CANADIAN GEOSPATIAL DATA INFRASTRUCTURE
INFORMATION PRODUCT 16

GeoConnections
Geospatial Return on Investment Case Study: BCeMap (MASAS)

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GeoConnections

Geospatial Return on Investment Case Study:

BCeMap (MASAS)

Developed by Emergency Management BC and GeoBC

Financial analysis performed by Mary Ann Stewart, Nova Blue Inc.

Report submitted February 21, 2011

Executive Summary

In late 2009 GeoConnections commissioned a series of Geospatial Return on Investment Case Studies to add to the body of knowledge of case studies based on the GITA ROI methodology for financial analysis of geospatial projects. This study focuses on BCeMap, developed by Emergency Management BC (EMBC) and GeoBC to enhance the Emergency Management Information Service (EMIS) being implemented by EMBC. The BC Emergency Map Viewer (BCeMap) as part of the Multi-Agency Situational Awareness System (MASAS) is intended to enable emergency management practitioners in preparing for and mitigating the impacts of emergency incidents through timely sharing of geospatially referenced information. BCeMap focuses on situational awareness data aggregation and connection to the national MASAS.

BCeMap provides a single resource to aggregate relevant incident data for emergency management and public safety personnel within BC and across Canada (via the MASAS integration) rather than use of several disparate systems where overlap, higher level effects and trends could be overlooked. In addition to the inherent efficiencies of seeing multiple data types in one common view, BCeMap has the potential to improve agency collaboration and improve public safety.

BCeMap was developed as a pilot project for the 2010 Olympic and Paralympic Games, using $198,000 in GeoConnections funding and matching in-kind resources. The pilot demonstrated capabilities for southwest British Columbia in the area where the games were held. EMBC is currently working to secure funding to move BCeMap to a full production mode and to extend its data capabilities to include the entire province. There is also an effort to extend awareness and training regarding the tool set throughout the stakeholder community.

Areas of where greatest tangible benefits were projected for this study include:

- Improved staff efficiency for routine operations
- Improved efficiency for event response
- Greater efficiency in protection of critical infrastructure
- Greater efficiency in preservation of business continuity

Areas where additional significant benefits were projected include: better retention of volunteers, improved effectiveness of volunteers, enhanced revenue from critical infrastructure owners, improved logistics regarding available transport during events, cost avoidance from redundant field data collection in areas with frequent fires, time saved maintaining critical infrastructure contact information, and time saved seeking information by district health staff.

Forward-looking five-year analysis of BCeMap: Cumulative benefits are $2.4M. Net Present Value is $1.8M, with an annualized Return on Investment of 60%. Payback period is two years. This high rate of return and short payback period points to the dramatic benefits that can be realized through use of real-time data feeds, development of standards to support interoperability, and implementation of interagency data sharing for situational awareness.

Résumé

Vers la fin de 2009, GéoConnexions a demandé la réalisation d'études de cas sur le rendement du capital investi, selon la méthode que la GITA utilise pour l'analyse financière des projets géospatiaux, afin d'ajouter au savoir en la matière. La présente étude met l'accent sur les cartes des urgences en C.-B. ou BCeMap, projet élaboré par Emergency Management BC (EMBC) et GéoBC afin d'améliorer le système d'information pour la gestion des urgences de la province. Le visualisateur de cartes des urgences en C.-B. s'inscrit dans le cadre du Système interorganisationnel de connaissance de la situation (SICS) et a pour but de permettre aux praticiens de la gestion des urgences de mieux se préparer aux urgences et d'en atténuer les impacts par un partage d'information géoréférencée en temps opportun. BCeMap met l'accent sur le regroupement des données de connaissance de la situation et sur son interconnexion au SICS national.

Ressource unique regroupant les données pertinentes sur les incidents destinées au personnel de gestion des urgences et de sécurité publique, dans la province et à l'échelle du pays (via le SICS), BCeMAP remplace plusieurs systèmes disparates qui favorisent les chevauchements et qui passent sous silence des incidences et des tendances plus importantes. En plus de permettre la visualisation de plusieurs types de données en même temps, et les économies inhérentes qui s'ensuivent, BCeMap favorise une meilleure collaboration interorganisme et donc une plus grande sécurité publique.

BCeMap était un projet pilote en vue des Jeux olympiques et paralympiques de 2010 et a été réalisé grâce aux 198 000 $ octroyés par GéoConnexions et à des contributions en nature correspondantes. Le projet a fait la démonstration des capacités pour le Sud-Ouest de la province, là où les Jeux olympiques se tenaient. EMBC s'efforce actuellement d'obtenir les fonds nécessaires pour rendre l'outil pleinement productif et étendre sa capacité de collecte des données à toute la province. Des efforts sont également déployés pour mieux le faire connaître et pour offrir la formation nécessaire à son utilisation à l'échelle de la communauté des utilisateurs.

Principaux avantages tangibles mis à jour par l'étude

- Améliorer le rendement du personnel dans l'exécution des activités courantes;
- Accroître l'efficacité des interventions d'urgence;
- Mieux protéger les infrastructures essentielles;
- Assurer une meilleure continuité des opérations.

D'autres avantages importants prévus incluent la plus grande fidélisation des bénévoles, l'accroissement de leur efficacité, une plus grande participation financière des propriétaires des infrastructures essentielles, la meilleure organisation des transports en cas d'urgence, les coûts évités en ne recueillant pas de données redondantes sur le terrain là où des incendies sont fréquents, le temps économisé grâce aux données disponibles sur les personnes à contacter au sujet des infrastructures essentielles et le temps que les préposés régionaux à la santé n'ont pas à consacrer pour se renseigner.

Analyse prospective quinquennale de BCeMap : Les avantages cumulatifs s'élèvent à 2,4 M$, et la valeur actualisée nette de 1,8 M$ affiche un rendement du capital investi calculé sur une année de 60 %. La période de récupération est de deux ans. Le taux de rendement élevé et la période de récupération brève sont révélateurs des avantages importants que permettent

la prestation de données en temps réel, l’élaboration de normes à l’appui de l’interopérabilité et la mise en oeuvre du partage de données entre agences à des fins de connaissance de la situation.

Introduction

GeoConnections has been a partner in the development of the GITA ROI methodology, sponsoring a portion of the original case studies, three of which were conducted in Alberta in early 2006. As the methodology continued to develop and more U.S. case studies were conducted, GeoConnections became interested in sponsoring additional case studies suited to its mission in Canada. It issued an RFP in August, 2009, for consulting services to create a Geospatial Return on Investment Project and awarded a contract to Mary Ann Stewart at Nova Blue Inc. of Kansas City, MO, to perform this work. The first case study, for the City of Quinte West's PRISM-GIS and PRISM-911 applications, was delivered on March 31, 2010. The contract was extended on April 2, 2010, to include four additional case studies to be completed by March 31, 2011.

The BCeMap case study was authorized on June 23, 2010, as an extension of the New Brunswick MASAS case study. Each provincial implementation of the MASAS core technology provides a unique approach and philosophy of use as a situational response tool. Thus, opening the scope of the project to include the BC implementation provides an opportunity to examine use of the technology under a somewhat different organizational structure responding to a different set of characteristic emergency events.

Arrangements were made with Todd Smith, EMIS Program Manager for EMBC, for a five-day visit by Ms. Stewart to provide ROI training and conduct on-site interviews to collect metrics for the financial analysis. This visit took place August 23-27, 2010. Training and interviews were conducted in both Surrey and Victoria offices, with an additional site visit to City of Vancouver Emergency Management offices.

Staff participating in training in Surrey were:

- Kris Hayne (EMBC)
- Gurdeep Singh (Portfolio Manager, Emergency Management, GeoBC)
- Joshua Chan (Land Information Coordinator, GeoBC)
- Robert Darts (EComm)
- Dave Burgess (Director, Operational Readiness, Emergency Management Unit, Ministry of Health Services)
- Clarence Lai (Coroner's Service)
- Heather Lyle (EMBC)

Staff participating in training in Victoria were:

- Todd Smith (Program Manager, EMBC)
- Malcolm Gray (GeoBC)
- A.J. Bryan (technology for Mike Webb)
- Jennifer Bresciani (fire reporting)
- Aja Norgaard (Planning)

On-site interviews were conducted with:

- Dave Burgess (Director, Operational Readiness, Emergency Management Unit, Ministry of Health Services)
- Sean McCune (Coordinator, Business Continuity, Fraser Health Authority)
- Mike Andrews (Regional Manager, EMBC)
- Daniel Stevens (City of Vancouver Emergency Management)
- Gurdeep Singh (Portfolio Manager, Emergency Management, GeoBC)
- Todd Smith (EMIS Program Manager, EMBC)
- Sonia Woolford (EMBC)
- Aja Norgaard (Director Integrated Planning, EMBC)
- Cam Lewis (Executive Advisor, EMBC)
- Chris Duffy (Director, Emergency Coordination, EMBC)
- David Tomaz (Local Authority Planning Coordinator, EMBC)
- Bob Kennedy (Emergency Social Services Training Specialist, EMBC)

Tangible and strategic benefits for the analysis were collected by phone and email dialogue with:

- Todd Smith (EMIS Program Manager, EMBC)
- Kris Hayne (Business Area Expert, EMBC)
- Mike Webb (Manager, Telecom & Specialty Systems, EMBC)
- Paul Childs (BCeMap Project Manager, Planetworks Consulting)
- Daniel Stevens (Manager, Emergency Planning, City of Vancouver Office of Emergency Management)
- Mike Andrews (Regional Manager, EMBC)
- Miranda Myles (Integrated Planning Section, Research Coordinator, EMBC)
- Clarence Lai (Geo-Spatial Information Analyst, Coroner's Service)
- Kelli Kryzanowski (Manager, Catastrophic Disaster Recovery Planning, EMBC)
- Robert Darts (E-Comm)
- Dwayne Meredith and Nairn Albrecht (Manager, Flood Protection, EMBC)
- Dave Burgess (Director, Operational Readiness, Emergency Management Unit, Ministry of Health Services)
- Cameron Lewis (Advisor, Executive Officer, EMBC)
- Jeff Haack (Search and Rescue, EMBC)
- Jennifer Bresciani (Fire Reporting System Officer, EMBC)
- Christine Grist (Manager Operations, Emergency Management Unit, Chief Operating Office, Ministry of Health Services)
- Sunny Mak (BC CDC)
- Heather Lyle (Director, Integrated Public Safety, EMBC)
- Carol Ogborne (ILMB)
- Cam Filmer (Director of Planning, EMBC)
- Tina Neff (Manager, Finance & Administration, Office of the Fire Commissioner)
- Bob Kennedy (Emergency Social Services Training Specialist, EMBC)
- Becky Denlinger (Fire and Emergency Management Commissioner, EMBC)

- Carol McClintock (Manager, Training and Volunteer Programs, EMBC)
- Rob Owens (Office of the Fire Commissioner)
- W. Murray Tekano (District Manager, Transportation - Okanagan Shuswap District & Senior Project Director, Kicking Horse Canyon Project, BC Ministry of Transportation and Infrastructure)
- Rian Jones (Business Continuity, EMBC)
- Anne McKeachie (Provincial Advisor, Business Continuity Management Program, EMBC)
- Andrew Morrison (Regional Manager, EMBC)

The BCeMap Project

Public Safety Canada is leading the Multi-Agency Situational Awareness System (MASAS) project, with support from GeoConnections, to:

"establish an operational capability to enable the sharing and accessing of geospatial data and information between public safety and security community members in order to improve situational awareness." – Public Safety Canada MASAS Project Charter

MASAS is composed of a system of systems, based on standards, enabling each participant to publish geospatial information for others to consume.

In April 2009 Emergency Management British Columbia, in conjunction with GeoBC and support from multiple stakeholders, submitted an application for $200,000 in GeoConnections funding for a British Columbian MASAS development. This request was approved in June 2009 and the project was initiated under the project title: *British Columbia Emergency Event Map (BCeMap*). Total cost of the pilot project, including partners and in-kind contributions, was $421,493.

The GeoConnections budget for the project was initially funded through mid-January 2010 and was later extended to the end of March 2010. The project was a pilot to be used for the respective stakeholders and participants to determine the utility of this system and serve as a framework to develop the discussion regarding the longer term funding, maintenance and potential extension of such a system. The target was to implement a trial version by the Gold Olympic exercises in November 2009 and for the pilot BCeMap project to be available for use during the Olympic games in February 2010.

The goal for this project was to develop and implement a web-based mapping application called the BC Emergency Map Viewer (BCeMap). This application would provide near real-time dissemination of a Provincial-wide incident map between trusted partners.

BCeMap is intended to be part of the national Multi-Agency Situational Awareness System (MASAS) that will enable emergency management practitioners to better prepare for, respond to, and mitigate the impacts of emergency events through timely sharing of geospatially referenced information within a Common Operating Picture application.

Two other initiatives are considered part of the national MASAS framework, Common Operating Picture developments in Manitoba and New Brunswick. The national MASAS is envisioned as a de-centralized collection of independent systems operated by emergency management agencies in a variety of jurisdictions and connected through standard interfaces.

The BC Emergency Event Map system (BCeMap) is intended to:

- Provide real-time dissemination of a province-wide emergency event map to trusted partners in British Columbia, including local, regional, provincial and

national emergency management organisations, other public safety agencies and critical infrastructure operators.

- Provide a Common Operating Picture that integrates incident, geographic, infrastructure, threat and hazard information to provide common situational awareness to multiple agencies while planning for and responding to emergency events of all types.

- Provide the ability to access and disseminate geospatial incident information to other trusted federal and provincial partners. This may include dissemination of information to other geospatially enabled systems such that the partners may not need to use the map component if user interfaces already exist.

Data needs of stakeholders were gathered early in the project, with the following requirements emerging as most prominent:

- Assist risk and resilience assessment
- Display pre-incident forecasts about hazard behavior, such as damage, property vulnerability and potential victims
- Provide decision aids to support recommendations for pre-positioning resources and evacuation
- Display real-time, incident-specific location information with respect to hazards, damage, victims and resources, and the location of available resources
- Offer insight into the interdependence and status of infrastructure components (energy, water, sanitation, road, communications, security systems) and awareness of critical infrastructure and facility vulnerability and status (refineries, chemical facilities, hazardous waste sites, bridges, tunnels, reservoirs)

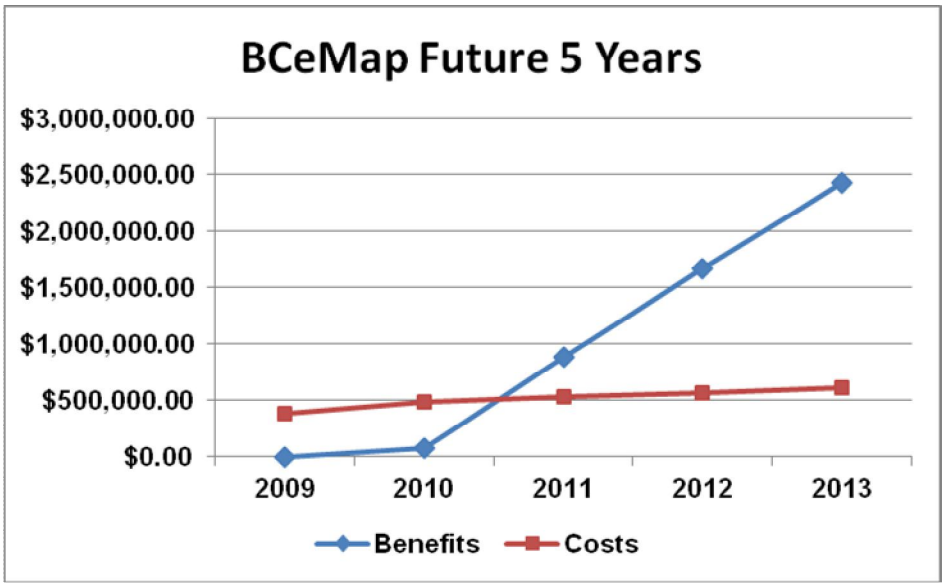
Fifty-seven hazards have been identified as pertinent to BC. The big three hazards are earthquake (occurring almost every day in BC), wildfire, and floods.

Financial Analysis

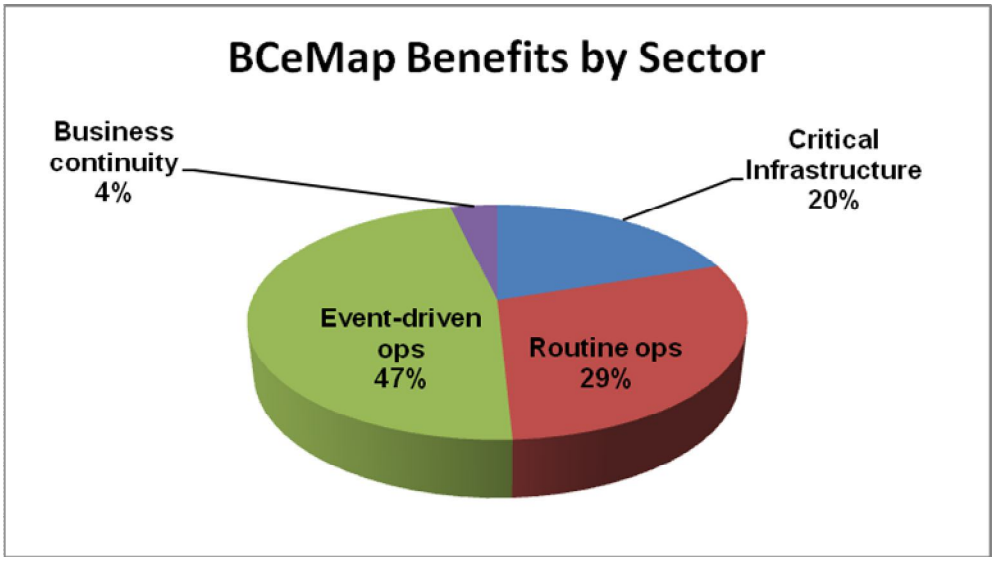
Forward-Looking Five-Year Financial Analysis of BCeMap

Total investment in BCeMap to date, incorporating startup costs in 2009 and 2010, is $482,964. This includes $198,000 in funding provided by GeoConnections. Total costs for the five-year study (2009-2013) are $606,406 and include development of critical infrastructure contact capabilities, integration of an additional tool each year, development of a web training program, and ongoing training and outreach.

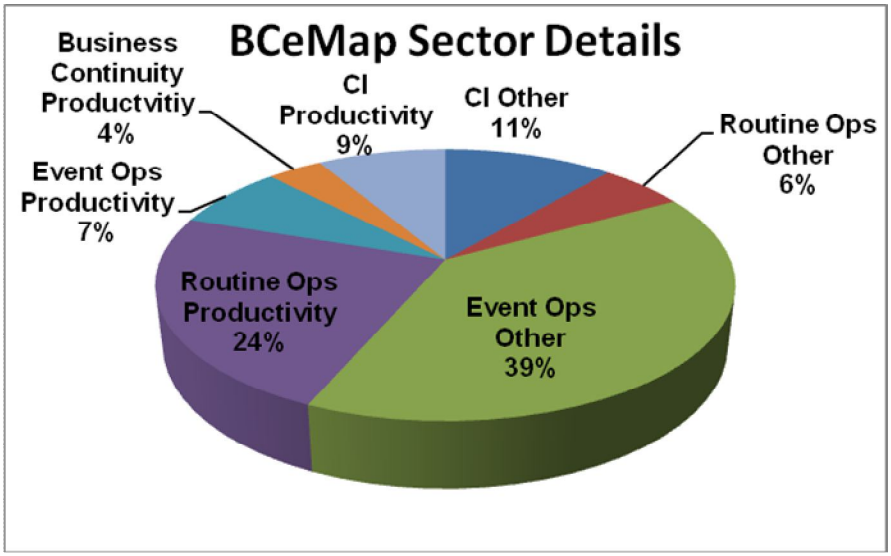
Net Present Value is $1,824,172, with an annualized return on investment of 60%. Breakeven point will be reached in 2011, two years into the project. This project demonstrates the dramatic potential for significant return on investment for geospatially-enabled emergency response projects, particularly in the area of improving efficiency of operations.



The greatest category of benefit found by the BCeMap analysis is in event-driven operational support, comprising 47% of total benefits. This benefit includes greater staff efficiency as well as better logistics support and improved training of volunteers. The second greatest category of benefit was in routine daily operational support, comprising 29% of total benefits. This benefit includes greater staff efficiency as well as elimination of redundant routine data collection efforts. The third greatest category of benefit was critical infrastructure protection, comprising 20% of total benefits. This benefit includes enhanced revenue from critical infrastructure owners, time saved maintaining contact information, and communication time saved during events.



Productivity benefits to staff working in Emergency Operations Center during an event are typically considered first when planning a project with MASAS architecture. As with the New Brunswick MASAS study, projected BCeMap benefits to EOC staff are important but do not provide the majority of the tangible benefits of this project. Productivity benefits represent 44% of total benefits but event-driven productivity benefits to EMBC staff comprise only 4.4% of total benefits, slightly over half of all productivity benefits from event-driven operations.



Annual costs to maintain BCeMap going forward are $44,630, which includes tools and applications hosting, publishing new data sets, development of one new tool a year, training and

outreach. Following the initial development phase, there is a one-time expected cost of $75,000 to develop critical infrastructure contact capabilities.

Quantifying the Benefits of Better Decision Making

In the course of this case study, considerable effort was made attempting to quantify the benefits of better decision making. EMBC executives frequently commented that they expected the greatest benefits of BCeMap would come from improved decisions. They will use the tool to manage events such as search and rescue, provide information to executives during events, and analyze past events to improve operations in the future.

Given frequent statements that it was important to quantify the benefits of better decision making, we considered various approaches for estimating this type of benefit. The case study is somewhat hampered by the life stage of the BCeMap project, as it has just completed a pilot and is not yet considered to be in production mode. Thus, benefits from better decision making must be projected rather than collected as already realized benefits. This approach is challenging as it asks staff to envision an improved alternative to managing events they have experienced in the past. The result of such thinking will always remain somewhat hypothetical and staff may find it challenging to estimate these benefits.

We determined that a realistic approach would be to explore specific examples from the past and look at potential benefits from BCeMap assisting in improved decision making during such events. Given that the study was taking place during an active fire season, we anticipated that it would be possible to step through examples from working 2010 fire events. Benefits metrics have been developed for some components of 2010 fire response. Flood events presented another likely opportunity for study and benefits metrics have also been developed for some components of 2010 flood response.

Areas where we were able to quantify the benefits of better decision making include resource deployment during an event and volunteer retention. There are two instances of resource deployment benefits. One involves the potential for more efficient use of multi-modal transportation based on experiences during this fall's flood response. Use of BCeMap for analysis of availability and capacity of barges and ferries used during evacuation could result in more complete filling of the transport vehicles as well more effective evacuation procedures.

Another instance addresses the potential for improved logistics in deployment of structural protection units during 2010 fire season. Units were brought in from Alberta at great expense, but with the use of BCeMap it should be possible to minimize distance traveled to obtain available structural protection units. These two benefit categories present examples of the potential for much greater benefits in the area of improved decision making. Future study of these areas would be helpful to EMBC in developing its strategy for optimal use of BCeMap.

BCeMap and Volunteer Retention

The issue of volunteer retention is a large issue that EMBC will face in the coming years. The province is almost entirely dependent on volunteer services for response to smaller search and rescue events. Volunteers help with evacuations in the case of major events, but also during routine events such as house or apartment fires.

Volunteers are clearly recognized as valuable to the province's response capabilities. However, recent reduction in program funding and resources to support volunteer efforts has constrained the capabilities of EMBC's volunteer program. Concurrently, demographics show that many long-term volunteers will soon reach an age where they will no longer be active in the program. The province doesn't have a resource available to replace this diminishing resource.

Analysis for this study was hampered by lack of metrics showing number of active volunteers and retention rates. EMBC does not currently have a way to track use of volunteer resources in response to events, as volunteers typically are coordinated through local authorities. This lack of information presents an opportunity for BCeMap to provide the vehicle for data sharing around volunteer activity at events of all sizes. Use of the tool could also assist with planning around the dynamics of fluctuations in volunteer availability.

Bob Kennedy, Emergency Social Services Specialist with EMBC, contributed significantly to quantification of benefits and the following discussion of issues in volunteer retention.

Emergency Social Services in British Columbia

Emergency Social Services (ESS) in British Columbia is estimated to have approximately 5,000 volunteers registered with Emergency Management BC/Provincial Emergency Program. While registered with EMBC/PEP, these volunteers report to, and are the responsibility of, local authorities.

One of the greatest challenges faced by most ESS teams is recruitment and retention of volunteers. Some teams that are well established, primarily in urban centres, maintain a static enrolment and do not actively recruit. More commonly teams struggle to recruit volunteers to form a core membership capable of assuming leadership roles during emergencies.

Activation of ESS volunteers is not a frequent occurrence so they have little opportunity to practice their skills, unlike volunteers engaged in disciplines such as Search and Rescue or Emergency Radio Communications. Thus other activities or events must be offered. A small number of ESS volunteers engage themselves fully in the local planning efforts and this is often a very rewarding contribution to the volunteer's community resiliency. Enhancing the training and tools available for the planning process may attract new volunteers to the program.

In 2008 EMBC/PEP conducted a survey of ESS stakeholders. Training was among the highest rated of identified deficiencies, both in availability and content. The current training provided is primarily focused on the theory of the operational aspects of an ESS response. Survey results

identified a desire for more practical training opportunities and training that would assist teams in developing capacity based on the needs of their community or region. There are initiatives to develop such practical training but ESS teams need a set of tools to assist in their planning efforts. An important aspect of effective planning is a clear picture of a community's hazards, risks and vulnerabilities. Comprehensive mapping tools would provide a snapshot of a community's demographics, including income levels, ethnicity and age distribution, along with locations of critical facilities, supplies, transportation routes and areas of potential concern.

Formal training in the process of gathering and interpreting such data along with the time commitment in creating the necessary layers for all ESS teams in the province would be prohibitively expensive for individual communities. A readily available program would encourage its use and contribute to effectiveness of community planning.

Training ESS Volunteers

Some of the larger communities in British Columbia are sufficiently funded through local resources to provide training to their volunteers. Even with this ability, much of the local training provided is through the financial support of the province over and above what is funded locally. In the past fiscal year $235,000 was committed to ESS training. The amount committed to training resulted in courses across the province being provided to approximately 1,500 volunteers, at a cost of $156 per volunteer.

The training that provided was primarily delivered in the more established communities where it was easier to ensure a minimum number of participants. There is a demonstrated need to provide training to smaller, more remote communities. One method being explored is distance education, primarily through the use of social media and resources such as Live Meeting. The risk in remote training is that the facilitator may not understand the community's resources, challenges and opportunities. BCeMap would provide an instructor with regionally specific and relevant information, providing a better understanding for someone who is not physically present and making for a more personalized experience for the participants. The instructor would be able to address specifics on what is most needed to establish effective ESS capacity. The costs of such training would be significantly less than that of providing face to face instruction with associated travel expenses.

ESS courses are currently being offered in 29 communities. Twenty-two are urban, where recruitment and retention are considered manageable. The remaining 7 are small, generally remote communities where the number of participants is generally below what is considered optimum. Although the number of communities in British Columbia that forego ESS training is uncertain, there is concern that many would be unable to respond effectively and efficiently to the public safety needs of their citizens. Experience has shown that inadequate training has often resulted in unnecessary costs to the province as a result of mistaken assumptions.

Tangible volunteer program benefits collected for the case study include the benefits of reduced training needs through reduction in the volunteer churn cycle and increased volunteer contributions with reduced attrition. Use of BCeMap would provide an opportunity for improved location-specific training to volunteers, as EMBC staff use the tool to educate themselves about

each training area. Making the tool available to volunteers will provide significant life skills to volunteers, as well as offering a technology grab for younger volunteers.

Critical Infrastructure

Planning for protection of critical infrastructure is a top priority for the province. It has been observed that EMBC notification and communication regarding hazards has functioned well for local authorities but is often delayed for owners of infrastructure at risk. Infrastructure owners are reluctant to share information regarding their assets with the province and require control of their data in a secure environment, but must be notified when the province is aware of conditions that provide risk to their assets.

During the 2010 fire activation, the focus of critical infrastructure analysis and notification was on the telecommunications and energy sectors. However, it is recognized that analysis should include all ten critical infrastructure sectors.

In an effort to solve the puzzle of conflicting demands, BCeMap critical infrastructure viewing capabilities were piloted for the 2010 Olympic and Paralympic Games for a geographic target area. A CI Spatial Query tool was built, allowing one-click messaging to large numbers of asset owners. The tool enables EMBC staff to work with the owner of an infrastructure component to gain better understanding of assets that could be at risk. The tool holds contact information for notification regarding an owner's infrastructure within a five, 10, or 20 km grid. Asset owners can pick squares for which they want notification without specifying exact location of their assets. An EMBC event manager can send hazard notifications to asset owners by email. The prototype was done in Google Earth. Building the functionality of the query tool into BCeMap and inclusion of data from the entire province will provide a more permanent, interactive and secure platform for the query tool.

There is a plan to develop critical infrastructure contact information for incorporation into BCeMap. Capabilities developed for the pilot area will be extended throughout the province, with a focus on the tool's use by Regional Managers. EMBC staff working fires have noted that in many cases critical infrastructure information has not been updated since the big fires of 2003. Staff also noted that making manual notifications during 2010 fire events was time consuming and labor intensive, except in the South Coast areas where data had been developed for the pilot and notification could be automated.

Staff engaged in planning for protection of critical infrastructure need to have geospatial data developed before an event occurs so the information will be immediately available to support analysis during an emergency, potentially saving days to weeks of time during a disaster. This would be particularly helpful in planning for catastrophic, widespread events such as earthquakes.

Several types of critical infrastructure benefits were projected for this study. It is anticipated that providing information from BCeMap will produce a revenue stream from infrastructure owners. Productivity benefits will result from time saved by EMBC staff in manually notifying owners of threats to their infrastructure during events as well as staff time saved in routine maintenance of the owner database.

This case study does not address transportation and critical infrastructure issues due to the unavailability of the TransLink staff contact for BCeMap. We recognize that transportation is a vital component of critical infrastructure planning and hope it will be examined in future evaluation of benefits.

BCeMap will provide critical infrastructure viewing capabilities that could not be accomplished using the ETeam system as stand alone. For instance, BCeMap provides the ability to drill down through the data. Further analysis of capabilities could result in a plan for optimizing the capability of the two tools.

Tower locations and ownership is essential information for the critical infrastructure database. There is anecdotal information regarding the potential for critical points of failure in communications for 911 and broadcasting hubs during the 2010 fire season. Use of the critical infrastructure tool within BCeMap will enable better assessment of downstream consequences if an asset is lost.

There is a related project with Saskatchewan for a critical infrastructure asset database to provide a way to capture asset information. A common operating picture would pull assets up on a screen, as they fall within event-driven polygons. The framework is available for implementation in BC, with the potential for cost savings in leveraging the technology. Having a common operating picture across province lines would be beneficial to both provinces when responding to large events. If BC were to host this application for the two provinces, there would be potential for more cost effective deployment and maintenance of the BCeMap technology through wider use.

Business Continuity

Government assets are often overlooked as a component of critical infrastructure, until the continuity of government business is impacted by critical points of failure at these business locations. BCeMap can be a valuable tool for looking at government occupied facilities and recovery sites during or following an event to see immediately if help is needed. BCeMap viewing capabilities would help ensure that plans were being implemented and would assist in directing impacted offices to safe alternate locations.

There are several groups of stakeholders within EMBC that support business continuity that would be able to benefit from the use of BCeMap. Cross-ministry coordinators address the facilities and communication needs of Ministry offices, while another group focuses on catastrophic events with potential impact beyond government buildings.

Business continuity staff perceive several significant contributions that BCeMap could make to event response. Field staff doing damage assessment could use the tool on hand held units, entering collected data directly to the mapping application. Office staff could use the tool to display the extent of an event such as flooding or wildfires and work with the provided resources to do in-house analysis rather than seeking external analysis services.

Business continuity staff could use BCeMap to assist with triage when reestablishing business processes. The tool can help answer the critical questions: What buildings are affected? To what level? Can people work in them? Currently, EMBC staff don't know when a site goes down until they are notified, which presents a risk for the organization.

Currently Provincial Advisors use GeoBC maps from Integrated Land Management Bureau (ILMB) to view and distribute maps with an overlay of government buildings, infrastructure and other applicable features such as flood plains or diking systems. The information may not be current due to frequent government office relocations and does not incorporate actual event metrics. Having a system that integrates with the current building location database and provides a real time viewer would save staff time.

This case study projects business continuity productivity benefits to EMBC and ministry staff due to time saved communicating risk and solutions regarding government occupied facilities during events. There is an additional productivity benefit due to time saved by District Health staff in their business continuity communications during events. There would be an increase in these metrics if benefits from improved service to government offices and health departments during typical events were included in the financial analysis.

BCeMap Strategic Benefits

The approach of the GITA financial analysis methodology is to view strategic benefits from the perspective that they may become quantifiable in the future. Many strategic benefits can be converted to quantifiable benefits once suitable metrics are discovered or further experience has been gained with the application under analysis. Conversely, it may never be appropriate to quantify certain types of public benefits.

For this case study, improved decision making is the area of strategic benefit that appears to be most promising for future quantification. Opportunities for improved decision making were found in specific areas of response as well as in general operations.

General Benefits

The architecture of BCeMap provides a common operating picture and cross-organizational shared platform. Shared knowledge through a common platform will address disconnects between organizations and stakeholders and facilitate efficiency in emergency response.

BCeMap advances standards in the area of geospatial formats, handling up to 200 formats to support input from the diverse systems of participating organizations. Events managed using BCeMap do not respect jurisdictional boundaries. In order to present a common operating picture, BCeMap must be able to accommodate data from various Ministries of the province, as well as regional, local and Federal agencies, First Nations, and non-government organizations. Providing clear standards and ready access to the varied formats of these diverse data feeds promotes geospatial interoperability, the ability for different software systems to interact with geospatial information. Interoperability capability aligns with the January 2011 publication of the *Communications Interoperability Action Plan for Canada,* which calls for support of the implementation of the national MASAS framework.

Better decisions may result from providing decision makers with more data sources of greater currency and accuracy. Operations staff will benefit from timely information, especially at the onset of an event when resources and information are scarce.

BCeMap provides an opportunity to provide better information to executives based on rigorous, systematic use of geospatial data. Data from emergency response events could be studied after the event, in the manner that traffic departments use accident data for analysis. Authoritative information from known sources of expertise at agencies can be provided to the emergency response community.

Use of the geospatial tool promotes community and engagement. Last year's preparation for the Olympic games involved engaging with local governments regarding access to their data. The process fostered the establishment of a GIS community as well as data gathering. The tool demonstrates the value of GIS to staff in program areas outside of emergency response. The displays are attractive and raise interest, possibly stimulating ideas for new analysis and display functionality from new users.

Health Sector Benefits

Use of the geospatial tool promotes improved asset management by addressing static or dynamic resources (i.e., buildings, people, supply and equipment inventories). The Health Sector is a large organization with constant change, bringing challenges to asset management.

Ministry of Health staff envision using BCeMap for improved response to natural and human caused disasters, pandemics, routine health issues, and tracking of resource availability for response.

Province-wide health data as information is rolled up from the five Regional Health Authorities and Provincial Health Services Authority. BCeMap could be used to collect and display this data.

Infectious disease outbreaks and other population health data may provide the greatest ongoing opportunity for Ministry of Health use of BCeMap. The tool would assist in identifying trends, tracking individual cases and identification of clusters.

Fire Response

BCeMap could be used to provide consolidated mapping tools for fire response. The tool has already been useful for fire perimeter mapping and road closures. Its query capabilities are valuable for tactical staff.

BCeMap could provide real-time data for dynamic mapping. Response safety would be a significant benefit, as would better decision making due to improved data quality and speed of delivery. Live data would assist in more effective planning, and the ensuing results of this planning could be shown through timely displays of feedback information. More effective use of resources would result in reduced expense.

BCeMap could be used to support evacuations. When working fires, the evacuation order could be mapped and the tool used to make sure the local declaration fits the evacuation order.

Often after a fire event there are investigations. Staff involved in investigation and policy making must gather data about construction, height, sprinklers, and smoke alarms. Use of the mapping tool would facilitate observation of fire trends that previously went unnoticed. BCeMap could be used to provide access to the most critical statistics: how many evacuated, how many bodies, how much paid out in emergency social service assistance.

Flood Response

BCeMap could be used to support evacuation using alternate modes of transportation. During 2010 flooding, roads were out for up to three weeks and there was unprecedented response using alternate modes of transportation. Response involves complex logistics, which could be made more efficient by use of shared platforms and open communication.

BCeMap could provide access to an existing archive of aerial photos, which would be useful for mitigation by showing how communities have developed. Confidence in information received and decisions made would be greater with access to historic records.

The tool could provide ready access to property assessment values, resulting in better cost estimates of the value of a mitigation through knowledge of property at risk. Program areas addressing other types of hazards, such as fire or earthquake, could benefit similarly from ready access to property assessment values.

Earthquake Response

ECeMap could support multi-model transportation after a disaster. In planning for an earthquake in the greater Vancouver area, the supply chain must be expanded to include other regions of the province, the nation, and international participation and the tool could manage and display the necessary data.

The tool could be used to display an isomap of the level of effect of the earthquake at the surface. This would be created from real-time feeds from bridge locations showing acceleration and degree of shake during an earthquake.

Search and Rescue

Search and Rescue typically has three to five incidents a day. Search and rescue comprises 90% of year round activity, as contrasted to working fires only during the season.

BCeMap could be used to track and display paths searched, especially useful for large efforts. During such events, it is paramount to reduce search area as much as possible through analysis by drawing statistical rings and performing mathematical analysis. Results using search theory are intended to be objective statements of probability, but are prone to inaccuracy. Display of real-time GPS tracks using BCeMap would provide information about the location of searches as well as the time required to search each area.

Using BCeMap to display data on avalanche characteristics would be useful prior to deploying resources, in an effort to send experienced resources to the most avalanche-prone areas. Criteria to determine risk zones are quite well developed but SAR doesn't have a way to do this analysis internally. They rely on external expertise, which results in inefficiencies.

BCeMap could be used to provide resource tracking capability. Simultaneous ground and air searches are managed out of separate centers and the tool would improve interoperability.

Critical Infrastructure

BCeMap could serve as a planning tool by displaying location information of critical infrastructure.

The tool could display fire perimeter growth or other hazard perimeters, evacuation alerts, and evacuation order boundaries, all shown in relation to location of critical infrastructure.

By fostering information sharing with asset owners, BCeMap could serve as a tool to engage asset owners, businesses, and community members sooner. They would be likely to have more productive conversations with emergency management staff as well as being provided with greater lead time for planning.

Office of the Chief Coroner

Automation of spatial tagging of case files would be a big step forward for the coroner's office. This would save on manual tagging and improve data quality due to quick visual feedback in a BCeMap display.

BCeMap could help reduce delays accessing the Coroner's Office database and working with individuals who investigated an event.

Business Continuity

BCeMap could be used to look at government occupied facilities and recovery sites to quickly determine if help is needed. It could be used to show Ministries cases of their properties in the hazard path, enabling pre-emptive action by directing impacted offices to alternate locations. Having this information would assist in getting government business running following an event.

Better decision making for Business Continuity is primarily faster decision making. BCeMap could help support mission critical functions requiring robust recovery strategies, especially for those ministries that have emergency response roles to protect people, assets and critical infrastructure.

Emergency response priorities make it difficult for Business Continuity staff to get manual maps with current information in a timely fashion, as PREOCs and First Responders take first priority. If maps from BCeMap were accessible, staff would provide this information to Ministries to show properties are in the path of an event. This would enable pre-emptive action.

BCeMap display capabilities could be used to provide event context to executives. The executives managing Ministry Operations Centers change positions frequently. Often they are new to a locale and viewing the event on a map could provide a fuller description of an event.

Shared Services who own infrastructure throughout the province need to know if their fibre and other assets may be at risk. The earlier Shared Services knows about impending threats to critical government infrastructure, the greater their ability to mitigate the impact. Information feeds from BCeMap would allow time to work through options.

Volunteers

BCeMap could be used to show demographic information about the socio-economic area being evacuated, to assist staff in understanding the degree of services needed. Often staff must put everything on hold pending resolution of conflicting information. Real-time authenticated information would help prevent delays that cause upsets in internal processes, such as staff waiting to see if they will be deployed.

Conclusions

Analysis of BCeMap costs and benefits addresses a number of important issues for situational awareness interoperability. Significant findings of this case study include:

- Results of the 2010 pilot project for the Olympic and Paralympic Games support the business case for expansion of capabilities throughout the province.
- Time savings to staff in Emergency Operations Centers through use of real-time data feeds are critical, but do not comprise a large percentage of the study benefits.
- The potential for better decision making through improved data availability and analysis capabilities may ultimately provide the greatest area of benefits.
- BCeMap provides a flexible toolset for managing risk to critical infrastructure.
- BCeMap may provide value regarding emerging issues such as volunteer retention.
- BCeMap supports interoperability of GIS data and applications throughout provincial and local agencies, a high priority for communications at the provincial and national level.

BCeMap leverages the MASAS framework to provide a toolset suited for use by BC provincial and local government. Capabilities were developed quickly in order to pilot the tool in time for the 2010 Olympics. Use of the tool was demonstrated during that time frame but much remains to be done to extend BCeMap capabilities in full production mode throughout the province. Funding is currently being sought to stabilize and enhance the implementation.

This financial analysis primarily focuses on benefits that will be realized in the future. In general, benefits do not begin to accrue until 2011, halfway through the project. This is an accurate depiction of the project's current status, although unrecognized benefits may have been realized during the pilot phase of the project.

Incomplete description of tangible future benefits in some program areas may also have contributed to underrepresentation of benefits and distortion of benefits by program area. Thus, it is recommended that EMBC staff maintain the financial analysis of BCeMap as a living document, continuing to update it with actual costs and benefits as they are realized over time.

Benefit areas that merit further study include: improved decision making (particularly in the area of fire and flood response), minimization of risk to critical infrastructure, transportation sector benefits, health benefits to the public, and benefits to search and rescue operations.

Despite BCeMap being in the early stages of its life cycle, significant return on investment was obtained from this case study. Conservative estimation of a few areas of benefit and a few stakeholders shows 60% annualized Return on Investment, with a Net Present Value of over $1.8M and a two-year payback period. These illustrative examples of benefits show the dramatic potential for benefit from real-time feeds with a framework for interagency data sharing for situational awareness. One of the perceived risks of this analysis was that the projected returns would prove to be so high as to strain credibility. Therefore this is a conservative analysis, pointing toward greater tangible returns in the future.