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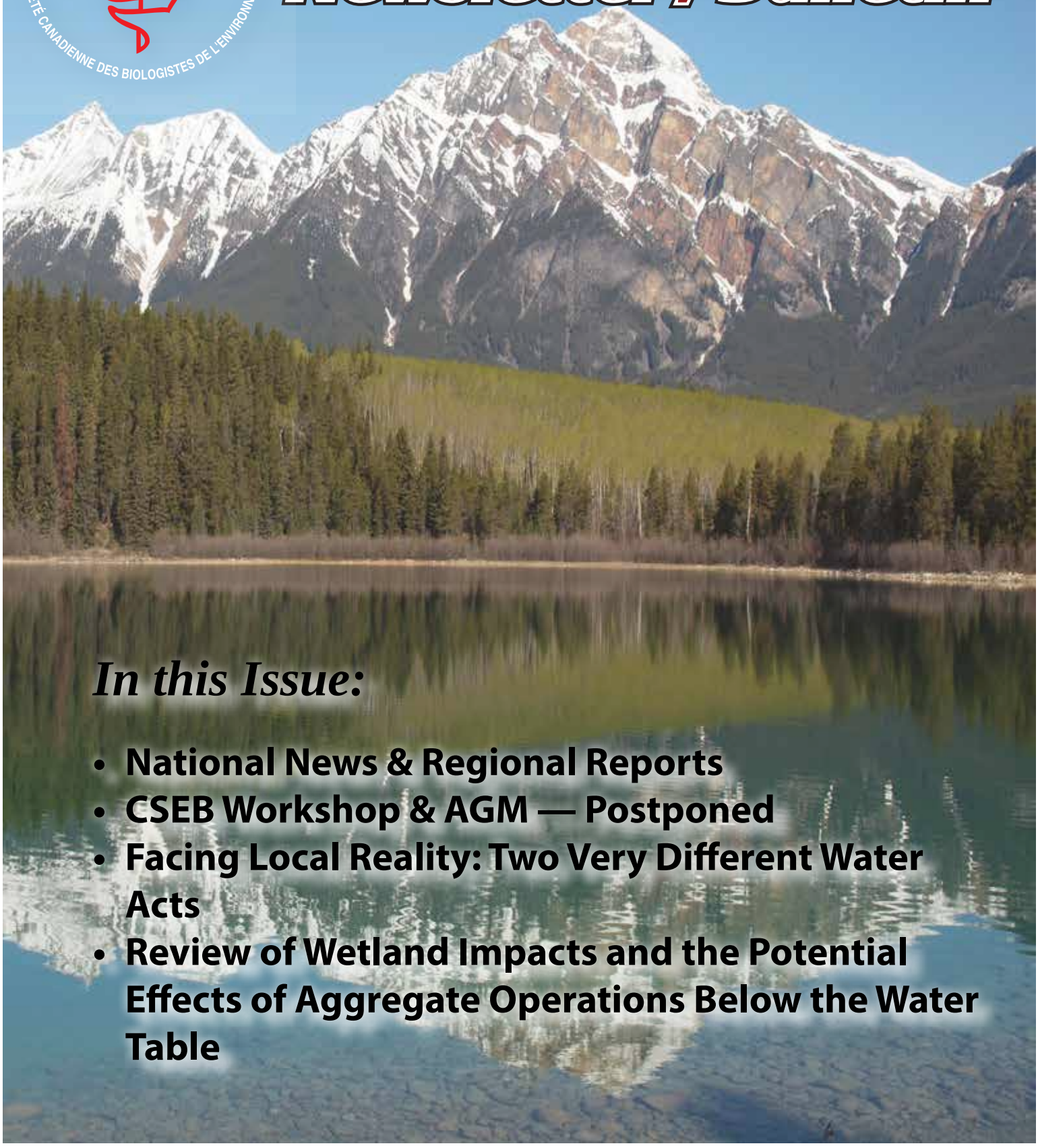
THE CANADIAN SOCIETY OF ENVIRONMENTAL BIOLOGISTS Newsletter / Bulletin



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CSEB Newsletter Bulletin SCBE

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In this issue

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Front Cover: Pyramid Mountain, and its reflection in Patricia Lake, above the Jasper town site in Jasper National Park, early May 2015. Photo Credit: Peter Wells, CSEB Member

Back Cover: View of a wildflower community adjacent to a monitored wetland associated with an aggregate quarry in central Ontario (see article on page 12 of this issue)

Photo Credit: Kim Logan, P. Geo. (Limited), P. Biol.

CSEB NEWSLETTER 2015

Vol. 72, Number 3 Fall 2015

The Canadian Society of Environmental Biologists Newsletter is a quarterly publication. The Newsletter keeps members informed of the Society's activities and updates members on the current affairs and advances in the field of environmental biology. This publication draws together the widely diverse group of Canadian environmental biologists through a national exchange of ideas. Members are invited to contribute papers, photos or announcements that are of a national biological and environmental interest. Letters to the editor are welcome. This is a volunteer non-profit organization and we rely on your participation to make the newsletter a productive forum for ideas and discussion.

All business correspondence, changes of address, undeliverable copies and membership applications should be sent to: CSEB National Office, P.O. Box 962, Station F, Toronto, ON., M4Y 2N9. **Editorial correspondence: Gary Ash, Editor, e-mail: gash@golder.com**

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LE BULLETIN de la SCBE 2015

Vol. 72, Numéro 3 Automne 2015

Le Bulletin de la SCBE est une publication trimestriel de la Société Canadienne des Biologistes de l'Environnement. Le Bulletin informe les membres des activité de la Société sur événements courant ainsi que les progrès qui font en sciences de l'environnement. Par un échange d'idées au niveau national, cette publication intéresse un groupe très diverssifié d'environnementalistes Canadien. Les membres sont invités a contribuer des articles, photos (noir et blanc) ou des messages qui sont d'intérêt nationale en sciences biologiques et environnementales. Les lettres à l'editeur sont bienvenues.

Tout la correspondence d'affaires, y compris les abonnements, les changements d'adresse, les exemplaires retournés et les formulaires: CSEB National Office, P.O.Box 962, Station F, Toronto, ON, M4Y 2N9. **Les lettres à l'editeur: Gary Ash, Editor, courriel: gash@golder.com**

Rédacteur en chef: Gary Ash

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The Canadian Society of Environmental Biologists

CSEB OBJECTIVES

The Canadian Society of Environmental Biologists (CSEB) is a national non-profit organization. Its primary objectives are:

- to further the conservation of Canadian natural resources.
- to ensure the prudent management of these resources so as to minimize environmental effects.
- to maintain high professional standards in education, research and management related to natural resources and the environment.

OBJECTIFS de la SOCIÉTÉ

La Société Canadienne des Biologistes de l'Environnement (SCBE) est une organisation nationale sans but lucratif. Ses objectifs premiers sont:

- de conserver les ressources naturelles canadiennes.
- d'assurer l'aménagement rationnel de ces ressources tout en minimisant les effets sur l'environnement.
- de maintenir des normes professionnels élevés en enseignement, recherche, et aménagement en relation avec la notion de durabilité des ressources naturelles et de l'environnement, et cela pour le bénéfice de la communauté.

NATIONAL News

PRESIDENT'S Report

By Bill Paton, CSEB President

Your Executive has decided to delay the Workshop the effects of oil and gas development until next fall (2016) and are recommending that for all future workshops, a two-year planning and implementation process will be used. Many details have already been accomplished but some technical difficulties with our new web-page and fully publicizing the event, and the lack of response to the first call for papers, has necessitated the postponement. The first call for papers and posters has gone out to individuals and environmental organizations across Canada and adjacent U.S. states (they will be advised by me on the delay). Titles and abstracts should still be forwarded to me at Patonw@Brandonu.ca. Please share information with any interested individuals or NGOs in your region.

We are attempting to bring to our Workshop experts from across Canada and adjacent US states. An oil spill is the release of petroleum hydrocarbons into the environment due to human activity. When an oil spill occurs, it can result in huge environmental impacts and financial loss. Oil spills can be caused by many things, but most currently occur when oil is transported across the ocean. The *Exxon Valdez* disaster is still impacting biota and ecosystems on the Alaskan coastline. Spills may also occur during the extraction process in the field or ocean platform or from the conversion process in refineries. Drilling can also cause seepage of oil. Pipeline leaks and rail accidents are also sources of oil in the environment.

More recently, the combination of hydraulic fracturing and horizontal drilling has transformed natural gas and oil production in North America. Natural gas production from U.S. shale formations now provides 40% of total U.S. gas production. The production of light oil from shales, tight sandstones, and other relatively impermeable formations in Canada rose from ~0 to >160,000 barrels per day in Saskatchewan, Alberta, and Manitoba. A similarly rapid rise in U.S. production drove output to 9 million barrels per day at the end of 2014, on par with the world's largest oil producer, Saudi Arabia.

Public concerns about the intensity and safety of high volume hydraulic fracturing have accompanied the approach to oil and gas recovery. These concerns include its water requirements and the potential for drinking-water contamination and surface spills, induced seismicity, and emissions of air toxics and greenhouse gases. Rail transportation linked to the Bakken Field oil production is now a major concern of many communities across the U.S. and Canada.

Register early for the workshop in Burnaby next fall. The developing field-trip plans also sound interesting – we would like to visit with First Nations in the area who challenged the proposed pipeline in their traditional lands and waters. A visit to a local provincial park is also being considered.

CSEB WORKSHOP & AGM POSTPONED

As noted in the President's Report, CSEB has postponed our upcoming Workshop and AGM to be held in Vancouver until the fall of 2016 to allow putting together a more robust program. We will hold a teleconference AGM later this year, with information about the date and time to be provided later.

As we are still planning for the 2016 workshop, CSEB is still looking for members to sit on the Organizing Committee to plan the 55th Meeting and Workshop. The theme for the workshop is I***nvestigation of the Effects of Oil and Gas Development on Ecosystems and the Environment.***

We are still looking for the following positions:

- Committee Chair
- Logistic Coordinator
- Program Coordinator
- Fund Raising / Sponsorship Coordinator
- Registration Coordinator

If you are interested in any of these positions or interested in helping out the committee, please contact Bill Paton at Patonw@Brandonu.ca.

Federal Election

Please examine the environmental and science policies of the federal parties

and

VOTE

October 19th for your preferred candidate/party

REGIONAL News

BRITISH COLUMBIA News

By Loys Maingon, CSEB BC Director

Facing Local Reality: Two Very Different Water Acts

Most of the concern on the West Coast this summer has been focused on the California drought and the ecological and economic implications of the unusually large and long-lasting warm water mass in the north Pacific, not affectionately known as "the blob." In most of BC, this has meant a succession of record-breaking temperatures, forest fires, droughts and water restrictions, together with a collapse in oyster harvest and freshwater fishing tourism.

In essence, this means that for the last 12 months, the rural municipalities of Vancouver Island and the watersheds that support them have been facing a constant succession of water alerts and restrictions. The weathervane for Vancouver Island's rural and small municipality watershed problems has been the Cowichan River. The Cowichan River is a designated heritage river. It is also the designated key indicator for the Lower Strait of Georgia salmon stocks in Canada/US fisheries treaty. With the absence of the snow pack, river flows throughout East Vancouver Island dropped radically between April and September, and water temperatures rose to above 23 degrees for over 30 day periods, putting many salmon stocks at risk, and giving us a glimpse into the probable "new normal."[1]

Thus, in spite of a major hatchery expansion on the Cowichan in 1991, and the associated significant increase in DFO's projected chinook targets, shifting environmental conditions over the past two and a half decades have cast into doubt the effectiveness of these technological "fixes." The rate at which anthropogenic factors have caused the environment to decline outstrips our capacity to mitigate impacts. And that is exactly the conclusion that Californian researchers are coming to: "*As anthropogenic effects increase, lessons from past droughts cannot simply be applied to future events…. Climate and hydrological scientists focus on large-scale phenomena and give little attention to local conditions and impacts, such as reduced economic production or depletion of local groundwater.*"[2]

The overall decline in critical water flows and the accompanying increase in average water temperatures over the past decade,[3] coupled with the repeated extremes observed in the last two years, confirm that BC's fisheries targets, and the water objectives set to meet them are proving to be increasingly elusive, if not simply unrealistic, in the face of the observed shifting climatic conditions.

For good reasons, California's plight has become a metaphor for the state of the world. California is, after all, one of the world's largest economies and a cornerstone of North America's food distribution system. It is what statisticians would call a representative sample of the most affluent sectors of the global economy. As the authors of a recent article in *Nature* entitled "*Recognize anthropogenic drought*" (27 August 2015, 409-411) eloquently put it: "*California's current extreme drought must be a lesson for managing water in a warmer, more densely populated world…..California's water troubles are a harbinger of things to come around the world, wherever populations and industries are growing.*"[2]

The California drought has really been about anthropogenic climate change and its economic and ecological implications, and the difficulties of ascertaining the long-term implications of "the new normal." What we see and find in California is telling about future trends for our ecosystems, and the relationship between our economic system and our environment in general. As in California, the drought in BC has been associated with an increase in forest fires that have exceeded the provincial budget, and with a general decline in primary productivity that has negatively affected agricultural production and has increased tree mortality rates. Thus, as the provincial government continues to push for the flooding of rich hay farms of the Peace River in order to develop the hydro potential of the Site C project needed to support its LNG gas development plans, the drought in Southern BC and Alberta has collapsed this year's hay crop, increased the cost of beef production, and reduced supply.[4] This is a mild "food shock", which is likely to develop as the "new normal" progresses.

What makes the situation in California particularly significant is that the current drought comes in the wake of a series of ever-increasing droughts (1976-1977, 1988-1992 and 2007-2009), that have made California the most well-adapted state in the world. It has "the world's most engineered and diversified water system."[2] This has made it possible for California to maintain a reasonable service to urban areas in spite of the severity of the drought. It is the rural systems that have been more severely impacted, and have had to resort to increasing ground water pumping rates, thereby abstracting aquifers as well as lotic and lentic base flows, with radical consequences for flora and fauna, particularly so for endangered species, as entire food webs have become altered. In California, streams and wetlands are disappearing, 12 million trees have died and Chinook hatcheries have closed.[2] The consequences of legislation to provide relief for farms include the abstraction of water from the Sacramento and San Joaquin rivers, which is likely to have "irreversible impacts, such as the extinction of native fishes."[2] While things are not so dire in BC, similarities are developing. It is, therefore, instructive to compare how California and BC are responding to these challenges.

That California has been able to meet urban needs thanks to its highly developed engineering planning, may sound comforting, until we stop to consider that urban centres are not isolated. They are extensively dependent on rural ecological services that support them economically. In simple terms, the economy depends on the maintenance of a reliable and renewable natural capital, which is taken for granted, but which has large impacts as it shrinks. The environmental state of rural California provides

clean water, relatively cheap food, an abundance of raw material and a relatively cheap seasonal labour force. As the water table continues to be pumped and to drop faster than it can be replenished, Californians understand that natural capital will diminish and the services it provides will become scarcer.

The most remarkable thing about California's response to the problems posed by the drought is the understanding that there is a need to move beyond the limits of the largely technological solutions of the past, and address potential impacts on local ecosystems and biodiversity at a local or regional level, by empowering communities. That means managing water locally to preserve local values and local economies. In California, concerns over the future sustainability of the rural water table have been addressed in a hard-hitting and revolutionary document, the 2014 *Sustainable Groundwater Management Act.*[5] One of the remarkable features of this act is that, in spite of the fact that California has the most advanced water distribution system, California recognizes that: "*The state's water management system is unsustainable. The system is unable to reliably meet human economic and ecological needs.*"[6]

To understand just how remarkable the Californian act is, one needs only compare it with BC's new *Water Sustainability Act*, which was tabled in May 2014 and which will come into force in 2016. The Californian act has two basic principles: 1) "Groundwater is best managed at the local or regional level", and 2) "The state will only intervene on a short-term where local agencies fail." To facilitate local implementation, the Sate of California is providing $100 million for groundwater planning and management. In other words, in crafting the act, California developed a means to implement and enforce a bottom-up approach to water sustainability in which local communities, agencies, and conservancies manage groundwater for collective environmental benefit.

By placing the responsibility and implementation control with local and regional agencies, and providing the means to do so, the Californian act places the decision-making directly with the communities that are most affected. Local communities determine what will most affect them. To understand what this means, one needs only compare the bottom-up implications of this legislation with the top-down approach to environment impact assessments that has governed the National Energy Board's controversial consultation policies for the past four years, which have repeatedly been found to unduly limit public input.

BC's *Water Sustainability Act*, which nominally has the same aims as the Californian act, takes a top down approach and in the view of some critics: "*doesn't have the necessary enforceable language and mandatory standards to actually protect freshwater in BC.*"[8] Enforcement will be addressed through a series of "regulations", which are being developed and which will be unveiled in 2016. As with the BC Environmental Assessment process, in comparison with its predecessor The *Water Act*, Section 13 of the new act fast-tracks the granting of licenses and authorizations to corporations and reduces the public consultation process. As in the much reviled NEB process, only parties determined by the "decision-makers" to have a legitimate claim, can file for a hearing.

As is customary in Canadian legislation, environmental objectives are left largely at the discretion of ministers and cabinet or their proxies, "decision makers". With regards to environmental objectives such as "critical flows", the decision makers are left to loosely "consider" (s.15) objectives—there are no stringent mandatory obligations or constraints. In the same vein, while the power exists to list some streams as "sensitive", there is no clear set of objective obligations to guide listing or de-listing. Water usage is loosely governed by the ill-defined concepts of "beneficial use" and "efficient use", which encompass "private use", and can always justify economic and commercial use over environmental priorities. In fact, environmental concerns of Section 15 stand in diametric opposition to allowances made immediately after, in Section 16, for "mitigation". Industrial damage is feasible on the "fiat" of a "decision-maker" and mitigation is highly flexible, there is no actual obligation to repair or off-set in situ, and whatever obligations may exist are not even obligatory but merely conditional. They "may be required":

> "*3) With the consent of the applicant, the terms and conditions of an authorization or change approval may require that the applicant take compensatory mitigation measures on a different stream or aquifer than the stream or aquifer in respect of which the application is made".*

In keeping with the custom to date, water usage remains "FITFIR" ("First-in-time First-in right). This is problematic for a number of reasons. In spite of the growing legal consensus that recognizes the priority of aboriginal right, this act does not include the priority of First Nations' rights to water. Given the controversy surrounding a number of mining projects in this province that have adversely affected First Nations' use of water and fisheries, such as the Mount Polley mine disaster, one senses that the act is out-of-sync with reality and biased in favour of corporate rights to pollute. Similarly, throughout the province where logging interests affect the use of crown lands, and particularly on the east side of Vancouver Island where the Dunsmuir Land Grant has placed half the island in the hands of private logging companies, which are held to a lower standard, water quality and supply are affected by the prior ownership and licensing of corporate interests. There have been for the past decade growing concerns that these licenses need to be curtailed to protect community watersheds.[9] Furthermore, throughout the province, agricultural water grandfathered FITFIR licenses allowing the virtually unlimited use of water remain a serious fisheries concern that cannot be adequately addressed by this legislation.

The key to some of these glaring contradictions really comes in Section 10 of the act. In this section the government gives itself a new power to repeatedly and for an indefinite amount of time issue short-term authorizations to the same parties, for the same purpose and in the same time.

> (3) For certainty, a use approval may be issued authorizing a p*erson to divert water from a source of water supply for a water use purpose in relation to an appurtenancy, if any, specified in the use approval, whether or not a use approval was previously issued authorizing the person to divert water from the same water source supply for the same water use purpose in relation to the same appurtenancy.*

As legal counsel for West Coast Environmental Law has pointed out, this is legislation written for the particular interests of hydraulic fracking:

"For some time the Oil and Gas commission has granted short-term approvals for water use for fracking, which currently can be for up to 24 months (the Water Act used to limit short-term approvals to 12 months, but was extended a year or two back). However, if the oil and gas companies take longer than 24 months to frack, the Commission has been issuing repeat authorizations to the same companies – a practice that Ecojustice has recently challenged in court." [7]

Given the importance that the current provincial government has staked in the development of LNG, it seems that BC's Bill 18 *Water Sustainability Act,* as Bill 14 the *Parks Act* before it, does not represent an attempt to move beyond the lessons of the past. The *Water Sustainability Act* is an attempt to greenwash the needs of industry. It is strangely out-of-step with the needs, which the California drought have made clear to the rest of the world. Unlike its Californian counterpart, this act is not really an attempt to protect water, within the context and challenges posed by a growing anthropogenic drought, which is increasingly recognized as "the new normal." This is not the management of groundwater for the beneficial use of local communities that stand to be affected for decades to come. This is legislation written to accommodate the rights of industry. This is an act that reflects a perpetuation of the questionable concept of "sustainability" proposed by the Brundtland Commission 30 years ago in response to the challenges posed by *Limits to Growth*, in which corporate interests are accommodated to perpetuate business-as-usual, with a new coat of green paint.

Just as California now recognizes the limits of technological adaptation, so should BC. This drought is an affirmation of the limits of sustainability. If "*California's current extreme drought must be a lesson for managing water in a warmer, more densely populated world…..,*" then the BC *Water Sustainability Act* has completely failed to connect with that reality, because it does not understand that business-as-usual, and the water management system it exploits, are no longer sustainable.

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Wrecking Balls Are Destroying B.C.'s Heritage — and Its Character

By Stephen Hume - reprinted from the Vancouver Sun, Aug 6, 2015

Demolition of Canadian artist and naturalist Mack Laing's former residence "Baybrook" in Comox.

Photograph by: Loys Maingon

Ho hum, another day, another fragment of British Columbia's heritage erased in the name of progress, cleanliness and saving NIMBY neighbourhoods from visitor parking.

There will be cheering among the historical sanitizers in Comox today as iconic Canadian artist and naturalist Mack Laing's former residence is consigned to the garbage. It joins the rubble of half a dozen other historic "eyesores", which no longer afflict the gaze of tourists whom civic leaders presumably think prefer visiting strip malls.

Nothing like making your town look like bland suburban everywhere instead of maintaining the unique sense of an edgy past that might actually attract cultural tourists instead of encouraging them to head on up to Cumberland or Campbell River where heritage seems important.

Mind you, the vision-bereft of Cumberland once had their day, too. What was once the biggest Chinatown outside San Francisco, including its magnificent opera house, was razed. Pothunters were then encouraged to rummage through the site and carry off artifacts from when Canada was in its infancy.

All that remains is a derelict log cabin, historical plaques, museum displays and the cemetery where — so far at any rate — nobody's advocated demolishing the historic tombstones of union activists, including the boulder with the red hammer and sickle. Oh, wait — they did that once, too, vandalizing the Japanese cemetery in the name of patriotism, although it has since been shamefacedly restored.

More recently, in a fit of ideological pique, the provincial government expunged from road signs the name of Ginger Goodwin, a socialist labour leader shot dead by Dominion police in 1918. His blood-stained memory, alas, rose from the grave to become the engine of a thriving cottage tourist industry.

Of course, signs bearing the name of his capitalist foe, mine owner Robert Dunsmuir, remain intact. Letter writers still rant about commemorating a draft-dodging communist but, hey, people are interested—why try to drive off those who want to leave their dollars in bed and breakfasts and local eateries? Isn't that called cutting off your nose to spite your face?

Who cares today whether Goodwin was a leftist radical or that coal from Dunsmuir's mines was reportedly sold to refuel German armoured cruisers menacing Vancouver from San Francisco harbour.

What's important—and what Cumberland has since come to recognize—is that meaningless retroactive moral judgments aside, it's all fascinating stuff for history buffs and it's the fascination that attracts cultural visitors to your town, where they spend their money.

Campbell River, points out Richard Mackie, who wrote the Laing's biography in 1985, hosts Roderick Haig-Brown's house Above Tide, built in the same year that Laing built his house above the beach at Comox.

"Look what Campbell River has done with Haig-Brown's legacy — the house anchors the Haig-Brown Institute, the Haig-Brown Festival, and the Haig-Brown Writer in Residency. Haig-Brown's Above Tide helped put Campbell River on the (cultural tourism) map, but with the demolition of Mack Laing's Baybrook, the Town of Comox has put itself on the map for all the wrong reasons."

Kathryn Molloy, executive director of Heritage B.C., which had urged Comox town council not to destroy what the organization described as an "irreplaceable" bit of the province's history, expressed disappointment that the politicians couldn't retain Baybrook "and use the building in ways that will conserve the heritage values of this significant site while celebrating the important life and work of Mack Laing."

Loys Maingon, the local heritage activist who advocated for saving the site and using it as a natural history interpretive centre, said that "hand deconstruction" of the building, salvage and recycling of materials was promised. Instead, he said, municipal authorities sent in heavy equipment to smash the structure.

"Our national heritage building can now be found at the sanitary landfill," he said.

"Baybrook was one of the last remaining heritage buildings in Comox. As the letter from the National Trust shows, it was the only building in the Comox Valley that qualified as a national heritage site. Its destruction is an incredible statement of cultural ignorance and a reprehensible betrayal of fundamental Canadian values," he said. "Today's events are a national disgrace that deserve national publicity."

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ALBERTA News

By Brian Free, CSEB Member

Like many western Canadian provinces, Alberta is experiencing a very dry summer. In some areas, especially in the central region around Edmonton, county officials are declaring a drought. The northern Peace region is especially dry. Nevertheless, recent rains have alleviated some of the stressful growing conditions.

Hot dry weather is also affecting our lakes and rivers. Low water flows combined with hot weather have resulted in high water temperatures in rivers and streams throughout southern Alberta. The fish are already under stress, so angling in these areas presents a high risk to fish populations and may result in mortalities, even when using catch and release practices. To best protect fish populations, several rivers and streams have been closed to all fishing until further notice.

The new NDP government has a number of election promises to fulfill. Recently, they announced a panel of five academic and stakeholder representatives to prepare some options to consider for Alberta's approach to greenhouse gas emissions reduction. There is a quick turnaround on this, as the Premier wants this to help in developing the Alberta position for the December United Nations climate change conference in Paris. The panel will provide advice on how to price carbon, how to grow the renewable energy sector, how to promote energy efficiency and how to reduce Alberta's reliance on coal-fired electricity generation. These aren't radical, new concepts, so some options should be easily developed. It's choosing the option that will have broad-based support that is the toughest challenge. For more information, check out the "Climate Leadership" website at http://alberta.ca/climate-leadership.cfm. A discussion document can be found there, as well as an on-line survey.

Another challenging issue is the wildlife mortality around Alberta's oil sands operations. Recently, 30 great blue herons were found dead at the Mildred Lake oil sands mine, north of Fort McMurray. A Syncrude employee discovered a great blue heron covered in bitumen near an inactive sump — a low area where water run-off collects. The bird was alive but had to be euthanized. Following a search, another 29 dead great blue herons were discovered. They appear to have died over a period of time. It's surprising that so many herons — typically solitary birds — were discovered in the same area outside of migratory season. Although the herons are common in Alberta, it is still a cause for concern.

There were no bird deterrents at the site because it was not by an active tailings pond, which has to be monitored under current regulations. (You'll recall the hundreds of migrating waterfowl that landed in an oil sands tailings pond a couple of years ago.) Nevertheless, Syncrude has taken steps to deter wildlife from entering the affected area. The company has erected a wildlife fence, stationed field personnel to monitor the area 24 hours a day, installed six sound cannons, six effigies on the sump, as well as a robotic falcon. Quite an interesting array of deterrents, eh? If anyone has any better ideas, give Syncrude a call. I'm sure they will be interested!

Leak of 'Low-risk' Pipeline Probed

Alberta's energy and environment ministers say they are troubled by a spill of 5 million litres of bitumen, sand, and water from a year-old, double-walled pipeline that went undetected by its warning system. The spill site is 35 kilometres southeast of Fort McMurray and covers a 16,000 square metre area. A contractor discovered the spill July 15 at Nexen Energy's Long Lake oil-sands project. "We are disappointed with this result and putting every effort to understand the root cause as a company to address it," Ron Bailey, Nexen's senior vice-president of Canadian operations, told reporters in Calgary. The spill occurred in an evergreen forest and measures have been taken to keep animals away while the contaminated water is sucked up. McCuaig-Boyd called the spill " unacceptable." "We all want to know that when an incident like this happens, not only is it contained and cleaned up, but every possible effort is made to find out what went wrong and fix it, prevent it from happening again here or anywhere else in Alberta."

This event happened as Canadian premiers were debating the safety of pipelines and the scope and direction of a Canadian energy strategy. "I think this amplifies that Canada still has work to do to ensure best-in-class practices around pipeline safety" said Erin Flanagan, an analyst at the Pembina Institute in Calgary.

Source: The Globe and Mail. Saturday July 18, 2015; Winnipeg Free Press July 25,2015

Needed For CSEB Newsletter

- Guest Editors
- Article Contributors
- Regional News Contributors
- Chapter News Contributors

If you are interested in helping out, please contact:

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SASKATCHEWAN News

By Robert Stedwill, CSEB Past President.& Sask. Chapter Chair

Musing on the happenings here in Saskatchewan this summer, one thinks of forest fires and very dry conditions, both here in the south and in northern Saskatchewan. So dry in fact, that the harvest is already underway. Good quality, but not a lot of bushels per acre, or should that be kilograms per hectare?

Regardless, it got me thinking about Saskatchewan Environment, and lo and behold, they have a new website, which I have yet to determine if it is better than the old one, but only time will tell as I navigate my way around. During my "navigation", somehow, either inadvertently, or by shear interest, I stumbled across a page put out by the Ministry of Economy entitled *Saskatchewan Now*. It is a publication put out quarterly on Saskatchewan people and businesses engaged in economic growth. The winter edition has pieces on an Italian pasta maker, the Boundary Dam Carbon Capture Project, and SED Systems[1], which was partly responsible for the great success of the Rosetta Orbiter landing a probe on an asteroid. But what caught my attention was the article on drones. UAV's to be exact: unmanned aerial vehicles.

The article entitled "A Flight into History" written by Darrell Noakes talks about the inclusion of a UAV into the permanent collection of the Smithsonian Institution's National Air and Space Museum in Washington D.C. in November of 2014. The manufacturer of the Draganflyer X4-ES drone is Draganflyer Innovations Inc. in Saskatoon. This is the first UAV to be placed in the museum, due in large part to its ability to observe things from above, which would likely be missed by ground based observers. This particular drone located a near death accident victim suffering from hypothermia using thermal imaging, which caught the attention of the Smithsonian as the first documented search and rescue mission undertaken by a drone.

I have never operated a drone. However, as professional biologists I think we need to think about this technology and its potential uses in our own field work. In my early career in the late 60s, I was heavily involved in the "ground truthing" of satellite imagery in the Kawartha Lakes in Southern Ontario. I thought the technology at that time as so advanced, I followed the science rigorously for a number of years to what we have today in terms of satellite imagery on any part of the planet. As a field biologist though, satellite imagery doesn't tell me immediately what I need to know in terms conducting field work. Can a drone determine whether a nest site is active without climbing a tree, or standing around waiting for birds to fly in and out? Could it monitor the extent of algal blooms on a lake, or the extent of a shoreline contaminated with oil from a leaking tanker anchored in the harbour? I think back to my days with the former government agencies I worked for trying to do good work, but difficult to do being tired after climbing power poles looking for active nests, walking countless kilometres of shoreline looking for ground nests, counting dead fish, and "guessing" as to how large an algal bloom was. Before

[1] *The Systems Engineering Division (SED) plans, designs and implements solutions for many of the world's space agencies and leading communications satellite manufacturers and operators.*

the advent of the snow machine (yes, I was around then doing field work), slogging through lake ice slush on skis and snowshoes made winter sampling a chore, and exhausting, and unsafe, occasionally going through unknown thin ice.

The ability of a drone to "see ahead" to avoid unsafe issues is one aspect that I would have appreciated way back then; and now, I can think of endless applications as to how drones might be used in biological field work.

Oh, to be back in the field!

MANITOBA News

Submitted by Bill Paton, CSEB President.

New Churchill Marine Observatory to Study Oil Spill Effects in the Arctic

Regional federal minister Shelly Glover and Manitoba Premier Greg Selinger were in Churchill in early July to jointly announce the approval of $22 million toward the $31.7 million centre to study impacts of oil spills in the arctic environment. The Canada Foundation for Innovation is providing $12.4 million and the province $9.7 million. In-kind funding is coming from the private sector and other public sector sources.

The University of Manitoba is a major partner in the project. Scientists from the universities of Calgary, Victoria, Laval, Dalhousie, and Washington will also be involved, as will federal government researchers.

Feiyue Wang, a professor of environmental chemistry at the University of Manitoba, who will be the principal investigator of the ocean component, said there is research on oil spills in the Arctic, but it takes place indoors in small tank experiments. The ability to do the research on-site in the Arctic makes this unique facility worldwide. It will study and develop technology to detect the presence of oil and other contaminants beneath the sea ice, research the impact, and test technologies to help clean up spills. One of the main components will be two saltwater sub-pools where various oil-spill scenarios can be mimicked and studied and compared with the control tank.

As many as 100 researchers will converge on Churchill over the course of a year to work at the new facility.

Source: Winnipeg Free Press July 7, 2015

Check out the CSEB Video at
http://youtu.be/J7cOuDbBf9c

TERRITORIES News

Submitted by Anne Wilson, CSEB 1st Vice-President and Territories Director

NWT and NU Fall 2015 Regional Update:

It has been another dry year in the NWT, and this is having far-reaching impacts. Forest fires have so far affected some 622,000 ha with 240 fires in total by mid-August, and the fire danger rating remains high to extreme. Most of these are in the south and southwest regions, but fires in the North Slave have threatened populated areas, and caused road closures. Boaters on Great Slave Lake have found the water level lower and extreme care must be taken when navigating – channels that previously avoided submerged rocks are now treacherous. Sealifts to the coastal communities that travel the Mackenzie River may be limited by water levels. Power costs in Yellowknife have skyrocketed as the low water levels reduce generation on the hydro system and switch generation to diesel. Here's hoping for a good amount of fall rain, and a substantial snow pack this winter.

Environment Canada updated the seasonal forecasts July 31st, for the fall period, and forecasts above normal temperatures across the NWT and much of NU. The precipitation outlook is variable: predicted to be above normal in much of the northwestern areas, and near normal in the southern NWT and most of NU this fall. However, if you look at the stats for historical percent correct for these types of forecasts, the batting average is below 50%, which begs the question—does this really mean the opposite will happen?!

Fires, poor air quality, and propeller-killing rocks are offset by fewer mosquitoes this year in many areas. Other hazards have been reported in the news lately though – bears! CBC News posted an article about polar bears visiting campers in Nunavut. The two polar bears fared better (scared off by a shotgun blast) than the black bear that visited Yellowknife's Shell station – it was shot and killed (for reasons not reported).

Two polar bears, a mother bear and her adolescent cub, approach a campsite near Chesterfield Inlet, Nunavut. Maggie Putulik grabbed her camera and started taking pictures — that is, until the mother bear began making her way toward the cabin.

(Submitted by Maggie Putulik)

Mining and Other Development News

Ongoing environmental assessments underway in the NWT and Nunavut include the following:

- Jay Pipe Expansion - Ekati Diamond Mine (Dominion Diamond Ekati Corp). The Jay Pipe is located under Lac du Sauvage, and is proposed to be accessed by constructing a ring dike around the kimberlite pipe. Following review of the Developer's Assessment Report, information requests and responses, and technical sessions, the next step will be the public hearings scheduled for the week of September 14th in Yellowknife and communities.
- Revised terms of reference were issued last February for the impact assessment of the Mackenzie Valley Highway project, now reduced to 333 km of all-season gravel road connecting Wrigley and Norman Wells. The next step is the submission of the Developer's Assessment Report.
- The road EA for the Prairie Creek Mine (Canadian Zinc Corp.) has paused, while the company works with to address deficiencies in the Developers Assessment Report. The company is working to assemble financing needed to take the mining project into production.
- A new environmental assessment has commenced for an access road upgrade in Howard's Pass, for the Selwyn mine project.
- Sabina's Back River gold project is undergoing environmental assessment, and the Final Environmental Impact Statement will be out in November.
- Baffinland's Mary River project has applied to increase the shipping season to year-round; this is being reviewed by the Nunavut Impact Review Board (NIRB).
- Agnico Eagle Mines Limited has applied to expand the Vault pit; this involves draining a small lake and the application is being reviewed by NIRB.
- TMAC Resources is looking to bring the Doris North gold mine into production, contingent on approvals for expansions in the Hope Bay Belt. A revised project description will be submitted soon to the NIRB.

In the regulatory forum, several mining projects are moving towards development or have applied for amendments to their water licences, or renewals:

- Snap Lake Diamond Mine (DeBeers Canada Inc.) was granted an amendment to discharge higher levels of TDS, with strict conditions. This approval is subject to signature by the Minister (GNWT), which has been delayed for time to consider further.
- Diavik is proceeding with construction of the A21 dyke, to allow them to access ore from an underwater pipe.
- North American Tungsten Limited's Cantung Mine water licence is up for renewal, and this is complicated by financial woes with the company under creditor protection.
- Fortune Minerals has not advanced further, and is working on financing to move the project to construction. Road access is also an issue.
- Canadian Zinc Corp.'s Prairie Creek Project is seeking financing to proceed.
- DeBeers Canada's Gahcho Kue Diamond Mine is under construction, and continuing monitoring work during the lake dewatering.
- The Avalon Rare Metals project is on hold, while the company does further work and lines up financing prior to going to water licence hearings.
- The Meadowbank Gold mine's Type A Water licence renewal has been granted. In addition to the Vault pit expansion, Agnico Eagle Mines is looking at an expansion with the Amaruq ore body. It is a satellite resource, so a 50 km road would need to be constructed, and this ore would extend the mine life by several years.
- The Meliadine Gold project water licence application has been submitted, and is proceeding through the technical review stages.
- The Lupin gold mine has been in "care and maintenance" for years, and the new owners have renewed the water licence with the stated intention of developing the Ulu deposit and reopening the mill.
- The Nanisivik and Polaris lead zinc mines have been issued closure licences, which cover the final monitoring phase.
- The Giant Mine Remediation project team is exploring remedial development options prior to submitting an updated water licence application. Terms of the long-expired water licence still apply however, and the mine is still complying with the MMER requirements.
- Several municipal water licences are up for renewal in Nunavut, with Iqaluit's at the top of the list.

Full details for current environmental assessments are available on the Board's web site at http://www.reviewboard.ca/registry and regulatory files at http://www.mvlwb.ca/Boards/mv/SitePages/registry.aspx.

Closing:

If you are connected to activities in the Yukon, NT or NU, there is a vacancy for a Director, and I would love to welcome someone on board. If you are doing work north of 60 that you would like to highlight in the newsletter, or running some seminars or other training opportunities, please let us know. The CSEB provides a valuable networking and communication forum, and a voice for biologists if there are any issues to be raised. There is also the option of instigating other CSEB activities – both of the fun and/or of the educational variety - with colleagues in the North. Please email your thoughts to anne.wilson@ec.gc.ca.

ATLANTIC News

BOOK REVIEW

by Peter G. Wells, Halifax, NS, CSEB Member

Kaye, Rob. 2015. Born to the Wild. Journals of a National Park Warden in the Canadian Rockies. Grey Wolf Books, www.robkaye.ca. 347 p. $21.95.

I discovered this book this summer while in Jasper, AB, and read it over five weeks of hiking, backpacking, and climbing in the Rockies and the Purcell Range in British Columbia. It became a well-worn, much appreciated companion due to its topic - wildlife conservation and management in the mountains, and the trials and tribulations of a park warden during the recent decades, some very difficult, of Parks Canada. It is an autobiography penned by

Rob Kaye, a retired, former Jasper Park warden and a specialist in backcountry management and resource conservation. The book is very readable, a real page-turner if you like the outdoors and are concerned about the future of wildlife and the environment in general. Rob's early experiences with wildlife while growing up in Jasper are described, then the book focuses on his many experiences patrolling the boundary regions of the Jasper Park wilderness as a park warden. One is introduced to the life of a warden, the dependence on horses (fascinating creatures!), the various animals encountered in the wilds (grizzlies, black bear, cougars, wolves, big horn sheep, elk), the frequent encounters with poachers seeking the big prize (a big horn sheep or a grizzly), and the day to day life of living in the back country for months at a time, in all seasons in the isolated warden cabins. Kaye's stories are engrossing, if not terrifying at times – the back country is still quite wild, though some species populations are greatly diminished. Importantly, the book is a plea for greater protection of our mountain spaces and species. The concluding chapters describe the policy changes and horrific losses of personnel and resources in Parks Canada suffered under recent governments. The backcountry of Jasper National Park is now patrolled by only three part-time resource management specialists; there are no wardens as such now. The park, as well as others (Banff NP in particular), is essentially unprotected against poaching and other misuse. The book should be of interest to CSEB members and others concerned about the very uncertain future of some of our national parks and the responsible agency, Parks Canada. It is responsible for the almost impossible task of balancing park recreation and tourism while preserving the ecological integrity of these former wild spaces. CSEB should help in any way possible to bring attention to this challenge. Please, read this book and pass it on to other biologists and concerned Canadians.

Peter G. Wells, longtime CSEB member, in the Skoki region of Banff National Park, early August 2015

REVIEW OF WETLAND IMPACTS AND THE POTENTIAL EFFECTS OF AGGREGATE OPERATIONS BELOW THE WATER TABLE

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Edited by Barbara C. Hard, Ph.D., P.Biol.

Introduction

The impacts that anthropogenic activities such as development can have on the function and ecological integrity of natural features are well documented (Binstock and Carter-Whitney, 2011; Kwak and Freeman, 2010; Albert and Minc, 2004). To meet the demands of an increasing population, construction of infrastructure such as housing, public amenities, and transportation routes require the extraction of natural aggregate resources to support such development. This can result in significant degradation or loss of natural ecosystems (ECO, 2013). As a result, many environmental policies (on provincial, regional, and municipal scales) have been established to ensure the protection of remaining natural features. These policies such as the Ontario Provincial Policy Statement (OMMAH, 2014), *Environmental Protection and Enhancement Act* (Province of Alberta, 2014) and the *Environmental Management and Protection Act* (Statues of Saskatchewan, 2010) provide a framework to ensure that adverse impacts from new developments are minimized to the greatest extent possible and mitigation measures are implemented where needed.

Based on the requirements of applications for Permits to Take Water, natural features (e.g., wetlands and woodlands) underlain by aggregate resources may be susceptible to anthropogenic changes, including fluctuating water levels due to dewatering of pits and quarries. Wetland communities are particularly susceptible to fluctuating hydrological regimes and can be negatively impacted through both flooding and drought conditions (Jones, 2013). The surrounding terrestrial communities, which provide ecological function to the natural environment system (that wetlands are a part of), can also face detrimental changes resulting in decreased biodiversity and increased susceptibility to non-native, invasive species (Sakaris, 2013).

As aggregate operations expand to meet the society's increased development demands, extraction of substantial volumes of groundwater is commonly required. Due to the intrusive nature of dewatering, direct environmental impacts within the immediate area of influence and aggregate extraction footprint, can be expected. Recognizing such potential impacts, e.g., the *Aggregate Resources Act* (Government of Ontario, 2009), Technical Guidance for Hydrogeological and Surface Water Studies in Support of Category 3 Applications for Permit to Take Water (MOE, 2008) and the Provincial Policy Statement (OMMAH, 2014) in Ontario require that monitoring and rehabilitation efforts be made following the completion of aggregate operations.

To gain access to valuable geological resources, there is the potential need to extract below the water table, which can result in the act of dewatering such that the amount of aggregates being extracted is encountered below the depth of the water table. Dewatering creates an excess amount of groundwater at the surface, which requires management either through surface flow and infiltration or recirculation/pumping back as groundwater. This extraction of groundwater within the vicinity of wetlands may impact the natural system two-fold: through temperature fluctuations and quantity/source changes. In a system that contains groundwater inputs, the aerial extent and influence of the cone of depression needs to be considered in relation to the location of any nearby wetlands. Alternatively, if extracted groundwater is to be altered to surface flow and expected to infiltrate back as groundwater, the location of nearby wetlands needs to be considered based on potential for increased surface water inputs. This alteration of wetland inputs and flow regimes is important in determining any potential for long term changes to the wetland ecosystem, such as vegetation community and species composition transitions including a loss of species richness and diversity (Sakaris, 2013; Albert and Minc, 2004). Additionally a loss of groundwater input can contribute to thermal impacts and changes in water quality (MOE, 2008).

Due to the beneficial functions of wetland ecosystems in a landscape (i.e., flood attenuation, sediment and toxin filtration, and wildlife habitat), conservation of these features and functions should be considered when designing aggregate management plans. A proactive approach can allow for ongoing control of activities (i.e., dewatering), which allow for steps to be taken that will minimize overall negative impacts to natural features. In obtaining a permit to take water, a suitable monitoring plan to limit the measures needed for reclamation can allow for time-scale issues and species specific variables where measurable triggers are not always straight forward (MOE, 2008). Continual monitoring of potentially affected natural features throughout the entirety of dewatering is crucial to allow for the identification of adverse impacts to help maintain the existing natural condition of these features. Parameters that can be used to monitor the impacts of fluctuating water levels in wetlands from extracted water inputs include Floristic Quality Assessment (FQA) and water quality and quantity measures (Sorrell et al., 2012; US EPA, 2012; Post et al., 2010; Hudon et al., 2006; Albert and Minc, 2004).

The Use of Vegetation Based Indices for Long Term Monitoring

Monitoring of plant communities can assist in the identification of changing ecological conditions and health of a wetland ecosystem (Albert and Minc, 2004). Due to the sedentary nature of vegetation species as well as their often fairly specific habitat requirements, the classification of plant communities can prove highly useful in indicating long term changes in ecosystem health and/or function in response to aggregate dewatering activities.

The use of standardized classification systems such as the FQA can support long term monitoring activities as they allow for the comparisons of vegetation communities over time at the same site, between different locales, or between communities of similar types (DeBoer et al., 2011; Rocchio, 2007; Bernthal, 2003). The FQA originated within the Chicago, Illinois area and was developed to aid in the assessment of local natural areas. Versions of this system have been adapted to reflect the specific conditions of other geographic regions. For instance, a widely-used version has been adapted for use in the assessment of natural areas throughout Southern Ontario (Oldham et al., 1995).

The FQA system assigns Conservation and Wetness Index values (C and W, respectively) to plant species. The Conservation Index (C) assigns values, between 0 and 10, to a species to indicate their degree of tolerance to habitat disturbance (higher values indicate more specialized habitat requirements and fidelity to narrower ranges of pristine landscapes). The Wetness Index (W) assigns a value between -5 and +5 to a species to indicate the probability that this species will occur in natural wetland conditions. Lower W values indicate higher requirements for wetland conditions (Oldham et al., 1995).

By averaging these FQA values of species across a community (i.e., grids, plots, transects), conclusions can be made regarding the general degree of naturalness/floristic integrity and wetness preferences of an area (Rocchio, 2007). Tracking changes of the mean C and W values can identify changes in the overall condition of each community within a system or make comparisons between systems. For instance, a dramatic decrease in W values over time may indicate that the community is becoming much wetter, and is being inhabited by more obligate wetland species. Although this result may be seen as positive from a wetland conservation point of view, it may alternatively suggest the loss of less flood-tolerant species that may provide critical functions to the original functioning of the overall wetland system.

Similarly, plant indices have also been developed for use in the general Great Lakes region, using data from coastal wetlands (Albert and Minc, 2004). Biological indices were developed through the incorporation of collected baseline abiotic/biotic information, and identification of main degradation sources in the region. Main stress sources identified within the Great Lakes region are reported as including alterations to flow regimes and degradation of water quality parameters. The use of wetland plant indices are recognized as being useful in tracking such stressors and their impacts on natural wetland features (Albert and Minc, 2004).

Ecosystem Impacts

Alterations in typical levels of salinity, turbidity or sedimentation, nutrients, and pesticide and heavy metals contamination may have impacts on the actual composition (proportion of species relative to the total number in a given area) of plant species assemblages associated with an aquatic system. Alterations in such parameters can occur in a wetland as a result of water inputs from adjacent dewatering activities. The use of vascular plants as indicators of changes in various water quality parameters has been documented for habitats such as prairie wetlands (EPA, 2012). Such changes can be tracked, and in addition to FQA-related information, conclusions regarding the overall ecological condition of a wetland system can be inferred. These parameters can all play a role in the overall temperature, pH, conductivity, and dissolved oxygen within a system.

The use of road salts is likely the most commonly considered cause of salinity level increases in nearby surface water features; however, within an area of aggregate resources, salinity can increase through natural sources such as the rock-water interaction and background levels (Kelly et al., 2012). As discussed, if during aggregate dewatering activities, groundwater from an aquifer is brought to the surface and discharged into a nearby wetland, changes in normal levels of water quality parameters such as salinity within the receiving feature can occur. For instance, an increase in salinity within a wetland due to natural source inputs of groundwater can occur if appropriate components such as brine are present (Great Lakes Science Advisory Board to the International Joint Commission, 2010).

Fish and invertebrates in freshwater systems typically have a narrow range of tolerance to salinity changes, and, therefore, increases in salinity can be detrimental to their survival (CCME, 2011). Similarly, plants have varying tolerance levels to salt-impacted soils/substrates. Changes in environmental salinity to levels outside of a species optimal "salt tolerance" range can result in identifiable changes in the resident plant assemblages of a wetland. For instance, an increase in salinity has been found to reduce new seed germination rates of high salt intolerant plants by altering their osmotic activities and preventing the transport of water and nutrients into their root systems. As a result, the plant community can experience a decrease in species richness (number of species in a community), with an expected decline in salt-intolerant species (US EPA, 2012; Wentz, 2001).

Turbidity levels within an aquatic system can also increase as a result of heightened flow and sediment input rates, and flooding. Turbidity is a measure of water clarity, and the amount of turbidity found in a system impacts the amount of light that can penetrate through the water column of a surface water feature. Through the addition of water inputs, turbidity in a wetland or surface water feature may increase, and as a result, shift the vegetation species composition to a more emergent or floating-leaved based community. As a result, a decrease in species richness and aerial coverage of colonizing submerged species requiring low light levels may also be expected. (US EPA, 2012; Albert and Minc, 2004) Increased turbidity can change the water quality by increasing temperature and reducing dissolved oxygen levels, which can alter the wildlife species composition dependent on

cooler temperatures and higher oxygen levels. Turbidity can also impact the physiological processes of aquatic organisms through a number of impacts (i.e., particles lodge in and clog gills, settling of particles over substrate smothering eggs/larvae, etc.) (Batzer & Baldwin, 2012; Verweig et al., 2010; US EPA, 1997).

An increase in nutrient loads in a wetland system as a result of inputs of high-nutrient containing water can cause a decline in submerged plants and an increase in the emergent and floating-leaved species within a community (US EPA, 2012; Albert, 2004). If enrichment is severe, the overall richness in emergents may actually decline (US EPA, 2012). More aggressive emergent wetland plants (cattails and *Phragmites australis*) may increase in biomass and aerial coverage if there is excessive nutrient loads and anoxia (US EPA, 2012; Albert and Minc, 2004). There is little risk associated with nutrient loading as a result of aggregate extraction and dewatering. Increased nutrients within a wetland system are more likely to arise from anthropogenic sources including sewage and agriculture. In the instance where an aggregate operation is separated from a wetland by anthropogenic influences, increased overland flow from dewatering activities may flush larger nutrient loads into a receiving wetland. During a planting experiment by Miller and Zedler (2003), results were obtained indicating that additions of nutrient-containing stormwater runoffs into a wetland encouraged the establishment of a non-native emergent grass species (i.e., *Phalaris arundinacea*) through impacts on water quality.

Changes in typical wetland temperatures can also occur as a result of increased water inputs. An increase in temperature can occur not just from seasonal changes but from alterations in water quality parameters as well. For instance, an increase in turbidity increases the absorption of heat by the particles within the water column, thus causing a rise in overall water temperature (US EPA, 2012). Increases in temperature may also occur through the addition of water inputs containing inorganic dissolved solids, which increase conductivity levels of the water and create warmer temperatures (US EPA, 1997). Such rises in water temperature can be minor or drastic, but both can cause detrimental effects to resident plant and wildlife species, depending on their tolerable temperature regime ranges. Temperature increases can also cause declines in levels of dissolved oxygen, which in turn can have detrimental impacts on resident organisms, such as influencing normal rates of photosynthesis in aquatic plants, and affecting metabolism in animals (US EPA, 1997).

Within the aggregate operations, there is a risk for a change to pH in a receiving wetland depending on the bedrock source of the dewatered inputs and how the extracted groundwater is managed. An increase in sediment load can also affect the pH. A change in pH outside of the ideal range (pH 6.5 to 8.0) can cause stress on reproductive functions, and lower pH can allow toxins to become more mobile and available for uptake by aquatic organisms (US EPA, 1997).

Water chemistry can play a significant role in wetlands; however, the depth of water within a wetland and the hydroperiod (duration of time soil is waterlogged) also play a large role in species composition and function of an overall ecosystem (Sorrell et al., 2012; Miller and Zedler, 2003). Water inputs into a wetland system from intentional sources such as aggregate dewatering activities, or unintentional such as flooding, causes an increase in water depth and overall length of hydroperiod, which ultimately impacts the water quality. Increased runoff inputs can create a system to be more susceptible to invasive species (Miller and Zedler, 2003). At greater depths, helophytes typically dominate due to their adaptation for surviving in oxygen deprived environments; this means species richness will begin to decline in a wetland with increasing water levels. Overall, fluctuating water levels will impact the dynamics of the wetland community, ultimately affecting productivity and function (Hudon et al., 2006).

Case Study

The ability to monitor impacts to the natural environment in response to intrusive anthropogenic activities such as aggregate extraction is crucial to effective resource management (MOE, 2008). Many of the above discussed concepts are currently being incorporated into monitoring plans to promote conservation of existing wetland resources (NDC, 2013; Sorrell et al., 2012; US EPA 2012; DeBoer et al., 2011; Hudon et al., 2010; Post et al., 2010; Rocchio, 2007; Albert and Minc, 2004; Miller and Zedler, 2003; US EPA, 1997). For instance, monitoring is currently being completed at a central Ontario quarry, where aggregate operations have expanded in size, and dewatering is required due to extraction proposed at depths below the water table. A naturally occurring wetland currently exists down-gradient (within approximately 1 km) of the proposed dewatering area. Settling ponds have been constructed to use for storage and filtration of the extracted groundwater; however, the water discharges overland from these ponds and is allowed to infiltrate back through fractured bedrock, with some inputs anticipated to flow into the adjacent wetland. Monitoring of this wetland is required through a Ministry of the Environment and Climate Change (MOECC) Permit to Take Water in order to assess the potential effects that such inputs and/or adjacent groundwater extraction will have on the feature.

Methodology

The monitoring program at this particular quarry has involved collection of data for three years prior to dewatering to represent baseline conditions of the wetland. Data has been collected using walking transects to record the vegetation that is present, and permanent stations are in place for monitoring water level and quality. This information will be compared to post-dewatering data to assess the impacts (if any) that the aggregate operations have had on the wetland feature. The walking transect monitoring will include vegetation inventories on a biannual basis (late spring/ early summer and late summer/early fall) including recording of C and W FQA values, fixed stations for water level recordings (staff gauges equipped with data loggers), wetland boundary delineation, and measuring of such water quality parameters as discussed above with a water quality meter at fixed shoreline stations.

Concluding Remarks

Based on the available literature and existing case studies it is apparent that aggregate operations have the potential to greatly influence the ecological balance of surrounding natural systems. This is recognized within the technical guidance documents published by the MOE for support of applications for Permits to Take Water and, as such, monitoring, contingency plans, and mitigation of impacts to natural features is a common condition of surface and

hydrogeological studies (MOE, 2008). Specific attention during the development of aggregate resource management plans should continue to be directed towards conservation of wetland ecosystems because they provide an abundance of ecological benefits to a landscape. The incorporation of standardized methodologies (such as the FQA and water quality measurements) into monitoring plans can not only help to ensure rehabilitation plans and restoration efforts are effective in restoring function to the surrounding landscape, but will allow for replication and comparison between sites. Based on the requirements of the PPS and the goal for an overall sustainable and resilient community based society, it is imperative that we minimize our development footprint where feasible both during and following anthropogenic activities to maintain the goal of long-term prosperity and social well-being within a clean and healthy environment (OMMAH, 2014).

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Monitored wetland prior to dewatering activities in Central Ontario (Photo Credit Erin Donkers B.Sc., Cert. Rest. Ecol.)

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Baseline conditions of a monitored wetland associated with future aggregate dewatering operations (Photo Credit Erin Donkers B.Sc., Cert. Rest. Ecol.)

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