

**ECONOMIC BENEFIT OF THE
CONTAMINATED SITE ASSESSMENT AND
REVIEW SECTOR
IN BRITISH COLUMBIA**

FINAL REPORT

Submitted to the:

**Contaminated Sites Approved Professionals Society of British
Columbia**

Submitted by:

TyPlan Consulting
and
The Economic Planning Group

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September 14, 2012

Contaminated Sites Approved Professionals Society
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Dear Ms. Schachtel:

Re: Contaminated Sites Sector in British Columbia – Draft Report

Enclosed herewith is a final report regarding the economic benefits of the contaminated sites sector in the province of BC. We wish your organization continued success in expediting the contaminated sites assessment review process in the Province of British Columbia.

Yours sincerely,

TyPlan Consulting

A handwritten signature in black ink, appearing to read "Russ Tyson". The signature is stylized and fluid, with a large, sweeping flourish at the end.

Russ Tyson, M.PI, MCIP, RPP, PLE

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1 INTRODUCTION

1.1 Background

In their current state, contaminated sites (or brownfields) represent an underutilization of the land base. They pose potential health threats and safety concerns to society at large. From a land use planning perspective the contaminated sites represent a lost opportunity to create economic activity, forgoing income resultant from the sites' redevelopment, the jobs created as a result of construction, and the on-going generation of taxes at all levels of government.

The land development life cycle for a contaminated site can be characterized by four (4) key phases associated with its use:

- Site assessment and review
- Remediation
- Redevelopment
- Operations

Within each phase in this development life cycle, various forms of economic activity occur, generating benefits to local communities and the provincial economy.

The remediation of sites within British Columbia involves a highly regulated and thorough review and approval process, which is both time consuming and costly. Time and cost are key barriers to entry in this market sector. The objective of the regulatory review process is the issuance of a certificate of compliance (COC), authorizing owners of the site to pursue redevelopment. The process to obtain environmental certification is managed by, and under the jurisdiction of, the BC Ministry of Environment.

To aid in streamlining the regulatory review process and related review timelines, the Contaminated Sites Approved Professionals Society (CSAP) was incorporated in March 2007. CSAP is supported by the Ministry of the Environment to help expedite approvals and reduce review timelines. Established as a self-regulating professional society, comprised of professional engineers and environmental scientists, CSAP's members are authorized to review site investigations associated with remediation of low to medium risk sites to determine:

- If a site is contaminated
- Review and approve remediation plans
- Recommend issuance of COC or other associated instruments.

As an independent body, CSAP ensures best practices are adhered to in investigation and remediation. CSAP has a commitment to/from the BC Ministry of Environment, industry, and to the general public to provide sound advice on regulatory policy. Since 2007 CSAP, through its members have been successful in reviewing approximately 400 projects over the organization's brief six-year history.

Their contribution to the process has resulted in an acceleration of the approvals timelines, reduction in overall expenditures, supporting commitments made by the Ministry of Environment.

CSAP was interested in documenting from a quantitative perspective, the economic benefit of the site investigation and remediation sector to the British Columbia economy and providing qualitative comment on the subsequent benefits of redevelopment and operations.

Terms of reference were prepared and in February 2012 the consulting team of TyPlan Consulting Ltd. (TyPlan) in association with the Economic Planning Group (EPG) was awarded the project.

1.2 Study Scope

The overall objective of the research project was to analyze the economic benefit of the site investigation and remediation sector on the provincial economy and provide qualitative insight into related redevelopment benefits. The report is concluded with a comparison of similar organizations in other jurisdictions.

The report has been divided into the following sections:

Section 1: Introduction; providing background, study scope, study methodology, study limitations and data sources.

Section 2: Contaminated Sites Sector in British Columbia: Situational Analysis; provides an overview of the contaminated sites sector in British Columbia.

Section 3: Regulation of Contaminated Sites in British Columbia; provides an overview of provincial government's involvement and CSAP's role in supporting provincial initiatives associated with remediating contaminated sites.

Section 4: Analysis and Composition of the Contaminated Sites Sector: provides, based on BC site registry data base and information provided by the National Brownfields Association and Hemmera Envirochem Inc., an overview of the composition of contaminated sites and various study costs associated with remediation.

Section 5: Economic Benefit Methodology Options; provides a series of methodological options available to evaluate economic benefits.

Section 6: Direct Benefits of the Site Assessment /Review and Remediation Sector on the Provincial Economy; provides a summary of the direct benefits of the site review/assessment sector on the provincial economy.

Section 7: Total Annual Economic Benefit of the Site Assessment and Remediation Sector on the Provincial Economy; provides a summary of the total annual benefits of the site review and assessment sector of the economy on the provincial economy.

Section 8: Redevelopment Multipliers; provides, based on anecdotal evidence, the relative benefits of redevelopment of remediated properties.

Section 9: Jurisdictional Benchmarks; provides a comparison of CSAP activities in relation to other jurisdictions throughout north America which have similar organizational mandates as CSAP, namely the states of Massachusetts, Oregon and Washington.

Section 10: Conclusions and Recommendations; provides next steps, conclusions and recommendations of this report.

1.3 Study Limitations

This study is intended to provide a high level assessment and preliminary indication of the annual economic benefits derived from the site assessment/review and remediation sector of the economy in British Columbia. An important limitation is that many sites undergo assessment and remediation in British Columbia that are not processed through CSAP and are not captured in this economic analysis. These include assessment and remediation conducted on federal properties, high risk sites managed by MOE and activities carried out by owners for due diligence that do not proceed to issuance of a COC or other regulatory instrument.

This is not meant, nor intended, to provide a definitive assessment of overall economic benefits to the provincial economy but rather insight and direction regarding the next steps required to further illustrate and calculate such economic benefits.

Due to the lack of available quantifiable data regarding site assessment/review and remediation costs, a number of assumptions were made by the Consultant team in determination of economic benefits. The range of costs compiled for the variety of studies undertaken throughout the remediation process varies significantly for each property under remediation, all of which limit the accuracy of the findings.

The results of this review must be considered in context to the assumptions made and the lack of raw data upon which this assessment has been based. In particular:

- There is no accurate tally of the number of contaminated sites in the province
- There is no central record of the number of sites that are being reviewed, assessed, and/or remediated at any one time
- Sites that are being reviewed, assessed and/or remediated include a mix of small, medium and large sites (which affects the costs)
- Sites can have a mix of contaminants resulting in reviews, assessments, and remediation that can range from simple to complex (which affects the costs)
- Sites are also located throughout the province from very urban locations to very remote locations (which also affects the costs)

As noted, the purpose of this document is to provide insight into the benefits of the remediation sector on the provincial economy, and to provide a starting point upon which CSAP, industry and the Province can better understand the magnitude of the benefit of this sector on the provincial economy.

1.4 Data Sources

Studies exist documenting the economic benefits of remediation. These studies range from complex economic models to anecdotal reports, but typically refer generally to the types of benefits that are generated (i.e., new economic activity, more jobs, increased tax revenue). No report was found that assessed the economic benefits associated with site assessment review specifically and resultant remediation activities on the local economy. Our review considered or utilized the following sources:

- Contaminated Sites Approved Professionals Society
- BC Site Registry
- BC Brownfields Renewal Strategy
- Canadian Petroleum Products Institute
- National Brownfields Association
- Hemmera EnviroChem Inc.
- US Environment Protection Agency
- Consultant reports (confidential)

The authors would like to thank those organizations stated above for their input into the review.

The study limitations identified (section 1.3) and the implications of the data gaps related to obtaining project costs are summarized below.

Table 1: Data collection limitations and issues

Issue	Description
No accurate number of contaminated sites.	BC Site Registry is a database of sites that may be contaminated, were under review, have been reviewed, or have been remediated. It contains an extensive list but does not provide a number of sites that are currently contaminated.
No record of the number of sites that are being reviewed or assessed at any one time.	CSAP provides reviews of some properties each year, averaging around 100 per year. However, many other sites go through the review process independently.
No record of the number of sites being remediated at any one time.	BC Site Registry provides notations of actions undertaken, but the records do not allow tallies to be conducted for a specific year.
Sites being reviewed and remediated include a mix of sizes.	Sites are typically categorized by size as small, medium or large. The size has a significant impact on costs to review and remediate.
Sites can have a mix of contaminants ranging from simple to complex.	The type and amount of contaminants have a significant impact on the costs to review and remediate.

Source: TyPlan. Economic Planning Group.

These issues make the economic analysis process challenging as costs to assess or remediate a “typical” site includes consideration of a range of factors, such as:

- size of site ranging from a few hundred square feet to hundreds of acres
- types of businesses that caused the contamination and types of contaminants
- amount of contamination

Consequently, we have used available data to create estimates of spending, relying on norms or weighted averages associated with specific studies required to remediate sites. This information has been obtained through personal communication with members of CSAP and with representatives of Hemmera Envirochem Inc.

2 CONTAMINATED SITES SECTOR: SITUATION ANALYSIS

The Government of Canada defines contaminated sites as:

“A site at which substances occur at concentrations (i) above background levels and pose, or are likely to pose, an immediate or long-term hazard to human health or the environment; or (ii) exceed levels specified in policies and regulations.”¹

The British Columbia Government defines contaminated sites as:

“An area of land in which the soil or underlying groundwater or sediment contains a hazardous waste or substance in an amount or concentration that exceeds provincial environmental quality standards. A site is contaminated if it is unsuitable for specific uses of land, water and sediment.”²

Sites can become contaminated through a prior land uses on site, the most common types of land uses being:

- Manufacturing facilities
- Waste processing, recycling, and disposal facilities
- Abandoned and operating mines
- Gasoline stations
- Abandoned or vacant residential buildings and warehouses
- Old railway yards and waterfronts

Contaminated sites are generally found in both urban and rural locations and are often located in strategic locations from a land use planning perspective. There is also an economic value associated with its location. Unfortunately, due to the cost to remediate the sites and the time period to secure approvals in relation to the market value of the site (e.g. COC) many of these sites remain vacant.

The actual number of contaminated sites in the province is not known, but is in the thousands. A recent national study put the number of BC sites at just under 8,000.³ The BC Brownfield Renewal Program estimates the total at between 6,000 and 8,000⁴. The BC Site Registry lists over 9,500 sites that have been identified as having, or having had, some

¹ ECO Canada, Who will do the Cleanup? 2007

² BC Ministry of Environment. Facts on Contaminated Sites; Fact Sheet 1. 2009

³ ECO Canada. Who will do the Cleanup? 2007. Appendix B, p.28.

⁴ <http://www.brownfieldrenewal.gov.bc.ca/qa.html#5>

form of contamination. (It is noted that the Site Registry contains sites that might be contaminated, that were contaminated and have been remediated, as well as sites that are currently contaminated.)

The site assessment and review sector is comprised of and supported by a number of businesses, companies and supporting service providers, all of which contribute to the provincial economy when undertaking remediation activities. The types of companies involved in the sector include:

- Environmental consultants
- Remediation services
- Engineers
- Construction companies
- Testing Laboratories
- Hazardous waste collection and treatment companies
- Public sector

Once remediation of a site has occurred, a number of longer term and more sustainable benefits can be derived from the redevelopment of the site, such as:

- Promotes regional and local economic development particularly in large population centres, creating jobs and supporting redevelopment
- Enhances quality of life through neighbourhood revitalization, reduced urban blight and conservation of scarce green space^{5,6}
- Reduces environmental contamination , thereby improving public health and safety
- Increases business opportunities in the private section, particularly :
 - Development , real estate
 - Lending /insurance and
 - New commercial /industrial development
- Reduction in urban sprawl
- Increases property values
- Reduces green house emissions as the need for transportation is reduced

⁵ Ministry of Environment Facts on Contaminated sites (38) August 2007

⁶ Brownfield's Sustainability Snapshot Federation of Canadian Municipalities Green Municipal Fund

3 REGULATION OF CONTAMINATED SITES IN BRITISH COLUMBIA

Government, industry and local governments all have a vested interest in remediating contaminated sites. A brief synopsis of the role and responsibility of key government ministries, programs and third party providers is outlined below:

3.1 Government: Ministry of Environment

The Ministry of Environment, Land Remediation Section administers the provisions for the investigation and remediation of contaminated sites in British Columbia under the *Environmental Management Act* and Contaminated Sites Regulation.

The section focuses on the remediation of brownfields, orphan sites and complex, high risk contaminated sites, and facilitates the remediation of low and medium risk sites.

The Land Remediation Section also manages the Site Registry (see section 3.3), provides operational and procedural contaminated sites guidance, and administers the site screening process using site profiles.

Through collaboration with communities, public organizations, other agencies and private parties, the Ministry strives to support development opportunities, protect human health and the environment.⁷

The facilitation of low and medium risk sites is undertaken via partnership with qualified professionals, specifically CSAP (see section 3.4).

3.2 Brownfield's Renewal Strategy

To encourage Brownfield redevelopment across British Columbia, the Province has established the BC Brownfield Renewal Strategy. The Strategy is intended to help reduce risk and uncertainty in brownfield redevelopment and create a more streamlined approval environment for brownfield projects. The Strategy is being led by the Ministry of Forests, Lands and Natural Resource Operations Crown Land Restoration Branch in coordination with the Ministries of Advanced Education and Labour Market, Community Development, Environment, and Finance.

⁷ <http://env.gov.bc.ca/edp/remdiat>

The BC Brownfield Renewal Strategy is intended to increase brownfield renewal activity across the province by addressing policy, regulatory, tax, funding, and information barriers to brownfield renewal through the following actions:

- Further streamline the remediation approvals process
- Broaden the suite of tools available to local governments to encourage brownfield redevelopment
- Apply strategic public investments to encourage the redevelopment of idle sites
- Build capacity and awareness of redevelopment tools and opportunities to enhance information about brownfields

Cleaning up and redeveloping sites has a number of intended benefits across the triple-bottom-line (environmental, social and economic) evaluation process such as:

- Reducing urban sprawl and protecting green spaces by encouraging the re-use of brownfield lands rather than undeveloped lands
- Providing opportunities for investment in brownfield sites that would otherwise sit idle
- Environmental restoration
- Providing opportunities to clean up and revitalize unattractive sites
- Creating investment and economic opportunities

As part of the Strategy, Brownfields Renewal operates a funding program. In 2012, the Province is providing up to \$1.8 million to revitalize brownfield sites throughout B.C. Since its creation in 2007, the Brownfield Renewal Funding Program has provided more than \$4.2 million toward 60 projects in 44 communities.

3.3 Site Registry

The contaminated sites provisions under the Environmental Assessment Act and Contaminated Sites Regulations require the Ministry provide public information about site investigations and clean ups. The provincial Site Registry meets this requirement.

Descriptions published by the MoE, stipulate that the Site Registry is not a registry solely of contaminated sites. Some sites are contaminated, but most are reported as being investigated, and many of these may require little clean-up, or have already been cleaned up to government standards.⁸ The goals of the Site Registry are to provide users with information that can be used to:

- Minimize legal and site cleanup costs
- Minimize liability associated with the sites

⁸ Ministry of Environment. *Facts on Contaminated Sites #20, the Site Registry*. 2006

- Enhance business certainty by being able to predict costs
- Ensure adequate protection of human health, the environment, property and utilities

The Site Registry documents provide milestones of the cleanup process of a site and contain information on sites that have been investigated and cleaned up in BC since 1988. The Registry can provide general information on clean ups for all sites known to the Ministry with detailed information on status. The Registry contains information grouped into five categories:

Table 2: BC site registry :Site categories and information

Categories	Type of Information
General	Information on a site's location, fee category, overall cleanup status, and current site profile
Notations	Information on legal events, such as issuance of pollution abatement, pollution prevention, and remediation orders, Certificates of Compliance, and Approvals in Principle; and administrative notations (for example, on site investigation and remediation reports)
Participants	Information on people and organizations involved in a site and their roles
Documents	Information on the existence of reports concerning a site
Land Use	Information on the land use related to a site

While concerns regarding the accuracy and usability of the Site Registry are commonly identified by industry, government and environmental professionals, the Registry does provide useful insight and information pertaining to the number of sites within the province of British Columbia.

The National Brownfield Association (NBA) retained Hemmera Envirochem Inc. (Hemmera) with the objective to provide a general understanding of the magnitude and spatial distribution of contaminated sites in British Columbia in order to assess the possibility of creating an entity to facilitate third party liability transfer.⁹ The entity, if established, was intended to enable the expansion, redevelopment, or reuse of underutilized sites affected by contamination. The assessment was based on the BC Site Registry information.

⁹ National Brownfield's Association. Report on Contaminated Sites Inventory in British Columbia, Hemmera Envirochem Inc. (October 2011)

Based on the BC Site Registry data base and findings presented in the NBA report, quantitative data was utilized as a basis to undertake the economic benefit assessment undertaken in this report.

3.4 Contaminated Sites Approved Professionals (CSAP)

The CSAP Society is an independent professional society, mandated by the BC provincial government through the Ministry of Environment, to review environmental certification applications. The society credentials its members and recommends their appointment to the Ministry's Roster of Approved Professionals.

CSAP members are qualified to review all low and medium risk environmental certification applications, and can recommend issuance of COC's. Within the contaminated sites sector, CSAP assists the Ministry in the review process by expediting the approvals process thereby readying sites for remediation and subsequent redevelopment.

Contaminated Site Approved Professionals are familiar with the regulations and technical standards, as well as recommending methods necessary to bring land back to the standards set out in the *Environmental Management Act* and Contaminated Sites Regulations.

Land owners or prospective buyers use the services of a Contaminated Site Approved Professional for their expertise and advice to clean up sites and demonstrate they have been appropriately investigated or remediated, subsequently enabling sites to be redeveloped for their highest and best use.

The CSAP Society was incorporated in 2007 as a self-regulating professional association. To date, members have reviewed approximately 420 sites.

4 ANALYSIS AND COMPOSITION OF CONTAMINATED SITES IN BRITISH COLUMBIA

Potentially contaminated sites on the registry are in various stages of review or remediation. The status of properties on the registry, based on a total of nearly 9,500 potentially contaminated site records, identifies that 87% of the sites are potentially contaminated (total less the remediation and assessment completed categories), resulting in approximately 8,265 potentially contaminated sites.

In better understanding the composition of those potentially contaminated sites throughout the province, information outlined in the BC Site Registry/NBA report, provides insight into:

- Geographical distribution of potentially contaminated sites
- Number of potentially contaminated sites by type of land use (e.g. property type)
- Size of potentially contaminated sites

Referencing the above and the estimated costs associated with each specific study required to remediate sites (estimated by Hemmera), the specific studies and their related costs can be further disaggregated into:

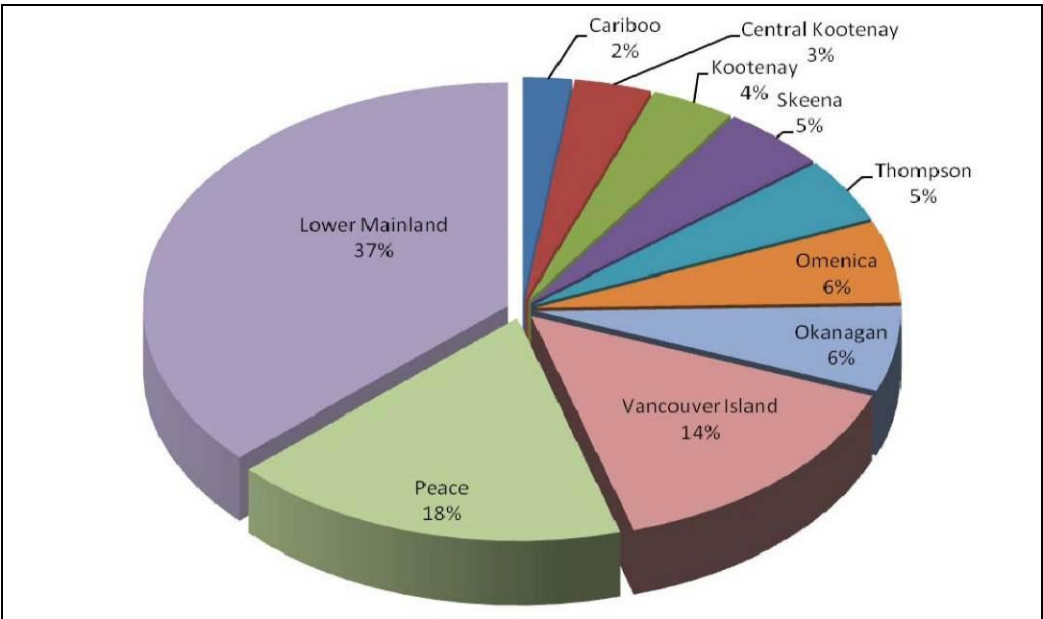
- Estimated costs for small, medium and large sites for undertaking:
 - Stage 1: Preliminary Site Investigations; (Stage 1 PSI)
 - Stage 2: Preliminary Site Investigation; (Stage 2 PSI)
 - Detailed Site Investigation (DSI)
- Estimated Remediation Action Plans (RAP) for medium sites for a) soil only , b) groundwater only and c) soil and groundwater
- Lab costs

The following sections highlight those findings.

4.1 Geographical Distribution of Potentially Contaminated Sites in British Columbia

The geographic distribution of potentially contaminated sites throughout Province of British Columbia in percentages is illustrated below:

Exhibit 1: Geographic distribution of potentially contaminated sites in British Columbia by region



Source: Hemmera. Contaminated Sites Inventory British Columbia, 2011, p.4 .

The geographic distribution illustrates that the Lower Mainland has 37% of the potentially contaminated sites, followed by the Peace Region with 18% (predominantly resultant from the oil and gas development in that region) and Vancouver Island with 14%, representing 69 % of the total.

4.2 Number of Potentially Contaminated Sites by Type of Land Use/Property Type

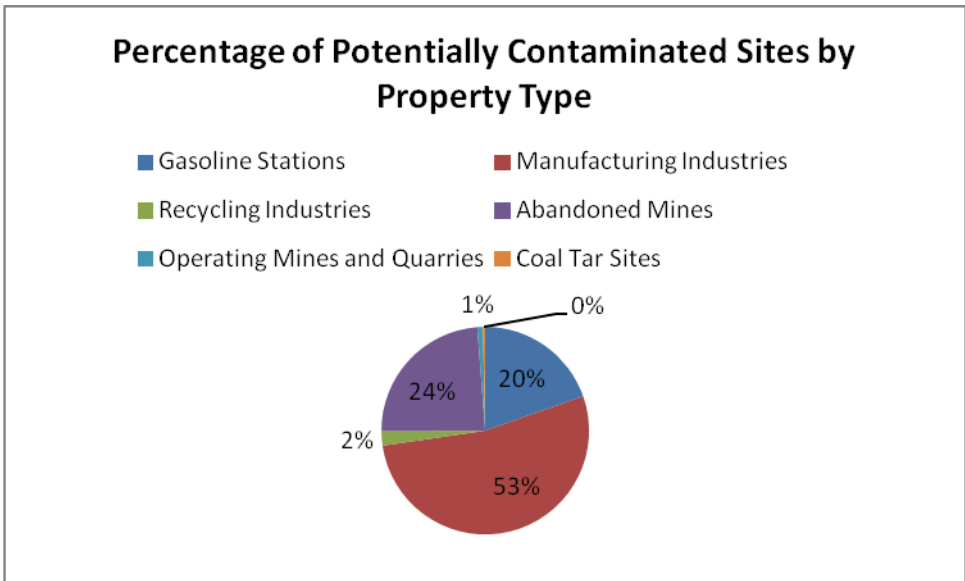
The number of potentially contaminated sites in the province disaggregated by type of land use, are divided into the following categories (types of properties):

- Gasoline stations
- Manufacturing industries

- Recycling industries
- Abandoned mines
- Operating Mines and Quarries
- Coal Tar sites

Exhibit 2 illustrates the number of sites within each land use category.

Exhibit 2: Percentage of potentially contaminated sites by property type



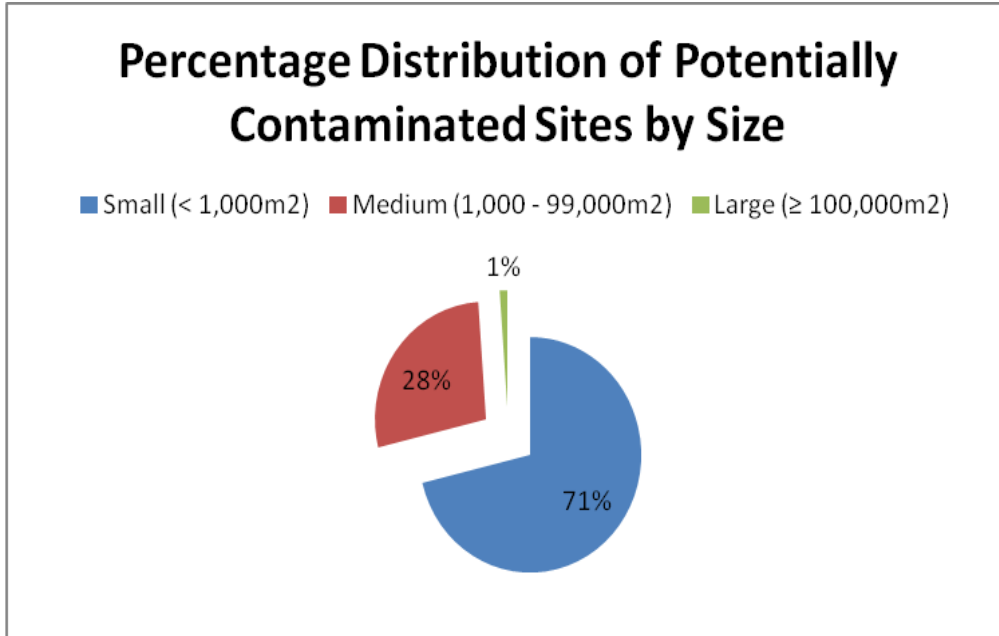
Source: National Brownfields Association (NBA) British Columbia Memorandum: Support for Tax Tools (2009)

4.3 Size of potentially contaminated sites

The size of potentially contaminated sites identified in the site registry is based on small (less than 1000m²), medium (1,000 to 99,000m²) and large sites (greater than 100,000m²).

The distribution of sites based on area is illustrated on Exhibit 3 below.

Exhibit 3: Percentage distribution of potentially contaminated sites by area



Source: National Brownfields Association (NBA) British Columbia Memorandum: Support for Tax Tools (2009)

As illustrated small sites comprise of 71% of the sites, medium sites comprise of 28% of sites and large sites comprise of only 1%.

The implications of understanding the size of potentially contaminated sites in context to site assessment/review and remediation costs are significant in estimating economic benefits.

Based on the geographic distribution of sites throughout British Columbia, the type of property or land use and the size of the site, the NBA report estimated costs to remediate sites based on the types of studies required to satisfy the regulatory requirements.

Specifically the environmental studies required to remediate contaminated sites include:

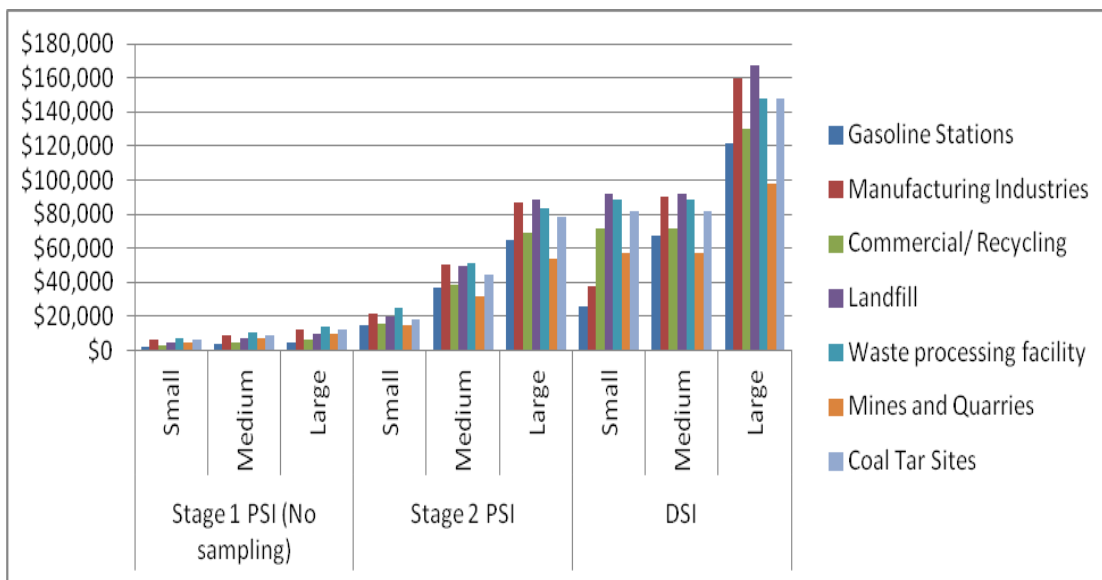
- Stage 1: Preliminary Site Assessments (PSI 1)
- Stage 2: Preliminary Site Assessments (PSI 2)
- Detailed Site Assessments (DSI)
- Remediation Planning
- Site Remediation

For each study type, estimated costs for small, medium and large sites are discussed in the next section.

4.4 Estimated Study Costs for Small Medium and Large Sites undertaking Preliminary Site Investigations Stage 1 (PSI 1), Preliminary Site Investigation Stage 2 (PSI 2) and Detailed Site Investigations

Estimated costs to undertake PSI 1, PSI 2 and DSI studies for small, medium and large sites are illustrated on Exhibit 4 below:

Exhibit 4: Estimated study costs for small medium and large sites undertaking preliminary site investigations stage 1 (PSI 1), preliminary site investigation stage 2 (PSI 2) and detailed site investigations



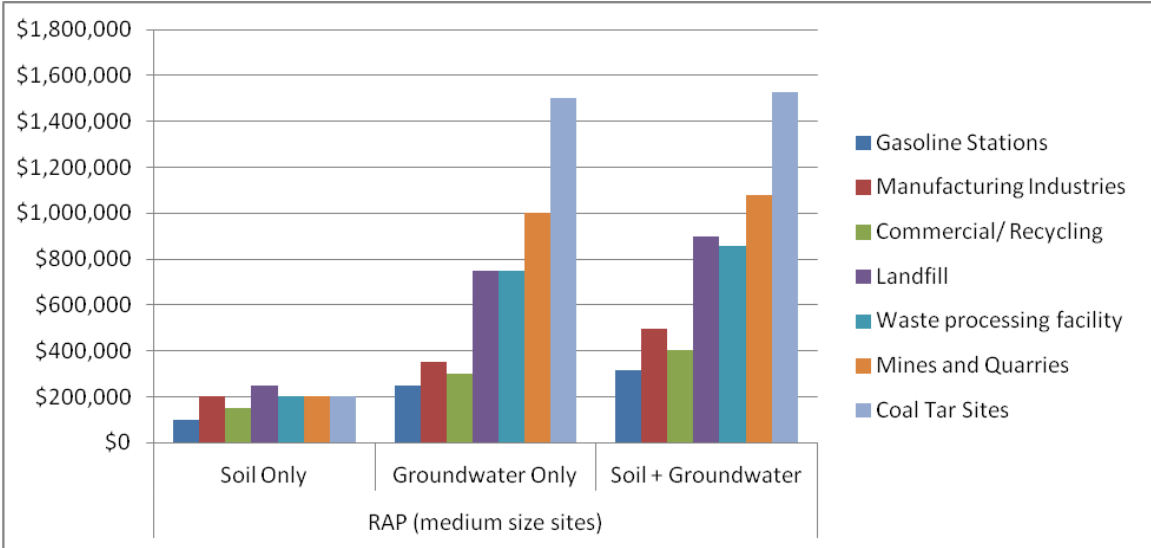
Source: National Brownfields Association (NBA) British Columbia Memorandum: Support for Tax Tools (2009)

As illustrated as a site progresses through the remediation process, the relative costs increase substantially. Furthermore, the costs vary depending upon the type of property being considered, making the range of costs to be utilized in the economic model more complicated.

4.5 Estimated remediation action plan costs for medium sites for soil only, groundwater only and soil and groundwater

Estimated costs to undertake the remedial action plans (RAP) for medium sites for soil only, groundwater only and soil and ground water studies, are illustrated on Exhibit 5:

Exhibit 5: Estimated remedial action plan costs



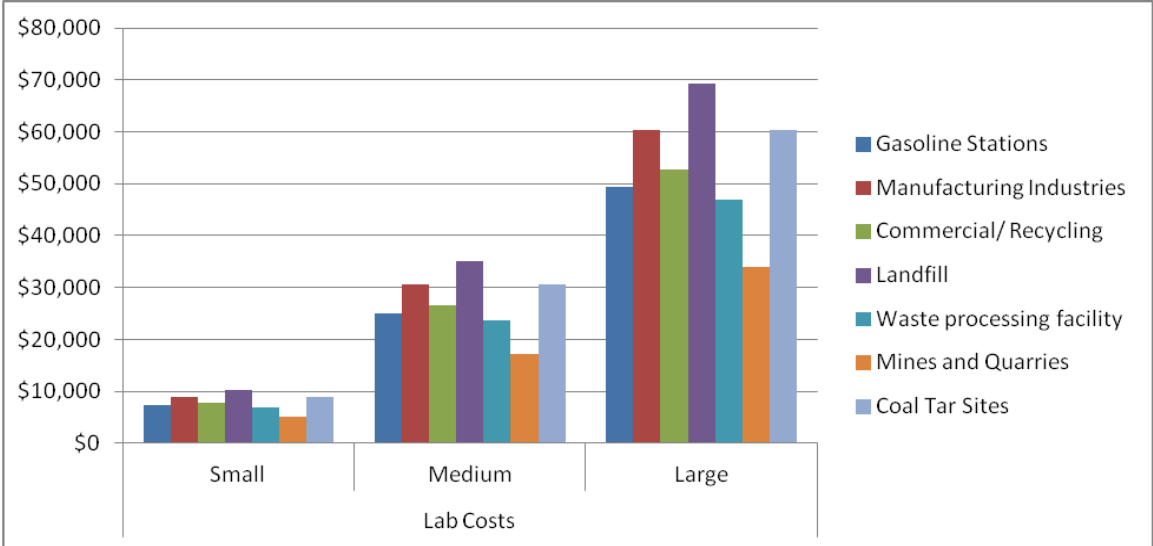
Source: National Brownfields Association (NBA) British Columbia Memorandum: Support for Tax Tools (2009)

The use of only a medium size site costs to undertake the RAP further complicates assumptions utilized in the economic analysis.

4.6 Lab Costs

The estimated lab costs supporting the various studies undertaken to support remediation are outlined in Exhibit 6 by land use (property type).

Exhibit 6: Lab Costs associated with remediation by land use (property type)



Source: National Brownfields Association (NBA) British Columbia Memorandum: Support for Tax Tools (2009)

It is noted that the range of costs estimated in this study have been cited by CSAP members as being somewhat less than anticipated especially those costs for laboratory analysis, however as the only source of published data the costs have been utilized in this review.

5 ECONOMIC BENEFIT METHODOLOGY OPTIONS

In preparing this economic benefit assessment, different possible methodological options were considered, including:

5.1 Sample Survey

Research indicated that there were likely to be several hundred individual contaminated sites in some phase of review, assessment or remediation, throughout the province at any given time. To produce results with reasonable reliability would require a sample size of approximately 100. This would involve a lengthy process to qualify potential participants and deal with them on a one-to-one basis. Also, property owners and their consultants tend to be protective of their cost information resulting in difficulty in obtaining reliable information.

This research methodology was not pursued.

5.2 Low and High Range

A feature of the contaminated sites sector is there is no such thing as a “typical” site. Sites vary significantly inclusive of:

- very small to very large
- variety of contaminants
- range from simple to complex in their remediation requirements
- Located in every region of the province

The single common trait is that they are contaminated in some manner. Consequently, the range of costs to investigate and remediate these sites varies significantly, from as little as several thousand dollars for small, simple sites to several million dollars for large complex sites. This research methodology was not pursued.

5.3 Single Best Estimate

The single best estimate approach relies on costs or norms based on actual investigation and remediation projects and estimated costs, e.g. NBA results (presented in Section 4). This process produces a single estimate of direct spending based on actual industry experience, weighted to reflect the proportion of sites by size (small, medium or large) and by type (gas station, manufacturing, etc.)

The single best estimate approach has been used for this analysis based on the data identified in this review.

5.4 Analysis timeframe

Economic impact analysis represents a snapshot of the sector being analyzed and typically focuses on a specific year (i.e. annual). This approach is used in order to tie the analysis to a given period in time, which can act as a benchmark against which future changes can be measured. Our intent was to tabulate expenditures for the year 2011, but the availability of data would not support selecting a specific year.

Consequently, we have focused our analysis on the information that was available during the research time period. This information is generally relatively current (covering the last two years), but is not specific to a single calendar or fiscal year. However, it should fairly represent the economic activity related to sites in the province during a typical, recent one year period.

6 DIRECT BENEFIT OF THE SITE ASSESSMENT AND REMEDIATION SECTOR ON THE PROVINCIAL ECONOMY

The direct benefit of the contaminated sites sector is defined as a summation of the study costs (e.g. PSI 1, PSI 2, DSI and RAP), supporting spending (lab costs) to review, assess and remediate sites (based on qualitative input provided by CSAP), multiplied by the number of sites under review over a given year.

As noted, sites within the review process require a variety of studies to be undertaken including some or all of the following stages associated with the site remediation process:

- Stage 1 Preliminary Site Investigations (PSI1)
- Stage 2 Preliminary Site Investigations(PSI 2)
- Detailed Site Investigations (DSI)
- Remediation Planning
- Site Remediation

For analytical purposes, we have attempted to group and aggregate information in order to produce a single, best-estimate value for direct spending to investigate and remediate contaminated sites. This information is based on the findings identified by the NBA in 2009 and summarized in Exhibits 1- 6 presented in this report.¹⁰

The estimates have been reported in aggregate and are proportionate to the findings outlined in Exhibits 1- 6. The following assumptions have been made:

- Combined weighted average costs calculated based on land use or property type distributions, which include a mix of gas stations (20%), manufacturing sites (53%), and other (27%). (Other includes recycling, landfills, waste processing, mines and coal tar sites.). This is proportionate to observations derived from the Site Registry/NBA data.
- This combined weighted average includes proportioning costs based on site sizes:
 - small sites (71%), medium sites (28%), and large sites (1%). This is proportionate to the size of sites identified in the Site Registry/NBA data.
- Remediation Action Plan costs have been based on soil and ground water plans reduced by 50% to reflect proportion of sites that are estimated to require only soil remediation. This is also proportionate to what is presented in the Site Registry/NBA data.

¹⁰ Correspondence from the National Brownfield Association. June 2009

The economic benefit analysis process outlined requires an estimate of the total number of sites that are either being investigated or remediated over the course of a one year time period.

Analysis conducted on the BC Contaminated Site Inventory indicates that approximately 600 sites enter into the remediation program in the province each year. On average as stated in the review, a typical site is in the review/remediation process for approximately two years, equating to a total of 1,200 sites undertaking some level of study to remediate the site. Based on the typical two year process, about 600 sites exit the system that have undertaken varying levels of study.

The net result is that we have assumed that a total of approximately 600 sites are being reviewed and or remediated over a given year.

Another key assumption or factor to consider in this assessment is that costs to review and assess the sites are not additive, as not all sites will be required to undertake the next level of detailed technical study associated with the remediation study process.

For example while all sites undertake a Stage 1 PSI, only a proportion of those are subject to undertaking a Stage 2 PSI and only a proportion of those require a DSI, and so on.

The following assumptions, based on input from CSAP Board and Hemmera have been used to allocate costs for those sites under review during a given year.

This allocation of the estimated number of sites in each category was the base against which the percentage distribution was calculated.

Table 3: Percentage of potentially contaminated sites undertaking various levels of study

Type of Investigation/Remediation	Percentage of Sites	Number of Sites
Preliminary Site Investigation – Stage 1	100%	600
Preliminary Site Investigation – Stage 2	28%	170
Detailed Site Investigation	17%	100
Remediation Plan (Soil & Water)	13%	80
Laboratory Costs	28%	170

Sources:

CSAP, personal communication for percentage allocation.

Contaminated Sites Inventory, Hemmera Envirochem Inc. 2011, and study team estimates for total number of sites (600).

Lab costs are assumed to be incurred for sites proceeding through Stage 2 PSI, Detailed Site Investigation and Remediation Plan.

6.1 Estimated Direct Expenditures

To calculate the value of expenditures made to investigate and remediate a “typical” site, a series of calculations have been made to the expenditure figures provided by the Hemmera report (Contaminated Sites Inventory BC, referenced earlier.). The calculations were designed to weight the reported expenditures by type of site (gas stations, manufacturing sites, and other), and by size of site (small, medium and large) to replicate the BC contaminated sites profile.

The first step involved weighting all the small sites by their relative proportions (20% gas station, 53% manufacturing and 27% other). A similar process was conducted for the medium and large sites. This produced a weighted average for each of the three site size categories. Next a combined weighted average was produced by allocating the appropriate proportion to the three size categories (71% small, 28% medium and 1% large).

To this combined weighted average was allocated the proportions reported in Table 3. This process produces an estimated “typical” site investigation and remediation figure of approximately \$75,000. The allocation is as follows:

Table 4: Contaminated Site Review and Assessment Estimate

Type of Investigation/Remediation	Combined weighted average cost (\$)	Proportion of sites (%)	Review and assessment costs (\$)
Preliminary Site Investigation – Stage 1	5,847	100	5,847
Preliminary Site Investigation – Stage 2	27,594	28	7,714
Detailed Site Investigation	48,531	17	8,250
Remediation Action Plan (Soil & Water)	375,990	13	48,879
Laboratory Costs	14,485	28	4,056
Total	472,402		74,745

Based on the total review and assessment costs estimated direct expenditures can be determined given below:

Table 5: Estimated Direct Expenditures

Phase within the Remediation Process	Assumptions and Calculation methodology	Estimated Direct Expenditures
Review and Assessment	Costs for a "typical" site	\$75,000
		x
	Number of sites in BC under investigation and/or remediation	600
		=
	Total expenditures on contaminated site investigations and remediation annually.	\$44.8 million
Remediation(see note below)	Actual site remediation estimated at approximately three times the cost to review and assess.*	x
		3
		=
		\$134.4 million
Total	Total direct spending on investigations and remediation of contaminated sites annually.	\$179.2 million

Source: CSAP, canvas of selected members for the ratio between dollars spent on remediation versus investigation.

The determination of the relative costs associated with remediation of the sites were derived from the following qualitative comments provided by industry:^{11,12}

- CSAP whom estimated that for every 1 dollar spent on site assessment and review 3 dollars were spent on remediation
- Hemmera identified a range of between 3 to 4 times the monies spent on remediation in comparison to each dollar spent on site assessment and review
- The Federation of Canadian Municipalities estimates that for every dollar invested in Brownfield redevelopment , an average of \$3.80 is invested in the economy, the assumption being that the \$3.80 is related to remediation

¹¹ CSAP and Hemmera were requested to provide a qualitative assessment of the relative costs incurred for site assessment and review vs. actual remediation. While not statistically valid it provided a rule of thumb for this assessment.

¹² Federation of Canadian Municipalities Green Municipal fund: Brownfields sustainability Snapshot

7 TOTAL ANNUAL ECONOMIC BENEFIT OF THE SITE ASSESSMENT AND REMEDIATION SECTOR ON THE PROVINCIAL ECONOMY

7.1 Description of the BC Input-Output Model

The above analysis produces estimates of the direct expenditures within the contaminated sites sector for investigations and remediation. A more complete estimate of the economic effects of the sector on the provincial economy includes the addition of related spin-off or multiplier effects. These indirect and induced effects have been estimated using the BC Input Output Model (BCIOM).

Input-output models are based on statistical information about the flow of goods and services among various industries. This information provides a comprehensive and detailed representation of the economy for a given year. Input-output models are used to assess the total economic impact associated with a change in industry activity or a change in demand for one or more commodities. These models use known information about inter-industry relationships to trace through all of the changes in the output of supplier industries that are required to support an initial increase in an industry's output.

The BCIOM is a snapshot of the BC economy. It is derived from Interprovincial Input-Output tables developed by Statistics Canada and includes details on 727 commodities, 300 industries and 170 final demand categories, plus a set of computer algorithms to do the calculations required. The model is operated by BC Stats, the central statistical agency of the Government of British Columbia.

The structure of the model is based on 2008 data, although tax revenue and employment estimates generated by the model are based on more up-to-date information. Tax revenue estimates reflect the current tax structure and existing tax rates. Provincial government revenues include the provincial portion of the Harmonized Sales Tax. Employment estimates generated by the model are calculated using information on average earnings in 2009.

For this contaminated sites analysis, effects are defined as follows:

Table 6: Type of economic effect

Type of Effect	Definition of Effect
<ul style="list-style-type: none"> Direct Effects 	Impacts arising from the initial expenditures on goods and services by firms involved with the review, assessment and remediation of contaminated sites.
<ul style="list-style-type: none"> Indirect Effects 	Impacts arising from the subsequent rounds of spending by the firms supplying goods and services to the directly benefiting companies.
<ul style="list-style-type: none"> Induced Effects 	Impacts arising from the spending of wages and salaries generated by the direct and indirect purchases of goods and services.

Total economic benefit is the sum of the direct, indirect and induced effects. The measures include total economic activity, employment and taxes, which are described as follows.

7.2 Measures of Economic Benefit

The process of economic impact or benefit analysis is a measure of expenditures. That is, economic activity occurs or is initiated by the spending of money. In the contaminated sites sector, this is an estimate of the amount of money that is spent during the review, assessment and remediation phases of the redevelopment process.

Another key measure of economic activity is employment. This is a tally of the number of jobs that are created by the investigation and remediation processes. The BC Input- Output Model operated by BC Stats has been employed to produce this estimate, based on the direct spending figure referenced above. (see Chapter 6.

Table 7: Type of economic activity

Type of Economic Activity	Definition of economic activity
<ul style="list-style-type: none"> Economic Activity 	A measure of all the spending that occurs to investigate and remediate contaminated sites.
<ul style="list-style-type: none"> Employment 	A measure of the number of jobs created by the investigation and remediation economic activity. The figure represents the number of full-time and part-time in the proportions typical of the sector.
<ul style="list-style-type: none"> Taxes 	A measure of federal, provincial and local taxes including personal income taxes, corporate taxes and consumption taxes.

The third measure of economic benefit is taxes, which includes taxes accruing to federal, provincial and municipal levels of government. These are also calculated by the BC Input-Out Model based on the initial direct expenditures.

7.3 Total Economic Benefits

The analysis process uses as input the \$179.2 million in direct expenditures as the base value. Subtracted from this total are leakages through imports from other provinces and countries. The model also nets out subsidies to produce a best estimate of the direct effects on the BC economy. These figures are:

Table 8: Total economic benefits

Type of Economic Effect	Total economic activity
Direct Effects	\$151.8 million
Indirect Effects	\$78.5 million
Inducted Effects	<u>\$33.2 million</u>
Total Annual Economic Benefit	\$263.5million

Therefore, the \$179.2 million in direct spending effects generates \$263.4 million in total economic effects. This spending also creates an estimated 1,811 jobs and \$19.0 million in taxes. The distribution of direct, indirect and induced effects is as follows:

Table 9: Total direct, indirect and induced spending

Measure	Direct	Indirect	Induced	Total
Economic Activity (\$million)	\$151.8	\$78.5	\$33.2	\$263.5
Employment	1,128	438	246	1,812
Taxes (\$ million)	\$11.2	5.1	2.7	19.0

8 REDEVELOPMENT MULTIPLIERS

Once remediated the redevelopment of the subject property is potentially initiated which introduces the next wave of economic benefits, creating additional contributions to the provincial economy. While this study is not intended to quantify such data, reference to the types of benefits and a number of case studies presenting rules of thumb are identified.

Reference to a study undertaken for the City of Guelph Ontario Council in 2002, provides insight into such downstream benefits of remediation.¹³ The study findings suggest that:

“Research indicates that post Brownfield redevelopment on average produces about 10 to 100 times more dollars in economic benefits than is spent on site remediation.”

The following examples demonstrate the economic benefits derived from the Brownfield redevelopment re use, according to the study:

- In Cobourg Ontario a \$ 2 million remediation cost for several Brownfield sites resulted in \$162 million dollars worth of construction projects
- In Montreal \$18 million spent on site rehabilitation of 64 projects have generated \$950 million in construction, 5000 jobs and \$40 million in municipal taxes
- In Guelph Ontario an analysis of rehabilitated Brownfield properties indicate that property assessment increased nearly \$27,000,000 following redevelopment and municipal taxes increased nearly \$600,000 representing a 10% increase in municipal revenue from the properties.

Based on actual property tax assessment rolls, the properties in Guelph prior to and after redevelopment are presented below:

¹³ Brownfield’s Strategy city of Guelph May 2002

Table 10: Change in property tax revenues due to brownfield redevelopment/re –use of selected Industrial sites in Guelph, Ontario

Land Use Before	Year	Property Assessment (\$)	Tax Bill (\$)	Land Use After	Year	Property Assessment (\$)	Tax Bill (\$)
Guelph Textile Mills (83 Neville Street)	1993	272,426	4,111	Wellington Condo. Victor Davis Memorial Apartments, Guelph Non Profit Housing, Hi rise apartments.	2001	10,185,000	331,807
Factory By the Grand River (67 Wyndham Street)	1997	45,312	587	Condominiums	2001	763,000	10,895
Industrial Use (490 York Road)	1991	481,140	6,868	Business Incubator	2001	1,371,580	53,458
Pirelli Cable (265 Suffolk)	2000	1,002,238	47,152	Rezoned for Townhomes	2002	16,215,000	231,544
Total		1,801,116	58,718			28,534,580	627,704

Source: Brownfield's Strategy City of Guelph May 2002.

Specific to British Columbia the consultant team obtained information on two projects on the conditions of anonymity. Available information is reported below.

Table 11: Redevelopment of two project sites in BC

Site Attributes	Site Descriptions	
Project Description	Construction of a three story office and commercial building	Development of a marina, condominiums and retail
Site Location	Sub-urban area of a large municipality	Small community in a rural area
Size of Site	10,000 square feet	1.36 ha
Project Size	19,000 square feet	NA
Previous site use	Dry cleaning business	Industrial uses
Time site unused	Dry cleaning plant had closed many years ago (20+). Building used as drop-off/pick-up location only (no new contaminants).	NA
Reviews and Assessments	PSI 1, PSI 2, DSI	PSI 1, PSI 2, DSI
Duration of Site Review Process	15 months prior to start of construction...testing ongoing.	NA
Duration of Site Remediation	Five months to remove soil	NA
Cost of Site Review and Assessment	\$205,000	NA
Cost for Site Remediation	\$185,000	\$550,000
Project Capital Cost	\$5 million plus soft costs	\$26 million

Source: Economic Planning Group discussions with a local development company and information from the BC Brownfield Renewal Strategy

9 JURISDICTIONAL BENCHMARK REVIEW

Other jurisdictions in the United States have established similar organizations (with varying degrees of mandate and responsibility) to CSAP, all established to help expedite the contaminated site review process. A desktop benchmark review of three such organizations has been completed as part of this review to identify similarities and differences within those organizations. The three organizations reviewed include:

- Massachusetts Licensed Hazardous Waste Site Clean Up Professionals
- Oregon Department of Environmental Quality Environmental Clean Up Section
- Washington Department of Toxicology Toxic Clean Up Program

Each organization was assessed in terms of the date of incorporation, its mandate and purpose, the service it provides, whether a site registry is in existence, number of members, number of sites reviewed and concludes with the whether the related economic benefits derived from the organizations existence has been determined.

The following tables provide a synopsis of each organization.

Table 12: Massachusetts' Licensed Waste Site Cleanup Professionals

Organization: Massachusetts' Licensed Hazardous Waste Site Cleanup Professionals	
Main Site:	http://www.mass.gov/lsp/
Personnel:	Beverly Coles-Roby, Executive Director
Contact:	tell: 604-556-1019, fax: 617-292-5872 email: lsp.board@state.ma.us
Date Initiated	1993
Mandate/purpose	The Board of Registration of Hazardous Waste Site Cleanup Professionals is an independent, 11-member board that licenses and regulates Licensed Site Professionals (LSP). The Board works to maintain high standards of practice and to protect public health, welfare, and the environment by establishing qualifications for licensure, administering a licensing exam, requiring that LSPs obtain continuing education, and investigating complaints against LSPs to ensure compliance with state laws, regulations and the Board's own rules of professional conduct.
Services provided	Licensed Site Professionals oversee the cleanup and closure of all but the most complex sites, subject to Department of Environmental Protection (DEP) audit. The system was devised to clear up a bottleneck in site cleanup, which now enables DEP staff to oversee the most complex sites. (http://www.nj.gov/dep/srp/stakeholders/20070629massapp.pdf)
Registry of contaminated sites	Yes (http://public.dep.state.ma.us/SearchableSites/Search.asp)
Number of members	545 (http://db.state.ma.us/dep/lsp/Results4.asp?LicenseStatus=Active)
Number of sites	29,409 sites since 1993 (date current program took effect), averaging over 1600 per

Organization:	Massachusetts' Licensed Hazardous Waste Site Cleanup Professionals
reviewed per year	year. (http://www.mass.gov/dep/cleanup/priorities/progeval.htm)
Measures of economic benefit	None found
Relationship with government	It is a board created by an act of the State of Massachusetts, and administration appears to be provided by the government.

Source; Massachusetts Licensed Hazardous Waste site Cleanup Professionals (<http://mass.gov/lsp>).

Table 13: Oregon Department of Environmental Quality

Organization:	Oregon Department of Ecology: Toxics Cleanup Program
Web Site:	http://www.deq.state.or.us/lq/cu/
Personnel:	
Contact Information:	tell: 503-229-5696 email: cleanup.info@deq.state.or.us
Date Initiated	1988
Mandate/purpose	The Department of Environmental Quality (DEQ), a state government organization, oversees all cleanup projects with the exception of volunteer cleanups. Only in cases where there is no "imminent threats to human or environmental health," Volunteer cleanups are a cooperative process that works with DEQ oversight and guidance. In 1999, DEQ added a second "pathway" titled <i>Independent Cleanup</i> , by which parties complete cleanups with minimal DEQ oversight. In 1999, of 400 Voluntary cleanup sites, 100 followed the 'independent pathway'. (http://www.deq.state.or.us/lq/pubs/docs/cu/AnnualCUREporttoLegislature2011.pdf)
Services provided	See above
Registry of contaminated sites	Yes (http://www.deq.state.or.us/lq/ecsi/ecsiquery.asp?listtype=lis&listtitle=Environmental+Cleanup+Site%20Information+Database)
Number of members	NA
Number of sites reviewed per year	284 in 2010 (http://www.deq.state.or.us/lq/pubs/docs/cu/AnnualCUREporttoLegislature2011.pdf)
Economic benefit measures	None found
Relationship with government	Entirely under government administration

Source: Oregon Department of Environmental Quality environmental clean Up Section (<http://www.deq.state.or.us/L/cu/>).

Table 14: Washington department of ecology: Toxics clean up program

Organization:	Washington Department of Ecology: Toxics Cleanup Program
Web Site:	http://www.ecy.wa.gov/programs/tcp/cleanup.html
Personnel:	Jim Pendowski, Program Manager
Contact Information:	Jim: 360-407-7177; main line: 1-800-826-7716; Information & Policy: Dave Bradley (360-407-6907)
Date Initiated	1989
Mandate/purpose	Model Toxic Control Act's stated purpose is to: Raise sufficient funds to clean up all hazardous waste sites Prevent the creation of future hazards that result from improper disposal of toxic substances into the state's land and waters. Clean up and reuse contaminated industrial properties, and to make clean land available for future social use. (http://www.ecy.wa.gov/pubs/0909049.pdf)
Services provided	The Department of Commerce hosts the <i>Brownfield's Revolving Loan Fund</i> has 3 main goals: Makes low-interest loans to eligible local governments, developers, and property owners to clean up brown fields Links loan recipients with other brown fields programs for help with assessment and more Streamlines the process of cleanup and redevelopment by collaborating with federal, state, and local agencies. (http://www.choosewashington.com/business/financing/redevelopment/Pages/default.aspx) & (http://www.ecy.wa.gov/programs/tcp/brownfields/brownfields_hp.html)
Registry of contaminated sites	Yes (http://www.ecy.wa.gov/programs/tcp/mtca_gen/hazsites.html) & (https://fortress.wa.gov/ecy/gsp/SiteSearchPage.aspx)
Number of members	NA
Number of sites reviewed per year	NA
Economic benefit measures	NA
Relationship with government	Entirely under government administration

Source: Washington department of Toxicology toxic Cleanup Program
<http://www.ecy.wa.gov/programs/tcp/cleanup.html>)

Comparatively, the table below illustrates the findings:

Table 15: Comparative benchmark of environmental organizations in US

Jurisdiction	Date of Incorp.	Service	Site Registry	Non members	Sites Reviewed Annually	Economic Benefits Determined
Massachusetts	1993	Oversee closure of all but the most complicated sites Established and licensed professionals established to undertake work	Yes	545	29,409 sites since 1993. Average 1600 sites per year	No
Oregon	1988	Dept. of Environmental Quality , a state government oversees all clean up except for volunteer Clean Ups (no imminent threats to human or environmental health occurs Introduced second pathway Independent Clean Up for those sites with minimal DEQ oversight	Yes	N/A	284 in 2010	No
Washington	1989	Hosts Brownfield's Revolving Loan Fund, makes low interest loans to eligible local governments, developers and property owners Attempts to streamline clean up and redevelopment by collaborating with Federal state and local government.	Yes	N/A	NA	NA

Sources:

Massachusetts Licensed Hazardous Waste site Cleanup Professionals (<http://mass.gov/lsp>).

Oregon Department of Environmental Quality environmental clean Up Section (<http://www.deq.state.or.us/L/cu/>).

Washington department of Toxicology toxic Cleanup Program <http://www.ecy.wa.gov/programs/tcp/cleanup.html>).

Based on the desktop benchmark review it is evident that:

- The creation of a supporting site registry was an important factor associated with each organization in which the identification of contaminated sites, quantification of the number of sites and their locations were categorized which enabled organizations to track progress. The Massachusetts program supports non-governmental responsibility and empowers the private sector to assist in clean up of sites. The organization appears to most resemble CSAP objectives and the activities undertaken.
- Oregon, while retaining predominantly governmental control, has initiated a volunteer program intended to provide clean up of simple contaminated sites. More recently they have initiated another program in which more complicated sites can be cleaned up on a volunteer basis by private sector interests.
- The Oregon program has developed to provide for low interest loans for sites clean up and to attempt to streamline the review process and timelines. It would appear the BC Brownfield's Strategy provides a similar purpose.

It would appear that the creation of a contaminated sites registry, involvement of the private sector to aid in expediting the review process and providing government incentives to the private sector to facilitate the regulatory review process represent practices which other jurisdictions have also initiated.

10 CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The total economic benefit (direct, indirect and induced) benefits to the provincial economy (annually) of the site review, assessment and remediation sector based on the assumptions utilized, results in:

- \$263.5 million dollars in economic activity per annum
- 1812 person years of employment
- \$19 million dollars in provincial and federal taxes

Additional rules of thumb have been derived from this review that provides very subjective guidance regarding the economic benefits of remediating sites in the province of BC. They are

- For every dollar (1) spent on site assessment/review three (3) dollars are spent on remediation
- Once a site is remediated and redeveloped, for every dollar spent on remediation, on average produces about 10 to 100 times more dollars in economic benefits.

These figures do not account for contaminated sites activities in British Columbia on federal properties, high risk sites reviewed by the BC Ministry of Environment and other sites where owners voluntarily undertake investigation and remediation for due diligence purposes.

RECOMMENDATIONS

- CSAP provides a critical supporting role to the Ministry of Environment in relation to expediting site remediation timelines and related costs for the less complex sites, and should continue to do so.
- Due to the expertise available within its membership, the Ministry of Environment should work more closely with CSAP in the development of other means to further expedite the review timelines and reduce costs associated with remediation focusing on cost and timeline reductions associated with reviews.
- CSAP could potentially support the Ministry of Environment in dealing with the more complex contaminated sites.
- The Site Registry provides a valuable tool for government, industry and municipalities to identify and manage contaminated sites. While the current use is limited somewhat by the data within the registry and how it is structured, funding

should be made available to update the data base making it more user-friendly to the needs of site remediation professionals, industry and municipalities involved.

- While this economic assessment provides a very preliminary assessment of economic benefits of the site review/assessment and remediation sector of the economy on an annual basis, it is limited in the data that was utilized, the resultant assumptions made.
- The results do not present the complete benefit scenario as the redevelopment benefits have only been briefly touched upon.
- CSAP. The Ministry of Environment. The Brownfield's Renewal Program and industry should work more closely together to pursue an initiative that more clearly defines the economic benefits of this sector on the provincial economy.