinguish between production, consumption and demand. Future consumption and demand predictions should determine how much aggregate is produced in a given timeframe versus how much is consumed or purchased in a given timeframe.

Paper 2, *Future Aggregate Availability & Alternatives Analysis*, did not apply the same level of analysis to each alternative transportation scenario. Notably, the rail scenario analysis accounted for the operating costs of redistribution terminals. In the close to market scenario, however, the consultancy did not account for the movement of aggregate from extraction to end use. Consequently, the results were skewed towards the close to market trucking scenario. The consultancy should have clearly described the flow of aggregate materials from extraction to manufacturing to end use for each transportation scenario. Additionally, a description of the flow of aggregate materials should have been provided for various types of aggregate products and end uses. More research along these lines is required to accurately portray the costs and benefits associated with various transportation scenarios.

Paper 3, *The Value of Aggregates*, did not generate comprehensive findings about the value of the aggregate industry. The consultancy calculated the economic value of aggregates by evaluating the upstream and downstream flows of the aggregate industry. But it did not adopt the same method to calculate the social and environmental costs of the aggregate industry. The consultancy should have undertaken a life-cycle assessment of the economic, social and environmental impacts the aggregate industry – from the land use designation phase of extraction to final rehabilitation. This assessment should have considered the life-cycle economic, social and environmental impacts of a range of projects enabled by aggregate materials. Similarly, Paper 3 should have investigated the real impacts of pits and quarries from an ecosystems perspective. Dollar values should have been assigned to the ecological goods and services.

Paper 4, *Recycling,* adopted a consumption perspective, specifically in transportation infrastructure construction, to investigate the use of recycled materials. This narrow focus did not incorporate an in-depth analysis of current and potential sources of supply, considering the flow

of aggregate materials. Future research should focus on a supply chain analysis. The purpose of such a supply chain analysis should be to inform a methodology to identify sources of recycled aggregate and a feasible process for incorporating them into the supply chain.

Paper 5, *Aggregate Reserves in Existing Operations*, did not produce comprehensive data about the amount of aggregate available in reserves. The consultancy only explored the amount of bedrock limestone/dolostone in licenced quarries in geographic areas 2, 3, 4, and a portion of 5 that have a licenced area of 20 hectares of greater. This stands in contrast to the approach taken in Paper 1, *Aggregate Consumption and Demand,* which based its calculations on the availability of all types of aggregate, including recycled sources, in all eight identified aggregate producing geographic areas in Ontario. As it stands now, Paper 5 cannot provide a sound basis for assertions that there will be a shortage of supply to meet projected future consumption rates. Nor can it provide a legitimate justification for the need to maximize reserves in existing licenced operations. Future research should be devoted to calculating the amount of all aggregate materials available in all eight geographic areas identified in Paper 1.

Paper 6, *Rehabilitation,* did not present convincing evidence to support claims about the effectiveness of comprehensive rehabilitation planning and existing rehabilitation laws and policies. The consultancy discussed various rehabilitation techniques and current science and methodology. Satisfactory evidence was not provided, however, to support the use of comprehensive rehabilitation planning over other techniques. The evaluation of the effectiveness of rehabilitation practice revealed that almost half of the selected sites had not initiated progressive rehabilitation. We recommend that future research should investigate the economic, social and environmental implications of comprehensive rehabilitation planning. Research should also be devoted to promoting better industry adherence to progressive and final rehabilitation requirements.

4.4 Constructive SAROS Recommendations

The six SAROS papers generated some constructive recommendations. These constructive points reflect areas where further research and collaboration could benefit all stakeholders and enhance progress towards sustainability in aggregate resource management.

Paper 1, *Aggregate Consumption and Demand*; Paper 3, *The Value of Aggregates;* and Paper 4, *Recycling,* appropriately recommend some much needed data management initiatives that could (a) track the movement of aggregate and recycled aggregate within the eight Canadian Portland Cement Association Geographic Areas within Ontario; and (b) enhance our understanding of end uses in quantitative descriptions of the follow of aggregate material.

Paper 6, *Rehabilitation,* appropriately recommends building collaborative partnerships with environmental nongovernmental organizations, local communities, aggregate industry, MNR, and academics in rehabilitation efforts. It also recommends continued efforts toward the establishment of a rehabilitation incentive system, including market incentives and reintroducing the former rehabilitation security deposit system. It further recommends that best practice guidance documents should be developed to facilitate the implementation of key policies and legislation, and a formal data collection system should be developed to track progressive and final rehabilitation.

More research is required to understand the implications of these recommendations for all stakeholders. In particular, future research should be devoted to understanding how to implement these recommendations in order to ensure the accessibility of data to the public and the long-term

viability of such database management initiatives.

4.5 Overall Quality of SAROS 2009

As SAROS stands now, the six papers are primarily oriented towards industry-economic concerns. This industry-centric orientation has significant implications for subsequent strategic planning and sustainable aggregate resource management. First, any strategic planning informed by the six papers may give priority to industry-economic interests and issues at the expense of other significant economic, social and environmental stakeholder concerns. Notably, these industry-economic interests include ensuring (a) the identification and use of alternative sources of supply (e.g., mega-quarries, etc.); (b) the maximization of resource use within existing licences (e.g., by increasing excavation depth standards, etc.); (c) the use of on-site material for aggregate product as opposed to for rehabilitation purposes; (d) current rehabilitation standards; and (e) comprehensive rehabilitation planning, among others.

Finally, any strategic planning informed by SAROS may serve to protect and enhance the current haulage-based legislative framework that governs aggregate resource management in Ontario – at the expense of other policies that aim to protect communities and the environment from the adverse impacts of aggregate extraction. This legislative framework is comprised of some firmly entrenched norms in aggregate extraction practice, including, among others, ready access to aggregate resources close to market; a preoccupation with ensuring supply to meet all anticipated demand as opposed to conservation and efficient resource use; industry-generated consumption projections that illustrate a shortage of supply; and poor rehabilitation practices.

References

Altus Group Economic Consulting. (2009). *SAROS Paper 1 – Aggregate Consumption and Demand.* Retrieved from http://www.mnr.gov.on.ca/en/Business/Aggregates/2ColumnSubPage/286708.html

Canadian Model Forest Netowrk. (2008). *Valuing Ecological Goods and Services From the Forest: Overview and Results from Five Regional Workshops.* Retrieved from http://fundymodelforest.net/cms/conference_workshop_proceedings

David Suzuki Foundation. (2008). *Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services.* Retrieved from http://www.davidsuzuki.org/publications/reports/2008/ontarios-wealth-canadas-future-appreciating-the-value-of-the-greenbelts-eco-serv/

Emerton, L. (2005). *Values and Rewards: Counting and Capturing Ecosystem Water Services for Sustainable Development.* IUCN – The World Conservation Union, Ecosystems and Livelihoods Group Asia, Colombo. Retrieved from http://www.mekonginfo.org/mrc_en/doclib.nsf/78e6e7655dd37a62852571a000252177/593083eab7d191044725728f00325558?OpenDocument

Gibson, R.B., Hassan, S., Holtz, S., Tansey, J., & Whitelaw, G. (2005). *Sustainability Assessment: Criteria and Processes.* London, Sterling: Earthscan.

International Organization for Standardization. (2006). *Environmental Management- Life Cycle Assessment Principles and Framework.* Retrieved from http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_tc_browse.htm?commid=54854

Kennedy, M., & Wilson, J. (2009). *Natural Credit: Estimating the Value of Natural Capital in the Credit River Watershed*. Retrieved from http://pubs.pembina.org/reports/natural-credit-report.pdf

Mitchley, J., Price, M.F., & Tzanopoulos, J. (2006). Integrated futures for Europe's mountain regions: Reconciling biodiversity conservation and human livelihoods. *Journal of Mountain Science, 3*(4), 276-286.

Ontario Ministry of Natural Resources. (2005). *Our Sustainable Future: Ministry of Natural Resources Strategic Directions.* Ontario Ministry of Natural Resources: Author. Retrieved from http://www.mnr.gov.on.ca/en/About/2ColumnSubPage/200238.html

Ontario Municipal Board. (2008). PL080489: *Memorandum of oral decision delivered by H. Goldkind on November 5, 2008 and order of the Board.* Retrieved from http://www.omb.gov.on.ca/english/eDecisions/eDecisions.html

Parkin, J., Zeman, B., Sandhu, A., Cammaert, A., DeRuyter, N., Cleghorn, D., MacKay, M., Pitman, W., & Freitas, A. (2009). *SAROS Paper 2: Future Aggregate Availability & Alternatives Analysis*. Retrieved from http://www.mnr.gov.on.ca/en/Business/Aggregates/2ColumnSubPage/286708.html

Partidario, M.R., Sheate, W.R., Bina, O., Byron, H., & Augusto, B. (2009). Sustainability assessment for agriculture scenarios in mountain areas: Lessons from six study areas. *Environmental Management, 43,* 144-165.

Pope, J. (2006). Sustainability assessment in context: Issues of process, policy and governance. *Journal of Environmental Assessment Policy and Management, 8*(3), 373-398.

Sheate, W.R., Partidario, M.R., Byron, H., Bina, O., & Dagg, S. (2008). Sustainability assessment of future scenarios: Application to mountain areas of Europe. *Environmental Management, 41,* 282-299.

Winfield, M., Gibson, R.B., Markvart, T., Gaudreau, K., & Taylor, J. (2010). Implications of sustainability assessment for electricity system design: The case of the Ontario Power Authority's integrated power system plan. *Energy Policy, 38,* 4115-4126.

Winfield, M., & Taylor, J. (2005). *Rebalancing the Load: The Need for an Aggregates Conservation Strategy for Ontario.* Retrieved from http://www.greeneconomics.ca/pub/179

World Wildlife Fund. (2009). *Guide to Conservation Finance: Sustainable Financing for the Planet.* Retrieved from http://www.conservationfinance.org/upload/library/arquivo20100514183209.pdf

Appendix A

Section 2.0 briefly describes Gibson's sustainability principles and how they can be applied. Below, Gibson's sustainability principles are defined in detail. A more thorough description can be found in Gibson et al.'s (2005) *Sustainability Assessment: Criteria and Processes.*

Gibson's Sustainability Principles

1. Socio-ecological system integrity:
Build human-ecological relations to establish and maintain the long-term integrity of socio-biophysical systems and protect the irreplaceable life support functions upon which human as well as ecological well-being depends.

2. Livelihood sufficiency and opportunity:
Ensure that everyone and every community has enough for a decent life and that everyone has opportunities to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity.

3. Intragenerational equity:
Ensure that sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc.) between the rich and the poor.

4. Intergenerational equity:
Favour present options and actions that are most likely to preserve or enhance the opportunities and capabilities of future generations to live sustainably.

5. Resource maintenance and efficiency:
Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long-term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.

6. Socio-ecological civility and democratic governance:
Build the capacity, motivation and habitual inclination of individuals, communities and other collective decision making bodies to apply sustainability requirements through more open and better informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary and personal decision making practices.

7. Precaution and adaptation:
Respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability, plan to learn, design for surprise and manage for adaptation.

8. Immediate and long-term integration:
Apply all principles of sustainability at once, seeking mutually supportive benefits and multiple gains.