APPENDIX F

Green Roofs Technology Think-Tank Progress Report

DRAFT November 6, 2003

1. Purpose

The purpose of the Challenge Paper was to provide a guiding framework and background for the October 20th think-tank session and "to define a research agenda for the development of green roof technology".

2. The Initial Challenge

The Challenge for the Think-Tank held on October 20, 2003 was to define a research agenda for the development of green roof infrastructure focusing on innovative green roof technologies and market development.

3. Ideas Presented at the Think-Tank

* There are three research challenges:
    1. systems and product development
    2. site/building performance: new vs. existing; type of system/building; climate/design (private benefits)
    3. public benefits which are the most complicated: unique climates; different driver; range of policies/tools; quantifiable and non-quantifiable (quality of life issues)

***** There is no "standard" green roof; there is a range of green roofs. We need a cost benefit analysis between new and existing buildings that have green roofs.

*****What is the threshold at which incentives for green roofs are offered where public benefits kick-in?

***** From the government's perspective, it is a question of accuracy vs. precision**.**

* We need a comparison with other approaches to address the issues that green roofs can address. We need an academic advisory group to help us decide what the issues are. We have not told users what, over 20 years, a green roof will cost. Governments want to know what has worked and what has been implemented elsewhere and what the costs were. A set of best practices would be good.

* Installers, as well as designers, need to be at the table. Roofers control the roofs. They have to be involved from the beginning. General contractors and spec writers need to be invited to this table. Education has to happen for landscape architects; builders; roofers; and engineers.

* Drivers can be different – government policy; eco awareness; or "what a good idea"; it's a wide open field. A major driver in the United States for green roofs is the Clean Water Act. There is no end maintenance plan for a lot of green roofs. The reality is that a green roof has to be taken care of. Costs of installing and the costs of maintaining need to be addressed. The awareness of the plants to be used is low. Esthetics is important as well. Plant research is required.

* Erosion is a big issue for large scale green roofs in Germany. Storm water maintenance is built into the green roof yearly fee in Germany. Germany has seminars with roofers to bring them up-to-date with what is happening in green roof research and development. Use the German data as a guideline for integrating it into the scenarios here.

* Life-cycle costing is a priority. It is very important to choose the window of time to use when looking at the life-cycle. There needs to be a better understanding of the micro-

fauna and carbon sequestration. There are differences between research and case studies. There are many questions unanswered: what is the oxygen capacity of a green roof? What is a weed? Are green roofs a conduit for invasive species? What does a standard green roof look like? When does a roof become green (a rooftop garden vs. a green roof)? How is seasonality to be dealt with?
* There are many overlapping issues to phytoremediation. How ambient air quality is dealt with is worth contemplating.
* The same tools cannot be used in all scenarios.
* Awareness for municipalities is an issue: doing a green roof job but having to justify it gets none of us anywhere. There are databases owned by industry and conservation authorities of "green roof histories". What and how the plants are doing, over time would be an excellent addition to the database. Where is the monitoring data?
* Protocols need to be developed for reporting on the green roof and its impact on all aspects of the building.
* Connectivity is very important; the integration of ground space and elevated space is an issue. The green roofs are the connector.
* Cities need to be seen as areas of biodiversity. What is the benchmark for biodiversity? Is it after green roofs or before citifying?
* Municipalities are both building owners and regulators. They need to know what other municipalities are doing; what are their policies, regulations and research programs. The benefits have to be specific to the City. Municipalities have similar issues in Southern Ontario. It would be good to know what can be achieved; and if it can be measured, monitored, maintained. Are green roofs replacements for open space? In order to promote green roofs, guidelines are important. To require green roofs, standards have to be in place.
* Developers are asking the question: What's in it for me? Why would a corporation want to have support for green roof research?
* When speaking of cost vs. benefit, it is social benefits vs, long-term costs. It comes down to sustainable asset management.
* The target audiences for green roofs are the developers, planners, architects, building owners and research institutions.
* What can green roof infrastructure do for a community? What is the performance assessment for an existing site/ building versus that of new buildings?
* Certain design trade-offs are not well understood. Accessibility is an issue; too much access is also an issue. All buildings are not created equal; building types need to be identified.
* There is the issue of scale interaction; scaling up relating to government policy is required. The geographic context is important.

Common Threads of the Dialogue
1. There is no "standard" green roof; there is a range of green roofs.
2. We need an advisory group to help us decide what the issues are; possibly provide coordination, oversight and integration for the Green Roof Technology Program.
3. Installers, as well as designers, need to be at the table. Roofers control the roofs. They have to be involved from the beginning. General contractors and spec writers need to be

invited to this table. Education has to happen for landscape architects; builders; roofers; and engineers.
4. Drivers can be different – government policy; eco awareness; or "what a good idea"; it's a wide open field.
5. There is no end maintenance plan for a lot of green roofs. The reality is that a green roof has to be taken care of.
6. Germany has seminars with roofers to bring them up-to-date with what is happening in green roof research and development.
7. Life-cycle costing is a priority.
8. There are differences between research and case studies.
9. What is a weed? Are green roofs a conduit for invasive species?
10. The same tools cannot be used in all scenarios.
11. There are databases owned by industry and conservation authorities of "green roof histories".
12. Protocols need to be developed for reporting on the green roof and its impact on all aspects of the building.
13. Municipalities are both building owners and regulators. They need to know what other municipalities are doing; what are their policies, regulations and research programs. Municipalities have similar issues in Southern Ontario.In order to promote green roofs, guidelines are important. To require green roofs, standards have to be in place.
14. It comes down to sustainable asset management.
15. Certain design trade-offs are not well understood. Accessibility is an issue; too much access is also an issue. All buildings are not created equal; building types need to be identified.

7. Research Ideas out of the Challenge Document

1. environmental benefits and costs of green roofs
2. how to measure green roof market development
3. green roofs and storm water control; storm water quality; energy efficiency; ecological value (plant/animal/insect); GIS; performance; impacts
4. thermal mechanisms of green roofs (shade/cooling) – performance in different climates/ locations; new vs. retrofit
5. model – "green roof planner"
6. regional model (Quest- Envision Inc -UBC)
economics/demographics/land use; "green roof module"
what's the research challenge? – collecting data and scaling up
7. green roof infrastructure for communities – model
8. performance assessment of existing "commercialized" green roof systems
9. site/building level performance of new or existing – viz types of buildings. Climate and design questions
10. benefits and costs: how to compare "unique" green roof systems; private benefits; public benefits; plant types; roof life – SAM; soil types; water retention; policy tools – what's quantifiable and what is not; energy efficiency
11. plant types and soils (partnership with FCM)
12. guidelines/standards manual – installation costs; long term maintenance costs
13. impact of maintenance on green roof performance

14. stakeholder education
15. what does a low maintenance green roof system look like?
16. impacts on air quality (pollution) -- AIRSHED
17. life-cycle costing
18. standards
19. alternate roof proofing systems (landfill research membranes) – life-cycle impacts of green roof systems
20. micro fauna and impacts on the local environment
21. in situ green roof water treatment
22. phytoremediation technology and green roof systems
23. storm water management and green roofs
24. Ontario database of green roof applications and costs and performance and maintenance: monitoring data and monitoring guidelines and protocols – this will go to the Advisory Group
25. connectivity tools for integrated urban planning – integrating green roof systems into greenlands (ground)– tie back to ecological value
26. what other municipalities are doing – tie to database/ Advisory Group
27. what can be achieved?
28. implementation

Identification of the Research Issues and Teams

1. Green Roof Storm Water Control and Quality (13 votes) Champion: Glenn MacMillan, TRCA

2. Green Roof Costs and Benefits (including energy efficiency and ecological value). (9 votes) Champion: Dan McGillivray, CRESTech – to find a university champion, perhaps at Brock University

3. Guidelines (8 votes) Champion: Christine Doody- Hamilton, Seneca College

4. Green Roof Remediation Technologies - including in situ treatment systems and phyto-technologies. (7 votes) Champion: Dave Llewellyn, University of Guelph

5. Green Roof Maintenance Technologies. (7 votes) Champion: Tom Olien, Humber College

6. Energy Efficiency – leave it in # 2

7. Ecological Value (7 votes) Champion: Stephen Murphy, University of Waterloo

8. Next Steps

1. Next meeting date November 27, 2003 (9am- 1pm)
2. Champions – the first step is to have an EOI to Dan before the next meeting
3. Crystallize the concept of the Advisory Group for the next meeting

APPENDIX 1 – Background, Expectations, Assumptions and Outcome (from the original Challenge Paper)

Background

1. A workshop was held at the University of Toronto to define research opportunities and a standard protocol for undertaking green roof research. See "Researcher's Corner at www.greenroofs.ca."
2. Green roof research and development programs have been initiated in a dozen cities across North America including New York, Toronto, Chicago, Waterloo, Portland, and Atlanta.
3. Some things do not work; the price factor becomes very important.
4. The first annual Green Roof Conference was held in Chicago (May 29-30, 2003); it was entitled Greening Roof Tops for Sustainable Communities. The second annual conference will be held in Portland (June 2-4, 2004).
5. Toronto's "Green Roof Demonstration Project" is a public-private partnership with green roofs on the podium of Toronto City Hall and roof of the Eastview Community Centre. The National Research Council is monitoring the project's different roofing systems over the next two years.
6. Toronto City Council has established a Green Roofs Task Force to investigate and recommend policies and incentives to encourage the construction of more green roofs in new buildings and retrofits in the City (item J47 – http://www.city.toronto.on.ca/legdocs/2003/agendas/council/cc030922/cofa.pdf).
7. Environment Canada has completed the first ever green roof urban heat island study.
8. The Toronto and Region Conservation Authority (TRCA) is monitoring a green roof site at York University; data are available via the internet.
9. A green roof certification program is being developed.
10. Building owners need to justify the extra cost of the green roofs with expected benefits on the buildings (e.g. reduction in space conditioning cost, increase in property value...etc). Government needs to justify promotion of green roofs with public benefits provided (e.g. reduction of CSO, storm sewer infrastructure…etc

INPUT REQUEST #1.0: CHALLENGE AND BACKGROUND
[* Indicates a participant response to the original challenge paper.]

1.1 What additional clarification would help you better understand the Challenge?

* I think we should add "better understanding of benefits offered by green roofs" as a major focus of the Challenge. Building owners need to justify the extra cost of the green roofs with expected benefits on the buildings (e.g. reduction in space conditioning cost, increase in property value...etc). Government needs to justify promotion of green roofs with public benefits provided (e.g. reduction of CSO, storm sewer infrastructure…etc). It is important to quantify the benefits and finally be able to predict the benefits so the extra cost can be justified. This is definitely a challenge.

* - perhaps further explanation of the target we are trying to reach

* Definition of technology

* This is my first exposure to the idea of green roof technologies. As such, I am treating this as a learning experience.
* An update on where researchers "are at" with their projects; funding opportunities; and other opportunities for collaboration within existing research agendas
Market development…do you mean how much economic value has the City of Toronto experienced since the "word" about the environmental benefits of green roofs has been Spread? How will we measure market development?

* There is significant data on green roof applications, however minimal data on water quality, limited on energy efficiency (products and materials).

* Do we have statistical data by which to quantify the efficacy of "green roofs" as storm water control elements?

* Have we identified either the specific fields of research to be pursued?

1.2 What ideas did the Challenge statement spark in your mind?
* Ways to improve the current technologies - maximizing benefits while reducing cost.

* How can we work together with other municipalities/industry to implement green roofs across Southern Ontario? How can we take all of the various benefits that green roofs provide and fit them into package to market green roofs in a simple format "i.e.: this is what green roofs can do for you…" The lack of solid scientific research backing up the green roof benefits for North America (or Southern Ontario) and the costs for green roofs is always a challenge for selling this idea.

* Three key issues
    1) Increasing green space in city core
        a) Aesthetic value
        b) Ecology value
    2) Reducing heat island effect
        a) Energy monitoring
    3) Storm water management
        a) Municipal codes issues

* Issues some what exclusive
    i) Difficult to generate aesthetic green roof which is optimized for storm water management

* Education and awareness; I think based on my limited experience with green roofs and the academic literature that supports this technology, that some attention needs to be Education and awareness building. The average roofer in Toronto has no idea what we mean by "green roof" let alone the technology needed and the environmental benefits associated with them; Similarly, the average building owner in down town Toronto (including the senior engineer of the Air Canada Centre) had no idea what a green roof was, let alone the environmental and economic benefits of choosing a

green roof when it is time to re-roof; as well , the challenge statement sparks further need for discussion about policy instruments that will foster the utilization of green roof technology throughout municipalities in Canada etc.

* Other areas of research not necessarily directly related to either of the main challenges: e.g. impacts of green roof technologies on urban environments (effects at larger scales).

* Are we looking at the physical or botanical/horticultural components of the green roof, or both?

* Do the plantings within the "green roof" assist the storm water retention performance of the roof areas or are they performing a separate but integrated environmental role?

* Have the areas of research been clearly identified and are there existing, published hard data from comparable climatic regions. If so, are the authors considered technically and scientifically competent? What scientific disciplines should be involved?

* Who's missing? Owners? Managers? Architects? Mechanical Engineers (HVAC)? Civil Engineers?

* Have we identified the key players, decision makers, in the Canadian target green roof market?

1.3 What's missing from the Background?

* NRC established the first North American field facility that was dedicated for green roof research in 2000. It is fully instrumented and has been monitored for almost 3 years. The data has confirmed scientifically that green roofs can reduce a building's energy demand on space conditioning.
- NRC has collaborated with British Columbia Institute of Technology (BCIT) in Vancouver to establish a Green Roof Research Facility on its Great Northern Way campus. The facility is instrumented in 2003 and will provide performance data of green roofs in West Coast climate.

* Some of the European work

* Statement of issues; How technology addresses issues; End users of technology

* I would like to see included in this section some of the regulatory aspects of green roof implementation (building codes, zoning, etc.); also, some reference to the wealth of research undertaken by others in Canada (British Columbia, especially), the U.S. and abroad; we can use their experiences to "fine tune" our research.

* Who are the contractors, participants that install these systems, we require a better(true) understanding of the actual costs (initial, maintenance and long term)

* Are we looking at the physical or botanical/horticultural components of the green roof, or both?

* Do the plantings within the "green roof" assist the storm water retention performance of the roof areas or are they performing a separate but integrated environmental role?

* Have the areas of research been clearly identified and are there existing, published hard data from comparable climatic regions. If so, are the authors considered technically and scientifically competent? What scientific disciplines should be involved?

* Who's missing? Owners? Managers? Architects? Mechanical Engineers (HVAC)? Civil Engineers?

* Have we identified the key players, decision makers, in the Canadian target green roof market?

* What's missing? Hard data.

* What performance data is available on roof durability factors with and without green roofs – Lengthened service life or reduced service life of roof components? Life cycle trade off with performance versus infrastructure impact.

* GIS data/statements which confirm where the green roofs "are" in the City of Toronto. City of Vancouver used a Master's student to map the green roofs in Vancouver. Let's do a GIS of the green roofs in North America even! It will pale by comparison to Europe (no surprise).

* I have just returned from Switzerland (yesterday) where I toured green roofs with Dr. Stephan Brenneisan whom I met in Chicago re: biodiversity and green roofs. It was a day from paradise…but I am mostly interested in translating the City of Basel's policy instrument from German to English, as the ordinance there is conclusive that green roofs are a must, along with other green incentives…..more on that at the Think Tank, eh?

Expectations

1. Industry participants in the October 20th think-tank come prepared to present to the group what technologies/knowledge/processes they require to improve their performance in the marketplace.
2. Government participants in the October 20th think-tank come prepared to present to the group what technologies/knowledge/processes they require to develop strategies and policies to deal effectively with green roof infrastructure impact, evalution and policy and program issues.
3. Academic participants in the October 20th think-tank come prepared to "listen" and help develop research questions which directly address the "needs" of the industry and government representatives.
4. Land owner/manager participants in the October 20th Think-Tank come prepared to present to the group what technologies/knowledge/processes they can

incorporate into their property development and management business plan, and what incentives they require to do so.

INPUT REQUEST #2.0: EXPECTATIONS AND PROCESS
[* Indicates a participant response to the original challenge paper.]
2.1 What questions/concerns do you have about the process we're using?
* I like the process – the participant capture should be enhanced to include those representing the hard sciences and engineering and economics, along with specific social sciences

* I would like to see more Government representatives to be involved. For example, Public Works Government Services Canada (PWGSC) is the biggest landlord in the country. Their Environmental Services Group is very interested in green roof technology. In fact, I have given a tour of our green roof field facility to a group of over 20 people from PWGSC earlier this month. I would like to see their involvement. Also, NRCan does a lot of work on promoting energy efficiency in buildings. I think they should also be involved in this process.

* How will this information be used?

* None

* What research is eligible for funding?

* The expectations appear to be clear and reasonable for each of the groups (perhaps a bit wide ranging for the government participants, but presumably they span a wide range of departments).

2.2 Please identify in point form the technologies/knowledge/processes you "need":
* I would like to know more in the following areas:

- Various thermal mechanisms of green roofs identified and quantified
- Tools to predict green roof performance in different geographical locations
- Effectiveness of green roofs as source control tool of stormwater
- Effectiveness of various green roof systems on stormwater retention

* hard, reliable competent data and monitored case studies addressing specific quantifiable outcomes

* A computer model(s), or something similar, to identify locations in the Municipality to implement green roof systems to target areas of concern such as: air quality, energy efficiency, stormwater and finally green space opportunities (the best place to put green roofs – get the most bang for your buck)
- Formula to accurately estimate the costs of green roof implementation for future budget planning
- Process to educate the public on green roofs & gather support both publicly & politically

- Identify how we can use green roofs and other green technologies to improve our cities by providing new 'green industry' and the economic benefits of such a movement
- A good understanding or listing of ecosystems (specie lists & medium depths, conditions etc.), that green roofs can support for Southern Ontario (i.e. – Alvars, meadows, forests?). Most Cities have policies for the use of native species – what does the green roof industry/producers understand that demand & are they going to start growing these species?

* Defined benefits; Optimization of different selection criteria; Separation of "industrial" from "recreational" version of technology

* -experience with people who have put down a green roof on an old building
-experience of people who have use varying substrate depths as per the Brenneisan model, if there are any in Canada (I don't think there are)
-reports from academics who are doing energy benefits of green roofs
-reports from academics who are studying policy instrument development to foster green roof technology……if we are to follow Europe, we need all of their policy learnings particularly the monitoring and enforcement information……that's all hard to get I know

* initial, maintenance and long term costs
* effectiveness of green roofs
* swm,
* energy,
* environment,
* value as recreation,
* aesthetic value,
* heat island impact

*specifications of green roofs suitable for inclusion in numerical modeling of buildings/atmosphere

*performance of green roofs suitable for inclusion in numerical models of the atmosphere and/or suitable for use as validation of numerically modeled results

2.3 What expectations do you have for this meeting (as in "I would consider this Dialogue a success if….")

* I would consider this dialogue a success if…
    - Research priorities identified
    - Research collaborations between different sectors initiated
    - It raised awareness of technology for building owners and general public

* there was the identification of specific and quantifiable areas of research and opportunities to apply better engineering and architectural practices

* Start of green roof as a means not as an end; The technology should be a tool to do some well defined task

*I would consider this dialogue a success if I can get advice and support for a green roof installation at Seneca College for long term monitoring, and educational purposes.

* I think just getting together to discuss the various challenges and coming up with a list of target research areas will make this dialogue a success

- Networking and meeting other people facing the same challenges – working together to make green roofs successful

* it identifies the research needs and what needs to be done achieve adequate funding

* identification of individuals/groups that could be combined to define a multi-participant research project that addresses green roof impacts on the environment

* I knew more people who are invested in green roof research; I met people who are interested in developing a model for City of Toronto; Green roof Policy development based on learnings from Europe; I met people who are interested in supporting biodiversity/ecological habitat restoration principles in the green roof movement

Assumptions

1. A recent survey done for the City of Waterloo indicates that for the public, the environmental priorities for applying green roof technologies are:
    i) Air Quality
    ii) Energy Consumption
    iii) Water Quality
    iv) Recreation

    A review of the literature indicates that the following are also priorities, in no particular order:
    v) Food production (community gardens)
    vi) Biodiversity protection and enhancement
    vii) Stormwater management
    viii) Densification
    ix) Mitigation of Urban Heat Island Effect
2. Green roofs involve higher, upfront capital costs than traditional roofing systems but offer a number of environmental benefits and amenities to both building owners (private) and the community at large (public). For the building owner, green roofs can achieve energy conservation through reducing cooling and heating costs. They can provide green space for use of building occupants and others and can provide views from interior spaces and surrounding buildings overlooking the roof top garden. They also have potential to be utilized for local food production.
3. For the larger community, green roofs can hold and absorb storm water flow, potentially reducing both the amount of flow and the number of surge events, thus reducing the amount of pollutants flowing into lakes and rivers. Green roofs also have the potential to mitigate the urban heat island effect. By cooling roofs, the surrounding ambient air temperature is lowered, reducing the need for air

conditioning and thus smog. They can mitigate the impact of building footprints by replacing and/or restoring tree canopy and natural heritage.

4. The Green Roof Technology is the way to go, given the European experience.
5. Much of the research and development has been done for this technology, but little work has been done to understand the biophysical and socio-economic benefits of widespread green roof implementation in a holistic manner. Individual studies on watersheds (Vancouver and Winnipeg) and the urban heat island (Toronto) have been conducted.
6. In order to encourage more green roofs, the benefits and cost savings to both the building operator and the larger community needs to be quantified.

INPUT REQUEST #3.0: ASSUMPTIONS

[* Indicates a participant response to the original challenge paper.]

3.1 Which assumptions require more clarification for you to understand?

* #4. We need to clarify what it means by "the way to go". Is it in terms of energy saving (then how about reflective roofing?) or environmental benefits (how about reduce development density or increase park area?)? It needs clarification. In North America, especially in Canada, green space is not as "scarce" or "limited" as many European cities, so we do not feel the need as urgent. However, with the growth of our cities, we should plan ahead and the European experience can be viewed as a model for reference.

* quantify the benefits of green roofs in stormwater retention

* identify and quantify uses other than irrigation and fertifigation for retaining stormwater and quantify the benefits

* - point #4 & #6

* I question the following: Impact on air quality and Recreation potential???

* I have no problem understanding these assumptions; I have just completed an independent study credit for my Master's degree and have a fairly broad understanding of the assumptions.

* can food potential be a realistic objective?, the only areas appropriate to food production would be urban, otherwise ground level facilities are much less expensive, if the green roof system removes air pollutants, then is the food produced by green roofs safe to consume?

* do green roofs restore tree canopy? what kind of systems can do this?

* surge events or high peaks cause erosion in creeks, what is meant by 'pollutants', do the pollutants refer to the airborne pollutants that are filtered through green roofs or the suspended solids in water flow caused by erosion? this need clarification

* can we use Europe as a representative example in Ontario since we have a long freeze cycle and the benefits are greatly reduced in the winter?
is it safe to state that there are indeed cost savings? they should be qualified, over how many years?

* #4 seems unsupported explicitly (ie what is the European experience?)

3.2 Do you strongly disagree with any of these assumptions?
* some of the assumptions suggest but do not specify research that can be done to increase useful knowledge in this area.

* Nothing strong disagreeable with the above but #4 is definitely too strong a statement without much clarification.

* - no – although I am not sure I would agree with the last sentence in #3 – replacing tree canopy- I would not support development of existing green spaces to be replaced by a green roof

* I am not completely clear on what we mean by the biophysical benefits – I think we need to speak clearly about the cost of pollution ie. the cost of pollution at the sewage treatment plant, that all taxpayers absorb b/c we do not have a mechanism for challenging the amount of impervious surface area that the urban area supports. Once we get political will to change/evaluate/measure the surface runoff alone in Toronto, we will be more able to inform policy at the urban level. Each municipality will have to look at their sewer bylaw and consider how waste water run off ultimately costs big bucks at the end of the pipe; do municipalities want to incur these costs or 'split' the cost with users? Ie. industry/commercial building owners etc…..

* #1 (ix) and #3 with respect to urban heat islands, there is some difficulty in the use of terminology: green roofs can reduce urban air temperatures, but the urban heat island effect is primarily a nocturnal effect, not a daytime effect. Conceptually, green roofs cool urban atmospheres (at least during the warmest part of the day) but further work is required on the impacts of green roofs on urban atmospheres.

3.3 What assumptions would you add to the list?
* Based on our Ottawa study, extensive green roofs reduce cooling needs in the summer significantly but did not affect much the heating needs in the winter. Consider the cold climates of most of Canada, we are only benefiting from green roofs about half a year. This needs to be considered in cost-benefit analysis.

- More data would be needed to quantify how green roofs can improve air and water quality in the urban areas. The benefits might be significant when green roofs are installed on many buildings.

* None

* Just that green roof policy choices/policy instruments/policy formation is a very important piece of the green roof infrastructure to prioritize right now ….city of Toronto

will need to work collaboratively with community/commercial building owners/academics/green roof installers etc…and this is an exciting opportunity for us to grow/work together.

* The need to understand environmental problems first – then start using different tools to improve them. Then there is a need to monitor to see if they are indeed helping to improve various situations.

* that green roofs provide connectivity for ecosystems

Outcome:

3. Develop research questions which directly address the "needs" of the industry and government representatives.
4. Prioritize the research questions and create research teams and champions to develop research proposals.

INPUT REQUEST #4: ACTION PLAN

[* Indicates a participant response to the original challenge paper.]

4.1 What concerns does this action plan raise?

* I think we might need an educational component to the action plan. We need to educate the public to accept this new concept. There are old fashioned people in the construction industry still think green roofs only add problems (higher cost, leaks, maintenance…etc) to a building. We have to make sure the public would accept this new technology.

* A tree is a good analogy: we seem to have started from the branches and the leaves and are now building the trunk and the root system

* None

* How will this be funded?

- Is political & public support available?

* This seems a reasonable approach.

* What factors might be considered in prioritizing research questions?

* *no response…*

4.2 What new elements or ideas would you like to add?

* I think this Think-Tank is an excellent opportunity for the people working on green roofs to meet and exchange ideas and establish collaboration. Hopefully, we will get a few new collaborations started from this meeting.

* The owners need to be included.

* None

* - a time line needs to be included in action planning

* Do green roof targets need to be developed?

* How can green roofs technology be added to municipal development policy and service charges?

* I think considerable emphasis could be placed on assumption #5.

APPENDIX 2 – Participants' list

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