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Comments on the Registration Document for Fundy Gypsum's proposed Miller's Creek Mine Extension Project

My comments focus on aspects related to plant biodiversity. I see serious flaws in the proponents' arguments that, under their proposal, the biodiversity of the area will not be seriously affected. I have additional concerns about the effects on the hydrological regime, and on existing and potential sustainable livelihoods in the region. Some of these concerns I expressed in a letter to The Honourable Mark Parent on March 14, 2007.

I wish to emphasize, as other have, that the registration document is voluminous and that far from adequate time has been given to allow it to be properly reviewed. In my case the previously unannounced registration/10-days-to-receive-comments came in the midst of dealing with a mass of mid-term assignments and I was not able to give it a full day of attention until today. There may be a few errors as a result; more regrettably, there are many aspects of the proposal beyond what I present that concern me, but I was not able to even begin to consider them.

The context of plant biodiversity considerations

The special nature of the plant biodiversity that would be affected by the mine and that has been affected by previous mine developments is well summarized in this extract from the Natural History of Nova Scotia (N.S. Museum, 1996):

The vegetation of gypsum areas is influenced by the calcareous nature and dryness of the soils and by a karst topography that limits disturbance through forestry and agriculture. The main form of disturbance associated with gypsum is mining, but this is now mostly confined to deep, unweathered deposits; gypsum outcrops and cliffs are more likely to be left untouched. Mixed forest (often including Eastern Hemlock, Red Spruce, and Red Oak) is interspersed with bare or scrubby areas where the soil is too thin and dry to support tree growth.

Botanical interest is provided by a number of rare or unusual plants that survive in gypsum areas because of the comparative lack of competition. The flowers are best in the early spring, before the soil becomes parched. Fleabane can be found growing on the crumbling cliff faces, and above it on the cliff tops, Gypsum Ragwort grows. Trout Lily and Yellow Lady's-slipper can be found beneath trees on the plateau. Several hardy shrubs exist here, including Round-leaved Dogwood, Buffalo Berry and Shrubby Cinquefoil. Some of these plants require basic soils, while others (cinquefoil and Yellow Lady's-slipper) can also be found in acidic bogs, where the mechanisms to reduce evaporation, which are so necessary on the dry gypsum, help to prevent the plant from being poisoned by excessive take-up of acid water. Rarities occasionally found in gypsum areas include Leatherwood and the Ram's-head Lady's-slipper…

The gypsum provides calcareous soils, which support the greatest diversity of land snails* found in Nova Scotia. The caves in gypsum provide hibernating sites for bats. Productive aquatic habitats support a more diverse freshwater fauna than is found elsewhere in the province. [I have searched the registration document for mention of snails; there appear to be none - DP]
There is a wonderful description as well by John Erskine in an essay titled "Plaster Rock" (Forest and Field, N.S. Museum, 1976). Interestingly, coming at this juncture, he describes on page 48 his discovery while "scrambling over Newport gypsum" of the ram's head lady's slipper: "…this flower puzzled me. I had been quite sure that there were no more orchids of this genus left to be found in Nova Scotia. So I turned to the books of wider range and these were in no doubt. This was the ram's head lady's slipper .. whose easterly range reached to central new England and southwestern Quebec."

That apparently marked the discovery of this species in Nova Scotia (although the first formally reported occurrence by Erskine was for plants in Wentworth Creek gypsum quarry). The ram's head was placed on Nova Scotia's list of legally endangered species in 2007.

Mining, including the Miller's Creek mine are cited in the related report as a factor contributing to the fragile status of this species and to its designation as a legally listed endangered species. The following is Extracted from the Nova Scotia Provincial Status Report on Ram's-Head Lady Slipper (*Cypripedium arietinum* R. Br.) prepared for Nova Scotia Species at Risk Working Group by Sean Blaney and David Mazerolle, 2007.
Special Significance of the Species Nova Scotia represents the easternmost occurrence for the species. Populations are over 330 km disjunct from the next closest site in Maine, and could thus be genetically distinct. The species' flower structure is unique among North American lady slippers and is considered structurally primitive. Ram's-head Lady Slipper is much appreciated for its beauty and is cultivated by some orchid enthusiasts. It may be available commercially from specialized growers. The species could possess useful medicinal qualities. Cypripedium species have been used historically or are presently contributing to the treatment of joint inflammation, menstrual pains, neuralgia and epilepsy.

In Nova Scotia, the species is strongly associated with gypsum bedrock, and is found growing in moderately open, mesic woods on outcrops, shaded tops of cliffs, terraces, moderate to steep wooded slopes and in sinkholes (Erskine 1954, Pronych and Wilson 1993, AC CDC database records). Forest cover at known sites includes deciduous dominated, conifer-dominated and mixed

stands of young-intermediate to mature forest. Tree species noted as present in the field are large-toothed aspen, beech, white birch, black cherry, balsam fir, hemlock, red maple, sugar maple, white pine, red spruce, white spruce, and red oak. All locations except for the one at Angevine Lake, Cumberland County are from areas having extensive surface exposures of Windsor Group gypsum bedrock nearby and, with the exception of the Cogmagun site, having karst topography.

Over the longer term, the Millers Creek, Wentworth Creek and MacKay Section quarries have certainly removed suitable habitat for Ram's-head Lady Slipper. The area of these three active or recent gypsum quarries is 790 ha, representing 2.4% of gypsum bearing bedrock (Carboniferous age bedrock of the Windsor Group) within 20km of Poplar Grove (Lawrence Benjamin, NS DNR Kentville, pers. comm.). The 2.4% figure can thus serve as a minimum estimate of the proportion of potential Ram's-head Lady Slipper habitat lost to gypsum mining in the past 75 years. The proportion of occupied habitat removed by the three quarries is likely significantly greater than that, because most of the known occurrences are clustered near the quarries and much of the potentially suitable habitat identified in the above analysis may never have supported Ram's-head Lady's slipper.
That brief background, provides a setting for my comments.

1. In general, I think the consultants have done a reasonably good job in documenting the nature of the plant communities in the proposed mine area and surrounding areas. Indeed, this very documentation makes a strong case for giving conservation priority over the mine.
The report notes that "33 red-listed and 55 yellow-listed species have potential to occur on the site" and, based on the surveys they conducted,* comment that "Ram's head lady's-slipper, round-lobed hepatica (Hepatica nobilis), black ash, eastern leatherwood, yellow lady's-slipper, thimbleweed (Anemone quinquefolia) and Canada buffalo-berry (Shepherdia canadensis) were all found on the project site" as well as a red-listed cyanolichen, *Solorina saccata.*
*No details appear to be given in the registration document about how the surveys were conducted so it is not possible to critique them; I have no basis to believe either that they were of appropriate rigour or that they were not.

2. In contrast to the reasonably good job in documenting the nature of the plant communities in the proposed mine area, the suggested impacts (or lack of them) and proposed mitigative measures (versus documenting what is there) do NOT bear the signature of critical scientific review and comment. In particular, cumulative environmental impacts, including consideration of impacts on metapopulations are lacking.

A most revealing statement in this regard is given on page 124: (underlining is mine)
Cumulative habitat losses on the Avon Peninsula have already been significant. Historical and ongoing agriculture has had significant adverse effects on the vascular flora of the study site, in that extensive areas of mature forest habitat have been permanently removed and replaced with monocultures of non-native agricultural crops and/or pasture, which provides little if any suitable habitat for the original species of flora. Historical and ongoing forestry has also had significant effects on the vascular flora of the study site, in that extensive areas of mature forest habitat have been removed and are now in varying stages of regrowth. Road construction and historic mining activities have also had significant impacts, leading to the complete loss of forest habitats in some areas. Creation of roads has also led to increased penetration of interior forests by humans with ATVs, and has decreased the amount of undisturbed interior forest. <u>It is unlikely that the impacts</u>

from the mine could exceed the impacts of agriculture, road development, and forestry on the flora of the Avon Peninsula, none of which has likely been compensated for.

Cumulative Impact Assessment is an important principle in environmental impact assessments. It means several things; one is that a particular impact comes on top of already existing human impacts on a region or environment and it is the total impact that must be considered. So rather than being an argument to excuse the mine's impacts or equate them with previous impacts, the past activities in the area are instead an argument to give new activities more scrutiny than past activities.

In the same vein, a key concept in modern ecology and conservation biology is that of metapopulations of a species. A **metapopulation** consists of a network of subpopulations. The subpopulations are not static, but dynamic and are maintained by recurrent immigration and gene flow from other populations; local populations go extinct in the short term, but over the longer term are maintained by recolonization from other populations. In this view of populations and sites (for which there is voluminous scientific evidence) the whole is greater than the sum of the parts; conversely, losing a subpopulation can have a disproportionate impact on the viability of the whole population. The concept is very relevant to the arguments made by the proponents about whether or not certain populations of particular species will remain viable after loss of the proposed mine area, but this is not discussed, in fact they appear completely unaware of the concept. For example, on page p. 109 in regard to Poplar Grove as a habitat for rare species, it is commented that "This area is located south of the Project site and will not be affected by the Project" However, if Poplar Grove is losing a major nearby source of new immigrants, the Poplar Grove populations themselves become much more precarious.

Statements that various wetlands that would be lost to the mine footprint are too small to be of significance, e.g., "None of the wetlands are large enough to play significant roles in any wetland functions on the Avon Peninsula.", are similarly seriously flawed.

The 40 hectare conservation area: this is not Noah's Ark!

The proponents make much ado about their efforts not to disturb areas currently supporting ram's head orchid, which they found at 9 sites, one not in their proposed conservation area; they modified their plans to include that other site. However, the conservation area is only 40 hectares out of 420 hectares, the remainder being the mine and spill area. **A well known rule of thumb in conservation biology predicts that a tenfold reduction in habitat results in approximately 50% reduction in the number of species an area can support.** So even if that 40 hectares contains all of the species of the area initially (something like Noah's Ark), there will be a large reduction in the number of species conserved over the long run.

While the proponents plan to avoid direct loss of ram's head, it is acknowledged that there will be direct loss of habitat for other red listed species such as hepatica, leatherwood and the lichen *Solorina sacatta* in the mine footprint area. That these are not *legally* protected makes them no less important than ram's head. Not all species that should be on protected species lists are on those lists now; it is an ongoing process involving a lot of documentation and research, largely by a consortium of volunteers. Red listed species ("Red - any species known to be, or believed to be, at risk."), are essentially candidates in waiting for protected status.

Even for ram's head, the loss of habitat to the mine could be very significant. Over time one would expect this species to establish in the footprint area, and undoubtedly it has been there in the past and come and gone, as discussed above. Just because it is not there now does not mean that the habitat lost is unimportant for conservation of ram's head.

Cumulative losses at the regional level

There has already been substantial loss of the gypsum karst and limestone communities to other mine sites (for limestone as well as gypsum) in Nova Scotia and N.B, which must likewise be taken into consideration. My colleague at Guelph, has submitted comments on this issue separately, as has another from Saint Mary's University; both are well recognized plant ecologists with a lot of experience in the region. In addition, a highly respected plant ecologist in the province who is now residing in the western U.S., submitted some comments in this regard last year. So the lack of consideration of this cumulative issue at a regional level, as well as at the level of the whole peninsula, is a further serious deficiency in the proponents' document.

3. Assumptions that populations can recover within the timeframe of mine development are highly dubious.

There are a number of places in the registration document where it is being argued or inferred that as the mine will be developed in about 10 to 15 year sections, there will be time for populations to recover: "a significant adverse effect on vascular plants or cyanolichens is one that results in a decline in the population of a listed species such that natural recruitment would not return the population(s), or any populations to their former level within several generations." They are not very explicit about it, but it is clear what they are hinting at: gradual is better than sudden as there will be time to recover. That may be true for a few species, but certainly not for many of them, such as leatherwood, ram's head, hepatica. Not only are there issues related to metapopulations as I have discussed, there are genetic factors, and many of these plants are dependent on particular soil conditions and fungi that may take several decades, even centuries to develop.

4. Misleading comments about impacts of mining

On page 125, the argument is made that since yellow lady's-slipper occurs in habitats that have been subjected to some disturbance, "suitable habitat for this species will be recreated (as evidenced by its current high abundance in areas historically disturbed by mining activities)." This is comparing mice and elephants. Nova Scotia has a history of small scale gypsum operations that complemented rural livelihoods based on forestry, farming and fishing and there were even a number of "valued added" small industries as well call them now. But that picture does not apply to today's megamines. The Abandoned Mine in the Forest Commons was miniscule in area by comparison with the proposed mine and was a much shallower mine (probably less then 30-40 meters), without the massive spill areas characteristic of the current mine or the use of the compaction-generating machinery of today. "Some disturbance" in reference to lady's slipper has ecological meaning; it definitely does not imply tolerance of the sorts of disturbance being proposed.

5. Lack of detail concerning the Conservation Area.

While there is great emphasis put on the conservation area, there is very little information in the registration document about how it would be managed or justification for the argument that it will not be impacted by adjacent mine activities. There is ample reason to believe that it will be

impacted, e.g., coming from studies of impacts of highways on adjacent wilderness areas going up to over a kilometer away from the highways.

6. Grasping at straws: "It is unlikely that the impacts from the mine could exceed the impacts of agriculture, road development, and forestry on the flora of the Avon Peninsula". This statement is simply ludicrous. None of those latter activities (agriculture, road development, and forestry) has created a crater to below sea level in the centre of the watershed! Indeed, the very fact that the upland area where the mine would be located remains forested and is referred to as the "Forest Commons" shows that the local community has understood its significance for the integrity of the whole watershed.

Agriculture and forestry are indefinitely sustainable, and the roads support a sustainable local economy; in contrast, the mine will provide employment for only 30 to 50 years, and eliminate most of the current and potential sustainable activity for centuries if not millennia. Further, most of the effects of forestry and agriculture, especially the rather non-intensive type that occurs on the peninsula, are largely reversible: abandon them and the natural communities will re-establish; in contrast, no one is going to return exported gypsum to the crater left by the mine so that the area can regain its former integrity!

7. Amhibians need more attention.
I visited the Forest Commons area in August of this year and was amazed at the abundance of green frogs, wood frogs, and bull frogs in the area which is pock marked with small wetlands and quasi-wetlands. This is in marked contrast to reports of rapidly dwindling populations of amphibians over much of the globe. The registration document seems to dismiss the small wetlands and quasi-wetlands of the Forest Commons as important, and does not acknowledge the abundance of frogs in the Forest Commons. Also, local residents tell me that there are significant populations of painted turtle in some of the ponds. The frog and turtle populations will all be lost to the mine footprint, rendering the populations in the residual conservation area very much more precarious, due to metapopulation factors as discussed above.

8. Water Resources
It is well known that karst systems are highly sensitive to drilling and similar activities, and the full impacts - especially when the proposed mine is in the upland forested area of the watershed - cannot be accurately predicted. The report seems to focus on Shaw Brook, but there could be repercussions over much larger areas. Given the attention to water quality and protection of source waters in Canada over the last few years and the more recent acknowledgement that we are in an era of rapid and largely unpredictable climatic change, it seems inconceivable that a project of this sort could go ahead.

9. Environmental record and responsibility of the proponents.
The proponents comments to the contrary notwithstanding, the proponents do not have a good record locally for responsible environmental management. Examples have been cited in the press, and I am sure they will be well documented in other submissions. To add to those, perhaps, are these examples.

- There are reports of water becoming sulphurous in the last 2 years which is suspected to be

related to extensive coring by Fundy Gypsum in the proposed mine area.

- In 1979, Environment Canada reported that quarry dewatering at Wentworth Creek amounted to 600 million gallons, dumped into the St. Croix river. The toxic contents of that water are widely believed to have a significant impact on fish habitat in the inner Bay of Fundy/Minas Basin.
- On page 109: "An area east of Ferry Road was identified in the Significant Habitats Database as having historical records of a rare plant, the Canada Violet (Viola canadensis). This plant was listed as extirpated in Nova Scotia by NSDNR in 2003 (pers. com. Mark Elderkin)." This seems to be a reason to dismiss this issue. However, amongst naturalists familiar with the area, there has been concern for years that the Canada violet population was destroyed by spill from the present mine. Regardless, to date, there has apparently been no consideration given to destruction of rare flora by spill from that mine.
- In August of this year, I was invited by the Avon Peninsula Watershed Preservation Society to accompany several members of their WatershedDiscover the Watershed Project and area residents on a hike into the Forest Commons. They showed me areas where there had been extensive clearcutting & bulldozing within the last 2 years on the large blocks of land owned by the gypsum company, apparently without consideration of the impacts on the Beaver Pond trout population, which residents said had now disappeared. It seems it was being assumed that the mine would go ahead and therefore there was no reason to take steps to protect that population. I think such actions speak for themselves.

10. The elimination of sustainable livelihoods

Finally, I would simply like to reiterate concerns expressed by many residents about the destruction of sustainable livelihoods by this mine.

This mine would be, essentially, a death sentence for this lovely peninsula, its rich heritage, its farms and villages, its unique karst topography and the biodiversity this environment creates and sustains. More than that, it would eclipse the beginnings of a rural renaissance and a promising future.

Because the effects of the gypsum mine would be both short term and very long lasting, the losses of alternative, sustainable communities and livelihoods that would result from a new mine must be considered. The Avon Peninsula is a largely unspoiled land with rich agricultural soils, salt marshes, forest and small communities. Its unusual karst topography makes it exceptionally attractive and hosts unique assemblages of native plants and other wildlife. The farms include dairy, beef, fowl, certified organic market farms, orchards, a vineyard. There is tremendous potential for expansion of farming and cottage industries with direct marketing to the rapidly growing Halifax Regional Municipality. The area is also valued by artists, tourists and, increasingly, ecotourists - for a long time it has been a favourite place to take botany classes and naturalist groups, or for individuals or groups to search for unusual species of snails, beetles and bats associated with the gypsum karst.

The proposed mine would eliminate all of this - beauty, and livelihoods. Indeed, the activities since 2005, when Fundy Gypsum first made its intensions clear, have created widespread dissension and depression in the community. Is this the Nova Scotia of the future?

Sustainable Multiple Use of the Forest Commons

During the summer some of the residents were beginning to gain some optimism that Fundy Gypsum might not be proceeding with its proposal. I was invited to accompany several residents on a hike into the forest commons and to discuss sustainable alternatives for the area. Here are some of the things we came up with for sustainable multiple use of the Forest Commons.

- There are many features of the natural history that would be of interest to school classes, natural history groups and ecotourists: the karst topography/sink holes; diverse wetlands; amphibian, reptile and bird populations; the "Plaster Rock" plant species cited by John Erskine (including the ram's-head orchid, a legally protected endangered species which occurs in this area)3, older growth and regenerating forest on wet and dry terrain (and everything in-between).

- The two ponds in the Abandoned Mine area are interesting features that might be highlighted in sustainable multiple use options for the Forest Commons area. They are visually attractive and interesting with their unusual and contrasting hues, and in regard to the contrasting character of the two ponds. Studies of their depths, the nature of the white cloudiness, oxygen and hydrogen sulfide content, and species of aquatic vegetation and fauna in the ponds would be appropriate.

- A wilderness type camp ground and swimming area might be established by the Beaver Pond. Project personnel suggested that the pond could be restocked with trout.

- The topography makes for interesting mountain bike and ATV trails that might be specifically developed and managed for those uses.

- Forestry and hunting are traditional uses that could be maintained under a multiple use scheme. Managed for sustainability of the resources and protection of the watershed, these activities would add to the educational value of this area.

Surely, this sort of thinking about the Forest Commons is much more consistent with the environmental goals of the N.S. government and all Nova Scotians, than a large crater in the centre of that beautiful land.

Thank you for consideration of these comments.

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