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**British Columbia, Canada**  
A new partnership for British Columbia in Canada

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British Columbia, Canada
A new partnership for British Columbia in Canada

There is a new attention being focused on British Columbia, on every part of the province, not only as we think about how to take full advantage of the Winter Olympics in 2010, but as we think beyond 2010 to a golden decade that lies before the province and the country. There is an opportunity to imagine the progress we can make in the coming decade, and to exceed every expectation of what we hope to be.

There is above all an opportunity to open a door to opportunity that will be wide enough for the country to walk through. A door to the advantages of our diverse society; a door to opportunities that will expand our economic capacity; a door to the benefits of our natural resources; a door to the incredible difference that an individual can make. The door is British Columbia, Canada. It can be opened through a strategic new Partnership for British Columbia in Canada.

The federal government has over the decades recognized and supported critical industrial mass in the regions of Canada. In Ontario, there is support for Canada’s important automobile sector and in Quebec support for Canada’s essential aerospace sector. This support has advanced development of technical and industrial clusters that have brought significant benefits to the country.

Both through targeted and through broad-based measures, the federal government has advanced Canada’s economic capacity, facilitating the evolution of its vibrant economy within North American.

By drawing together these strategic federal measures, a unique opportunity now exists in British Columbia to target federal government efforts and build a new partnership that will advance and sustain the vibrant economies of British Columbia and Canada.

The federal government’s commitment to science and research, to cities, to important sectors, and to the infrastructure supports upon which Canada’s economic competitiveness and quality of life relies are essential to advancing British Columbia’s environmental sustainability, trade, and future economic growth.

British Columbia holds a suite of unique elements within Canada. Its coastline, its place as a critical link to Asia-Pacific, its traditional reliance on resource sectors and its burgeoning life sciences sector are pieces of a whole. Strategic and targeted measures, addressed jointly and designed to support these unique characteristics, will benefit British Columbia and all of Canada.

Opening up Canada’s Gateway to the Pacific

As Canada’s only Pacific Rim province, British Columbia’s geographic location gives it a natural advantage that can be used to foster continued economic growth for Canada. Key to realizing this vast potential is a well-functioning transportation system that can continue to offer shippers and travelers more efficient connections and better prices than competing gateways in North America.

The Asia-Pacific markets represent substantial opportunities for Canadian producers. China has become the world’s fastest-growing consumer of natural resources, including forest, mineral and petroleum products. These are commodities produced in Western Canada and shipped through British Columbia ports.

As a nation, Canada must create effective strategies to benefit from the growth of China and other Asian economies, or we will be left behind and our domestic industries and our national economy will suffer.

Over the next two decades, British Columbia’s transportation system will continue to grow as an efficient, safe and secure gateway for national and international trade. As a seamless, intermodal system, it will:

• support economic development strategies
• support supply chain management practices
• add value
• promote environmental consciousness.

British Columbia ports are facing a range of competitive pressures and opportunities -- most critical is the forecasted 250 per cent growth in container traffic between Asia and North America over the next 20 years. British Columbia’s ports require major capital investment in the coming years to expand, modernize and convert facilities in order to capture the container

Overview
A new Partnership will facilitate conditions that will support the long-term competitiveness and sustainable growth of Canada’s Pacific coast ports industry. We will collaborate on a long-term strategic approach that supports industry growth, re-investment and innovation, and advances the industry’s competitive position on the North American Pacific coast.

A new Partnership will also address the conditions that currently create barriers for the growth of British Columbia’s airports. The Partnership will expand airport operations and bring significant additional business travel and tourism to the province.

The Trans Canada Highway is Canada’s national highway, and a critical resource development, tourism and goods movement corridor for British Columbia. It is also the major highway gateway to British Columbia for the rest of Canada, and is essential to inter-provincial commerce. Inadequate attention to the Trans Canada has led to the diversion of goods southward to US highways that lead to US ports, weakening the competitiveness of Canadian gateway facilities. A new Partnership will advance existing efforts to address these challenges in a comprehensive way, addressing critical transportation demands across and up-and-down the province, and within and around urban hubs.

Over the next 10 years, the government of British Columbia will be investing almost $4.9 billion in the transportation system. An additional $3 billion will be invested through public-private partnerships. We are looking to the federal government to be an equal partner in investments that are central to the growth of the Canadian economy.

A Partnership that Recognizes British Columbia’s Unique Water Resource

Water is a key resource in British Columbia. As a coastal province, we rely on our ports to advance our trade and we rely on our ocean and river resources to sustain traditional resource economies.

As part of Canada’s smart regulation initiative, an opportunity exists for a Partnership with British Columbia to further protect and sustain our water-based resources.

For generations, our coast has supported great ecological diversity, as well as the social and economic foundation of coastal communities. Today, however, coastal communities are struggling with the decline of wild stocks and the commercial fishery has been hard hit. There are many opportunities to regenerate our ecological resources and create secure futures.

British Columbia will enhance our commitment with a number of strong new initiatives. We will develop and implement a bold new Freshwater and Ocean Strategy. This strategy would begin with negotiations with Fisheries and Oceans Canada to improve the relationship, reduce inconsistencies and delays in decision-making, and move towards a joint decision-making framework.

A new Partnership with the federal government can facilitate these critical goals by bringing together science capacity and decision-making processes into a shared governance structure through which ocean and freshwater resources can be sustained for future generations. Our common interests in the fishery can only be achieved through a partnership approach to fisheries management in the form of a new interest-based joint decision-making structure. Improved decision-making that is joint and based on common interests will serve Canadians better and make the federation more efficient.

British Columbia is looking for institutional and not constitutional reform. An effective new institutional arrangement will improve decision-making, deliver on recent federal commitments for enhanced federal-provincial relations, and cultivate a more positive public image.

The next generation of economic and environmental sustainability in British Columbia

Our ability to improve the province’s transportation networks and protect and sustain our water-based resources is closely linked to our ability to harness the potential of life sciences to promote environmental sustainability and prepare for further growth in resource-dependent communities.

The government of British Columbia has worked over the past two years to establish a New Era for research activity in the province. Investments of $250 million have been made in research infrastructure at universities and research hospitals through the British Columbia Knowledge Development Fund, the Leading Edge Endowment Fund for BC Leadership and Regional Innovation Research Chairs, Genome BC,
the Michael Smith Foundation for Health Research, support for the indirect costs of research at universities and other initiatives specific to the environment and social health of British Columbians. The result is that we have created a solid foundation for accelerated research activity in the province.

Over the past decade, the Government of Canada has demonstrated its commitment to research and innovation by investing heavily in regional and industrial development in other regions of the country. Despite having received lower levels of academic science funding from the federal government than other provinces, British Columbia has “done more with less.”

The goal of this new Partnership is to work with the federal government and post secondary and industry partners to make Canada a world leader in life sciences by building on British Columbia’s strengths and expertise in new and traditional sectors that are central to the overall success of the British Columbia economy. The Partnership will incorporate innovative approaches to research and commercialization that have been undertaken by the federal government elsewhere in Canada.

The Partnership will accelerate growth in new technologies and industries where British Columbia is emerging as a significant source of expertise - areas including genotyping, proteomics, nanotechnology, biotechnology, and bioinformatics. In addition, the Partnership will extend the value of core research to key sectors of the British Columbia economy, revitalizing traditional provincial industries such as forestry, fisheries, agriculture and mining.

A modest federal investment in life sciences in British Columbia has the potential to improve the global competitiveness of key industrial sectors located in every region of the country. Both the provincial government and the private sector in British Columbia are accelerating their science R&D commitment, which will ensure federal funding will be well leveraged.

These funds will provide opportunities across the full continuum of research, from basic research to technology transfer activities. They will also to take into account needs for infrastructure and laboratories that promote research collaboration, funding to undertake research and attract high quality researchers, and support to facilitate the transformation of ideas into marketable products.

The strategy will result in a concentration of life sciences researchers working in clusters related to health, biotechnology, forestry, agriculture, fisheries, and mining and will accelerate research through efficiencies and sharing of ideas. In addition, industries that serve and use new research-based technologies will locate near the core facilities on either a permanent or temporary basis, increasing economic activity in these locations or making use of the core until the technologies are ready to be taken to other regions of the province to generate new industry or regenerate traditional resource based industries.

In addition to these initiatives to advance the development of a life sciences cluster in British Columbia, more targeted measures are required – some relying on life sciences – to prepare British Columbia’s resource-dependent communities for both the full impacts of the pine beetle infestation and for the next generation of economic development.

British Columbia is currently experiencing the largest recorded Mountain Pine Beetle outbreak in North America. This forest health epidemic is a catastrophic natural disaster and is causing widespread mortality of lodgepole pine, the B.C interior’s most abundant commercial tree species. The epidemic threatens the stability and long-term economic well being of many communities and First Nations, and ultimately the economic health of the province. It has put significant forest values at risk within the province and has started to move eastward, jumping the Rocky Mountain barrier. The issue is of national importance in terms of sustainable forest management, Kyoto accord commitments and has international trade implications. This major natural disaster urgently requires the concerted, cooperative efforts of both the federal and provincial governments.

The epidemic could create an increase in economic activity in the epidemic areas as the timber harvest levels are increased to utilize dead pine trees before they lose their commercial value. The short-term surplus of harvestable fibre will be followed by a significant reduction in the allowable annual cut as the epidemic runs its course.

Over 30 communities in the epidemic area will be significantly affected by the downfall in the allowable annual cut. As a result, these communities will be forced to undergo major transition.

Mitigating the impacts of the epidemic goes well beyond normal forestry activities or the capabilities of the forest industry or local communities. Given the scope of the epidemic and the impending impact on communities and individuals, there is a public expectation that senior governments are actively
working to mitigate both the biological/environmental and socio-economic impacts of the epidemic.

British Columbia has developed a comprehensive strategy as part of the new Partnership with Canada. The goal of this strategy is to prepare forest-dependent communities affected by the pine beetle for the economic, social and environmental consequences of the infestation. By developing a long-term, five – 15 year plan through federal investment of $1 billion, the federal and provincial governments can prepare for and mitigate these impacts now.

A New Partnership for a Golden Decade

To succeed in our complex continental and global environment, we must be leaders in developing, applying and commercializing technology. This new Partnership will harness the momentum required to entrench a competitive position. This is essential for Canada as the most trade-dependent country in the G-7 and for British Columbia as one of its vibrant economic hubs.

To truly take advantage of the resulting trade advantage, the new Partnership will help vault the province’s growing life sciences sector to among the foremost in the world. It will facilitate the development of needed infrastructure in roads, airports and ports to advance Canada’s trade and tourism.

And to protect and sustain our ecological heritage, the new Partnership will help assist forest-dependent communities through the coming decade of change and will promote our fisheries-dependent communities through scientific investment and shared decision-making processes based on common interests.
As Canada’s only Pacific Rim province, British Columbia’s geographic location gives it a natural advantage that can be used to foster continued economic growth for Canada. Key to realizing this vast potential is a well-functioning transportation system that can continue to offer shippers and travelers more efficient connections and better prices than competing gateways in North America.

The Asia-Pacific markets represent substantial opportunities for Canadian producers. China has become the world’s fastest growing consumer of natural resources, including forest, mineral and petroleum products. These are commodities produced in Western Canada and shipped through British Columbia ports.

As a nation, Canada must create effective strategies to benefit from the growth of China and other Asian economies, or we will be left behind, and our domestic industries and our national economy will suffer. These strategies must also continue to build upon the growth of north/south trade with the U.S. British Columbia’s marine ports, international airports, regional airports network, highway and rail corridors, and border crossings are essential components of the basic infrastructure required to allow the provincial and national economies to benefit from new or emerging opportunities.

Over the next two decades British Columbia’s transportation system will continue to grow as an efficient, safe and secure gateway for national and international trade. As a seamless, intermodal system, it will:

• support economic development strategies
• support supply chain management practices
• add value
• promote environmental consciousness

The primary challenge in accommodating further growth is facilitating improvements to the efficiency of the Lower Mainland’s land based and intermodal transportation linkages. This is an increasingly common theme in North American port cities.

Focus on gateways

British Columbia’s Lower Mainland international gateways play a major role in supporting Canada’s economic growth.

Vancouver Port Authority alone now moves approximately 1.6 million TEU’s (twenty-foot equivalent unit) of containers or approximately one million containers annually. Each container is estimated to add $1,200 to the regional economy. Since 1997, Greater Vancouver’s ports have experienced double digit growth in container throughput every year, and gateway facilities now account for 75,000 jobs. Specifically, the Lower Mainland is now home to:

• **Canada Place and Ballantyne Terminals** – Canada’s largest passenger ship facility, with more than 1.1 million cruise ship passengers per year;
• **Pacific Border Crossing** – Canada’s fourth busiest border crossing, shipping $23.9 billion in goods annually, at which truck volumes are expected to double by 2020;
• **Vancouver International Airport (YVR)** – the second largest international passenger gateway on the West Coast of North America, serving 15 million passengers per year. YVR is also the premier air cargo gateway between North America and the Asia-Pacific;
• **The Port of Vancouver and Fraser River Port Authority** – Canada’s fastest growing container port facilities. VPA currently has 27% of the Pacific Northwest market share (2001), which is expected to grow to 40% by 2021. Container traffic is expected to grow by 250% over the next 20 years.
• **In Prince Rupert, the Prince Rupert Grain Terminal, Ridley Terminal and Fairview Terminal handle 10 to 13 million tonnes of natural resource exports per year.** About 87% of

75,000 people work in the Greater Vancouver Gateway facilities and supporting transportation services. 145,000 jobs in the four western provinces are directly or indirectly dependent on the Greater Vancouver Gateway transportation system.
the volume of shipments from Prince Rupert are destined for Asian markets.
The time is of the essence. If Canada captures the growth opportunities from Asia, by 2020 British Columbia marine ports could be handling $75 billion in trade and contributing $10.5 billion in economic output to the Canadian economy. However, China’s rapid emergence as a major market is occurring at the same time as British Columbia’s transportation system is approaching operating capacity. Investment in crucial infrastructure is required to expand capacity, develop new facilities and modernize existing facilities to capture growing market opportunities.
The stakes are high and failure to act will result in lost potential for generating economic wealth. Delays will erode development opportunities as shippers seek out the most efficient, reliable and effective gateways for delivering their goods to market.

- British Columbia ports currently handle half of Canada’s marine exports and 85% of the western provinces’ marine exports
- The total volume of Canada’s trade with China shipped through the Port of Vancouver has grown 56% in the past year. Lumber exports are up 46%. Sulphur exports are up 63%.
- On a recent trade mission to China, Japan, Korea and Taiwan, port representatives were told Asian shippers would double their volumes through the Port of Vancouver, but capacity is a concern.
- Canada’s key trading ports in British Columbia currently handle $35 billion a year in trade and contribute $4 billion annually in economic output to the Canadian economy.

The transportation network providing access to major gateways in the Vancouver Lower Mainland must also be addressed to ensure that British Columbia and Canada can best benefit from increasing trade opportunities in the Asia Pacific. Road congestion and constraints on rail capacity are already impeding the movement of goods.

Over the next ten years, the government of British Columbia will be investing almost $4.9 billion in the transportation system. An additional $3 billion will be invested through public-private partnerships.

Successful competition in the ever-changing global marketplace requires focused efforts in two areas. Both infrastructure investment and policy changes are necessary for continued development of a seamless, efficient and effective transportation system. Building, operating and maintaining transportation infrastructure is not enough to allow business to compete in international markets. Effective transportation policy and smart regulation are necessary to encourage investment.

Specific policy initiatives

Infrastructure investment alone will not optimize competitive potential. A policy framework that promotes investment from non-government partners while still respecting concerns about safety, security and the environment is essential.

There are a number of transportation policy initiatives that must be undertaken to establish an environment that encourages new investment and promotes growth. Most of the required policy changes present no direct costs to the federal government.

Air Policy

A strong Pacific Gateway requires a policy framework that:
- provides opportunities for expanding bilateral agreements
- enhances fifth freedom rights
- promotes open skies
- addresses concerns about airport rent
- facilitates regional and local airport funding

Developing this framework requires Canada to take a more aggressive role in negotiating with countries that represent potential new and expanding markets, especially the Asia-Pacific markets.

Federal air policies are currently constraining British Columbia’s ability to generate economic wealth. Only 40% of Canada’s bilateral air service agreements allow foreign carriers’ access to Vancouver International Airport (YVR), as compared to 75% for Toronto and 90% for Montreal. Increased and improved access is required to existing and new global markets.

Air policies should adopt a balanced approach by considering the impact on all parties: Canadian air carriers, tourism, cargo, business and community interests to determine the net economic impact for Canada. Protectionism in any form hinders consumer choice, competition and pursuit of growth potential. The benefits of liberalization are evident.
Bilateral Agreements

In 2004, the US and China signed a new and comprehensive air service agreement. Failing a similar or more liberal agreement between Canada and China, the future non-stop capacity from YVR will be significantly impacted. Canada’s air treaty with China has remained largely unchanged since 1997 and is capacity constrained. In recent months Canada has requested air talks with China with the intent of liberalizing its agreement. **British Columbia urges the federal government to aggressively pursue this initiative together with continuing to seek Approved Destination Status for Canada with the Chinese government.**

A major focus for YVR has been the development of air cargo linkages with China. The existing bilateral provides for an all-cargo route schedule, though with capacity and fifth freedom limitations. YVR is actively soliciting a Chinese all-cargo carrier to locate its operations in Vancouver. **In the event that the planned air negotiations with China are delayed, and that the planned service is outside the existing entitlements, British Columbia would request the federal government give favourable consideration of the additional traffic rights on an extra bilateral basis.**

In early 2004, British Columbia had the opportunity have Air Tahiti Nui, a designated carrier of France, operate a scheduled French Polynesia – YVR – Paris service. This was to replace some of the airline’s existing service via Los Angeles. Both YVR and British Columbia had strongly supported such a service on an extra bilateral basis or through other mechanisms. The federal government appears to be unwilling to detach this request from the broader and complex Canada – France bilateral issues. Since that time, Air Tahiti Nui has renewed its focus on Los Angeles to the detriment of Vancouver. Lack of progress on this issue also ensures that British Columbia’s largest unserved European market, Paris, will remain without a direct service. **Air Tahiti Nui is still interested in service through YVR; British Columbia urges the federal government to revisit this request.**

Fifth Freedom Rights

The Canada – Malaysia air service agreement offers the designated carrier of Malaysia the ability to operate twice per week between Kuala Lumpur and Vancouver via Taipei but with no fifth freedom entitlement. As evidenced in 1998, this arrangement is of no commercial value. Malaysia has advised YVR that if it can secure daily capacity with Taipei for fifth freedom rights, it will re-enter the Vancouver market. The Canada – Taiwan market is not currently served by a Canadian airline. **British Columbia urges that the federal government provide the necessary rights to Malaysia thereby resulting in much needed capacity between Canada and Taiwan and a direct daily service to Malaysia.**

Open Skies

The current “Open Transborder” agreement is approaching its 10th anniversary. While this agreement successfully demonstrated the benefits of liberalization it still falls short of what the U.S. defines as an “Open Skies” agreement. **British Columbia strongly supports that Canada pursue a true “Open Skies” agreement with the U.S. resulting in open fifth freedom rights.** Air Canada has also been supportive of re-opening this agreement under the auspices of their “Open Skies Plus” initiative. **The desirability and benefits of a common North American aviation market could also be explored.**

Airport Rent

**Changes to the policies affecting the level of airport rent are critical for the short term.** The federal government’s own analyses conclude that the costs of rent are too high, that anomalies exist and that there are differences in sizes of airports and their ability to pay. High federal airport rents have a negative impact on airport competitiveness. They adversely impact the health of the Canadian airline sector as airports are forced to recoup the costs from both airlines and consumers.

- Annual rent payment for Vancouver International Airport is the single biggest cost of operating the airport, taking away 25% of airport revenues. At YVR, about 50% of the rent payment is directly derived from the air carriers.

Victoria and Vancouver airports pay rent that is excessive, relative to other NAS airports and relative to their capacity to pay. Victoria Airport’s $1 million...
annual rent payment far exceeds that paid by other Canadian airports of similar size. YVR is the only airport without a cap on its rent payment. The rent charge at YVR on a per passenger basis exceeds all other airports except Toronto. In 2004, YVR’s rent will increase by $6 million to $72 million. If policy changes are not implemented, our airports will continue to struggle to maintain their competitive position.

Marine Policy

Canada must move quickly to establish the proper investment climate to meet the competitive pressures and opportunities that Canada’s Pacific Gateway marine facilities are facing. These pressures are directly related to the unprecedented growth in containerized traffic between China and other Asia Pacific countries and North America, and to the voracious appetite of the Chinese economy for our resource industry products. US west coast ports are actively pursuing these markets and expanding their capacity. Canada has the potential to increase its 9% current market share of west coast container traffic to 17% by 2020, increasing from 1.8 million TEU to 8.3 million TEU.

British Columbia’s Ports Strategy, which will be released soon, shows that capturing opportunities will have significant economic benefits to both British Columbia and Canada. In dollar terms, British Columbia’s ports currently contribute approximately $4 billion in annual direct economic output to the Canadian economy. By capturing the trade opportunities presented by the Asia-Pacific market, by 2020 this contribution could grow to approximately $10.5 billion in direct economic output for Canada.

To respond to this growth opportunity, more than $1.5 billion in container terminal developments are being planned in British Columbia. The Port of Vancouver requires at least one major container terminal project by 2010. At Fraser Port, current demand exceeds capacity. The proposed new terminal at Prince Rupert will add 1.2 million TEU by 2009.

The federal government has an opportunity to support this growth potential through effective policy changes, most notably immediate changes to the Canada Marine Act. Port authorities require increased financial flexibility to acquire the market financing they need to fund facility expansion.

Governments must work together on a “made-in-British Columbia ports system competitiveness policy” that addresses a range of issues related to competitiveness such as: taxation/stipend levels, private sector investment incentives, infrastructure financing options, and management of lands around and upland from the ports for port use. British Columbia, through a property taxation initiative for port terminal operators and through the ongoing development of a British Columbia Ports Strategy, has already done a considerable amount of work on this issue and will continue to discuss this matter with federal officials.

Ports must be eligible to receive direct federal financial support for strategic investments that are in the national interest. This is particularly important for the Port of Prince Rupert, which is currently seeking $40 million from the federal government towards the containerization of Fairview Terminal. British Columbia has already committed $17.2 million to the project and views this initiative as critical given the potential impacts for economic development of the northern corridor across Western Canada. Reduction or elimination of the annual federal charge on gross revenues, or stipend, also should be implemented where those revenues can be directed to projects of national significance.

Rail Policy

Railway traffic volumes are experiencing unprecedented growth for all commodities and in all areas of British Columbia and across Western Canada. This growth is at a time when rail infrastructure is reaching operating capacity, particularly in the Calgary–Vancouver Corridor. This situation is causing a substantial economic concern for British Columbia and Western Canada, with congestion at the Port of Vancouver, delays in moving cargo in a timely manner, and additional costs and penalties to both exporters and importers.

Increasing railway operational capacity will require significant infrastructure investment by Class 1 Railways. Lack of certainty on key policy issues, such as running rights, is a deterrent to commit further long-term, capital infrastructure investment to, for example, the Calgary–Vancouver Corridor.

British Columbia’s immediate concerns include the inability of railways to handle projected growth over the next five years, the potential for the loss of exports, job loss in Western Canada, and maintaining
our credibility in the world marketplace. The lack of certainty on the resolution of this federal transportation policy matter is causing much needed rail capacity investments in Western Canada, all of which support the growth of Canada’s Pacific Gateway, to be deferred.

Strategic infrastructure investment priorities

Significant infrastructure investment is necessary to make Canada’s Pacific Gateway the most competitive trade hub on the North American west coast. Following are the key priorities:

Kicking Horse Canyon

The Kicking Horse Canyon Project’s proposed improvements to the Trans-Canada Highway will deliver long overdue upgrades to this important national trade corridor. Safety and operating improvements will assist Canada in reinforcing this strategic link to our country’s western economic gateways. Improvement in this corridor will address regional and inter-provincial economic development as it compliments investments in Canada’s transportation infrastructure.

The project involves upgrading approximately 26 kilometers of the Trans-Canada Highway between the Town of Golden and Yoho National Park to a modern four-lane standard. Revitalizing this portion of the national highway system is critical to strengthening the Province of British Columbia as Canada’s gateway to the world and is the province’s number one transportation priority. Project components include:

- Replacement of the Yoho, Park and Mount Hunter Bridges with realigned four-lane structures to address structural condition, safety and traffic operations concerns.
- 25 kilometers of highway alignment improvements to reduce grades and curvature to improve safety and meet a 100 km/h design speed.
- Improvements to reduce rock fall hazard and address wildlife crossing concerns.

Considering the current traffic demands for both freight and passenger movement, the existing highway through the canyon is a weak link in the national highway system. It has limited passing opportunities, inadequate climbing lanes, narrow travel lanes, steep grades (extended sections of 7%), and extremely poor alignment with posted advisory speed zones between 40 and 60 km/h.

The corridor has a very poor safety history with accident rates, especially in the vicinity of the Yoho and Park bridges, 2.3 times the expected rate for this type of facility.

Trans-Canada Highway following the Kicking Horse River.

Narrow two lane winding alignment makes it difficult to clear accidents and rock fall events, resulting in extended lane and road closures and long queues forming on the highway that can take many hours to dissipate.

This corridor rates as one of the highest rock fall hazard areas in the province. Weather conditions combine with highway alignment to create significant seasonal safety concerns.

The absence of shoulders in many segments is problematic for recreational cyclists.

The average annual daily traffic for this section is approximately 4800 vehicles per day. There is a large seasonal fluctuation in the summer with traffic growing to 9400 vehicles per day.

- 18 percent of the traffic through the Kicking Horse Canyon is heavy vehicles, significantly higher than the provincial average of 12 percent.

The Kicking Horse Canyon highway improvements will have a substantial beneficial impact on the provincial and national economy. The economic
benefits of the project include government revenues, GDP and employment impacts.

**Capital costs, excluding the cost of land, are estimated at $730 million.** Investing the $730 million on this project could yield the province up to an additional $365 million in indirect economic impacts and $292 million in induced economic impacts.

The project is expected to generate $208 million in direct and indirect government revenues and $33 million in induced revenues. Broken down by level of government the expected revenues are:

- $130 million in federal revenues;
- $98 million in provincial revenues; and
- $13 million in municipal or regional revenues.

The project will also generate substantial employment during the construction period:

- 6,190 person-years of direct employment;
- 2,942 person-years of indirect employment; and
- 2,825 person-years of induced employment.

Work is presently underway in the corridor. Canada and the Province of British Columbia are jointly investing in the upgrade to the Yoho (5 Mile) Bridge under a $122.4 million SHIP agreement. This will be complimented by the previously announced federal contribution of $62.5 million under CSIF toward the replacement of Park Bridge under a P3 delivery model.

### Pitt River Bridge

The Pitt River Bridge is an integral component of the North Fraser Perimeter Road Project which is a set of proposed improvements to existing roads along the north shore of the Fraser River, providing an efficient, continuous route from New Westminster to Maple Ridge.

Given its strategic location at the heart of the Lower Mainland’s northeast sector, the Pitt River crossing is a critical component of the region’s transportation network. The North Fraser Perimeter Road is crucial to goods movement in the region, between Greater Vancouver’s key economic gateways and growing municipalities in the northeast sector. The corridor’s lack of reliability, primarily related to the existing swing bridges crossing the Pitt River, has acted as a significant obstacle to economic development in Maple Ridge and Pitt Meadows.

The project will provide significant improvement in the level of service. There are industrial and commercial land uses adjacent to the corridor over much of its length, in addition to a myriad of other goods movement origins and destinations that are served by segments of the corridor. With connections to Highways 1, 15, 7, 9 and 151, and TransLink’s Golden Ears Bridge, the route will take a significant step towards completing the network of major roads in Greater Vancouver. **This $400 million project, which includes the Pitt River Bridge and the North Fraser Perimeter Road, has broad-based community and industry support.**

With its strategic location along the north shore of the Fraser River, the North Fraser Perimeter Road is an important route for truck freight traffic as well as commuter traffic. Both marine and highway traffic will benefit significantly through the increase in reliability which will be gained when the two existing swing bridges are replaced with a new $150 million high level, six-lane, fixed link across the Pitt River.

As an integral component of the North Fraser Perimeter Road East segments, the Pitt River Bridge will link communities in the Northeast sector of the region with the Burrard Peninsula, and communities south of the Fraser River via the North Fraser Perimeter Road West Corridor. These links support key employment centres such as the Pacific Reach and Mayfair Industrial Parks in Coquitlam, the Mary Hill Industrial Park, CP Rail facilities in Port Coquitlam and the CPR Intermodal Facility in Pitt Meadows.

The North Fraser Perimeter Road presents an opportunity to improve the competitiveness of the region’s integrated intermodal freight system. The route is viewed as essential to the expansion of the containerized freight industry in the Lower Mainland and to expansion of the freight-dependent industries that have clustered in proximity to the primary gateway facilities.

Without the Pitt River Bridge and, in fact, without the entire North Fraser Perimeter Road, the growth potential of the Lower Mainland will be compromised, and simultaneously the volumes of freight-related truck traffic will continue to operate at low speeds on congested roads, resulting in serious economic, road safety, environmental, and social impacts, and shift in container traffic to our U.S competitors. By constructing the North Fraser Perimeter Road, the...
growth potential of the region can be improved, ultimately, having an enduring beneficial impact on Canada’s competitiveness as a trading nation.

The North Fraser Perimeter Road will have a beneficial impact on the provincial and national economy. The economic benefits of the project include government revenues, GDP and employment impacts.

The entire project is expected to generate $63 million in direct and indirect government revenues and $8 million in induced revenues. Broken down by level of government the expected revenues are:

- $40 million in federal revenues;
- $29 million in provincial revenues; and
- $2 million in municipal revenues.

The project is also expected to generate an additional $145 million in GDP (including direct, indirect and induced impacts).

The project will also generate substantial employment during the construction period:

- 1,300 person-years of direct employment;
- 700 person-years of indirect employment; and
- 500 person-years of induced employment.

The North Fraser Perimeter Road will improve the reliability and connectivity of the Lower Mainland’s transportation system with specific focus on the movement of containerized freight, goods and people. The planned improvements, including a reliable new Pitt River crossing, will support the corridor as an integrated hub for the freight industry and facilitate the continued strong development and growth of the northeast sector of the Lower Mainland.

Port Mann/Highway 1

The Port Mann/Highway 1 Project is a key component of an integrated network of road and bridge improvements proposed for British Columbia’s Lower Mainland to improve economic competitiveness by promoting efficient, reliable and safe movement of goods, services and people. The strategic location of the Highway 1 corridor as the primary east-west transportation route makes it extremely important to the economy of the region. Highway 1 serves to connect many of the major municipalities from the Burrard Peninsula to the Fraser Valley and beyond to the entire nation. As part of the Trans Canada Highway, it remains an integral component of the regional and provincial economic engine. It also serves as a critical link between major arterials and regional highways.

The $1.4 billion project includes twinning the Port Mann Bridge and improving access and safety on Highway 1 from Vancouver to Langley to provide eight core lanes over most of the route.

The Port Mann Bridge carries an estimated 10,000 trucks a day, in addition to 117,000 other vehicles.

Highway 1 is the busiest and most economically critical route for both commercial and recreational traffic. It is the most heavily traveled truck route in Western Canada; the Port Mann Bridge carries an estimated 10,000 trucks per day, in addition to 117,000 other vehicles. It introduces visitors to the Pacific coast, providing access to Whistler via Highway 99 and to Vancouver Island through the Horseshoe Bay ferry terminal.

This critical link is at risk due to increased congestion. Capacity improvements will facilitate the more efficient movement of goods and services to key regional areas, such as the North Shore and Vancouver Port Authority’s Burrard Inlet facilities, plus access to the Canada-U.S. border to facilitate growing north/south trade. Capacity improvements would also allow for the extension of High Occupancy Vehicle (HOV) lanes or the introduction of other special purpose facilities, such as truck priority lanes. The Port Mann/Highway 1 improvements will increase efficiency and reliability of both short and long haul access to the Port of Vancouver, North Shore rail facilities, and intermodal terminals, as well as improve access to the Sea-to-Sky highway to Whistler.

Congestion will place a growing drag on economic development potential.

The Port Mann/Highway 1 project will have a beneficial impact on the provincial and national transportation gateway.
The economic benefits of the project include government revenues, GDP and employment impacts.

- Transport Canada currently estimates that the cost of congestion delays in the region is up to $1.5 billion annually, $500 million of which are borne by British Columbia Trucking Association members.
- Currently the Port Mann Bridge is near or at capacity 12 to 14 hours a day. The typical morning queue east of Port Mann extends for between eight and 10 kilometres, and the average trip from Langley City to the Port of Vancouver takes 60 minutes, or close to twice what it would under free-flowing conditions.
- Projected travel time savings to 2031 of between 55 and 85 per cent, depending on trip length. This travel time saving is based on relieving congestion and managing demand through tolls and/or other methods.

The project is expected to generate $320 million in direct and indirect government revenues and $45 million in induced revenues. Broken down by level of government the expected revenues are:
- $200 million in federal revenues;
- $145 million in provincial revenues; and
- $20 million in municipal revenues.

The project is also expected to generate an additional $875 million in GDP (including direct, indirect and induced impacts).

The project will also generate substantial employment during the construction period:
- 7,500 person-years of direct employment;
- 4,300 person–years of indirect employment; and
- 2,500 person-years of induced employment.

Without the Port Mann/Highway 1 project, the growth potential of the Lower Mainland ports will be compromised, and simultaneously the volumes of freight-related and other types of truck traffic will continue to operate at low speeds on this heavily congested corridor, resulting in significant economic loss as export traffic shifts to U.S competitors. By improving the Port Mann/Highway 1 corridor, the growth potential of the region can be realized, ultimately, having an enduring beneficial impact on Canada’s competitiveness as a trading nation, and on our economic relations with the Pacific Rim.

**South Fraser Perimeter Road**

The South Fraser Perimeter Road Project is planned as a primarily new four-lane, high-standard transportation corridor along the south shore of the Fraser River through the municipalities of Surrey and Delta (40 km). It will provide a much-needed continuous and efficient route to serve the multi-billion dollar freight and service industry along this key economic corridor. The project will link key economic gateway facilities such as the Vancouver Port Authority’s Deltaport and planned new Roberts Bank container terminals, Vancouver International Airport, Seaspan, the Fraser River Port Authority’s Fraser Surrey Docks, CN Intermodal yard, Canada/U.S. border crossings, the ferry terminal to Vancouver Island, and numerous industrial areas.

With connections to Highways 1, 15, 91, 99, and 17, and the Greater Vancouver Transportation Authority’s proposed new Fraser River crossing (Golden Ears Bridge), the route will be an essential component of the network of major roads in Greater Vancouver.

This $800 million project is designed to improve the efficiency and capacity of the land-based links that connect the “Gateway facilities,” which comprise the region’s freight system and facilitate the continued strong growth of this sector while reducing its impacts on the region. The South Fraser Perimeter Road has broad-based community and industry support, but has not moved forward to construction due to funding limitations.

The South Fraser Perimeter Road is an ideal route for truck freight traffic. Traffic through this area is presently served by a patchwork provincial highway segments, local arterials and collectors, which provide a partial, fragmented, discontinuous and inefficient route. The project will provide a continuous through corridor along a critical commercial route that sees up to four times the average truck traffic of other primary routes in the Lower Mainland.

The combination of proximity to the Fraser River and adjacent land use makes the South Fraser Perimeter Road extremely well-suited to truck traffic. While it would provide a desirable ability to redistribute traffic between adjacent bridges when incidents require, it is not inherently a high-volume commuter route. Thus, it holds the promise of being readily available for the freight industry without major capacity erosion from competing commuter traffic. In recognizing this
character, the corridor has been identified as a priority for regional and provincial investment for many years.

The project will facilitate improved access to the Vancouver Port Authority’s proposed Roberts Bank container port improvements, support the Fraser River Port Authority’s development plans for Fraser Surrey Docks and the currently underused port lands west of the Alex Fraser Bridge, improve access to the Canada-U.S. border to facilitate growing north/south trade, and help meet municipal employment targets and economic development aspirations for industrial areas such as Tilbury Island in Delta, Bridgeview in Surrey and Port Kells in Surrey/Langley, which are currently underused.

The South Fraser Perimeter Road presents a unique, focused, and strategic opportunity to improve the competitiveness of the region’s integrated intermodal freight system. It is essential to the expansion of the containerized freight industry in the Lower Mainland and to expansion of the freight-dependent industries that have clustered in proximity to the primary gateway facilities.

Without the South Fraser Perimeter Road, the growth potential of the Lower Mainland ports will be compromised, and simultaneously the volumes of freight-related truck traffic will continue to operate at low speeds on congested local roads, resulting in serious economic, road safety, environmental, and social impacts, and a shift in container traffic to U.S. ports. By constructing the South Fraser Perimeter Road, the growth potential of the region can be realized, ultimately, having an enduring beneficial impact on Canada’s competitiveness as a trading nation, and on our economic relations with the Pacific Rim.

The South Fraser Perimeter Road will have a beneficial impact on the provincial and national economy. The economic benefits of the project include government revenues, GDP and employment impacts.

The project is expected to generate $160 million in direct and indirect government revenues and $25 million in induced revenues. Broken down by level of government the expected revenues are:

- $100 million in federal revenues;
- $75 million in provincial revenues; and
- $10 million in municipal revenues.

The project is also expected to generate an additional $445 million in GDP (including direct, indirect and induced impacts).

The project will also generate substantial employment during the construction period:

- 2,200 person–years of indirect employment; and
- 1,300 person-years of induced employment.

Due to the importance in the continued success of the National economy, the province has initiated steps to request that the South Fraser Perimeter Road be designated as part of the National Highway System.

The South Fraser Perimeter Road will have a beneficial impact on the provincial and national economy.

The South Fraser Perimeter Road is a proposed new quantum improvement to the Lower Mainland’s transportation system with a specific focus on the movement of containerized freight and other goods. It will provide dramatically improved functionality and connections that are not currently available. Relatively immune from capacity erosion from commuters, this corridor will dramatically improve the road connections between the region’s key Gateway facilities, and the associated freight-dependent industry which has clustered in the region. It has the ability to improve the efficiency of the region as an integrated hub for the freight industry and to facilitate the continued strong growth of containerized freight through the region and to destinations across Canada.

New Westminster Rail Bridge

The New Westminster Rail Bridge (NWRB) is a 100 year old, single-track swing bridge, which is owned by the Government of Canada but operated and maintained by CN. It carries 46 trains per day and opens 17 times per day for marine traffic. Its navigation clearance is restrictive for most chip barges that pass through, thus requiring openings for most of them. Moreover, the bridge is prone to ship collision due to the narrow openings for marine traffic. Of the
7,000 ship movements under the bridge, there were 60 collisions with the bridge in a 40 year period. Regarding the structural condition of the bridge, the creosote-soaked wooden approach trestles will eventually need to be upgraded on both ends due to fire risk. There is an engineering and safety perspective which is also extremely important. The structural state of the steel truss superstructure is between fair and poor, and the bridge, given its vintage, was not designed to accommodate seismic events.

Railway companies operating in the Lower Mainland, the Port of Vancouver and other port authorities, and the Greater Vancouver Gateway Council are questioning whether the NWRB can accommodate growing future demand. The NWRB is currently operating at almost near capacity, and forecasted traffic growth moving through the Vancouver Gateway will exacerbate rail and port congestion already being experienced. Recent cooperative initiatives by CN and CPR which commenced in Fall 2004 have bought time for what is emerging as a crisis need.

Port of Prince Rupert

Current plans to convert the Fairview Terminal from break bulk to a container terminal represent a major step in allowing the northwest corridor to benefit from the expansion in container traffic. The order of magnitude total cost for developing a container handling facility at Fairview Terminal (Phase 1) is between $140-180 million, with financing provided by the port authority, CN Rail, Maher Terminals, and contributions from the provincial and federal governments. Phase 1 of the expansion is expected to result in $163 million in total annual economic benefits. The container terminal will be the catalyst for the development of a northern Pacific Gateway for Canada and takes advantage of the shortest land-sea trade route, the shortest/fastest sailing time to Asia, the fastest rail connections to the US mid-west, and a natural deep harbour to accommodate the next generation of container vessels.

While the investment by both British Columbia and Canada, through joint-funding partnerships such as the Border Infrastructure Program, Strategic Highway Improvement Fund, Strategic Infrastructure Projects (including Phase 2 of the Kicking Horse Canyon Project) and the Richmond-Airport-Vancouver (RAV) transit line represent a good start, more investment is needed if British Columbia and Canada wish to continue to benefit from our competitive advantages.

Summary

British Columbia's Pacific Gateway facilities and transportation system are strategic national assets that require the same level of interest and investment from the Government of Canada as national assets in other regions of the country, many of which benefit from strategic, federal-provincial bilateral relationships. The Gateway is one of British Columbia's top three priorities for engagement with the federal government.

Canada's international reputation as an attractive Pacific Gateway for future trade and investment depends on the ability of all Gateway partners to address the challenges and opportunities ahead. If Canada and British Columbia do not take action now, the losses will be felt for years to come.

Strategically targeted investment in projects such as the Kicking Horse Canyon, Port Mann/Highway 1, Pitt River Bridge, South Fraser Perimeter Road and the New Westminster Rail Bridge is crucial for British Columbia to optimize its potential as Canada's gateway to the Asia-Pacific. These infrastructure projects, when accompanied by policy changes will enhance Canada's and British Columbia's potential for economic growth.

The objective is clear -- to make Canada's Pacific Gateway the most competitive international trade hub on the North American west coast for the benefit of British Columbia, Western Canada and the entire country. Participation and commitment of the federal government is essential.
The Case for British Columbia’s Mountain Pine Beetle Strategy

A. Mountain Pine Beetle Epidemic

British Columbia is currently experiencing the largest recorded Mountain Pine Beetle outbreak in North America. This forest health epidemic is a catastrophic natural disaster and is causing widespread mortality of lodgepole pine, the B.C. interior’s most abundant commercial tree species. The epidemic threatens the stability and long-term economic well-being of many communities and First Nations, and ultimately the economic health of the province. It has put significant forest values at risk within the province and has started to move eastward, jumping the Rocky Mountain barrier. The issue is of national importance in terms of sustainable forest management, Kyoto Accord commitments and has international trade implications. This major natural disaster urgently requires the concerted, co-operative efforts of both the federal and provincial governments.

The province’s total inventory of lodgepole pine is approximately 1 billion cubic meters on 12 million hectares of forestland. Mountain Pine Beetles have reached epidemic levels several times over the last century in British Columbia, however past outbreaks were generally confined to limited geographic areas and were typically extinguished by cold weather events. The current beetle epidemic now includes, to a greater or lesser extent, the entire area of pine forest (12 million hectares) in the central and southern interior of British Columbia and has killed approximately 280 million cubic meters of pine trees (4 times the entire annual timber harvest in the province). Infestations are now appearing in the Peace River Region and threaten to move eastward across Canada.

Only an extended period of extremely cold weather (e.g. -40°C) throughout the affected area can stop the epidemic. Provincial and federal scientists suggest that the epidemic is so large it is unlikely that the province would ever experience a cold weather event widespread enough to stop the infestation. It is likely the epidemic will not end until all the mature pine in British Columbia is affected. The Ministry of Forests predicts that at the current rate of spread, 50% of the mature pine will be dead by 2008 and 80% by 2013.

B. Importance of Forestry to British Columbia

The forest sector is the primary driver of the British Columbia economy, accounting for 50 percent of British Columbia’s export revenue and 22 percent of total provincial employment.

About 25%-30% of the province’s entire timber harvesting land base are pine forests. In a large portion of the B.C. interior regions, pine forests makes up over 50% of the harvestable timber. Of the province’s 63 regional economic areas, 41% rely on forestry as their principal source of income. Within the epidemic areas, the forest sector accounts for at least 30% of direct and indirect income, and in some cases it is considerably higher.

In the short term, the epidemic could create an increase in economic activity in the epidemic areas as...
the timber harvest levels are increased to utilize dead pine trees before they lose their commercial value. The dead trees have an estimated shelf life of somewhere between 5 and 15 years depending on their location, climatic conditions and eventual use. This short-term surplus of harvestable fibre will be followed by a significant reduction in the allowable annual cut (AAC) as the epidemic runs its course and dead trees reach the end of their economic usefulness. The projected harvest in the epidemic areas is expected to suffer a 33% reduction from pre-epidemic harvest levels. The impact of the reduced harvest will be evident in significant layoffs, mill closures and a significant depression of the economy of the area and British Columbia as a whole. The future reduction in harvest levels presents a very significant challenge to affected communities and the province.

Over 30 communities in the epidemic area, bounded by McKenzie in the North, Anaheim Lake in the West, Kamloops in the South and McBride in the East, will be significantly affected by the downfall in AAC. As a result, these communities will be forced to undergo major transition (see attachment 1). Other communities in the south central part of the province and the Kootenay region are also expected to be hit hard by the impact of the beetle epidemic. Other economic drivers in the area such as tourism, hunting, fishing, camping, backcountry and skiing will also be severely affected as they are not viable operations in the sea of dead snags left behind by the beetle.

The scale and magnitude of the MPB infestation threatens many of Canada’s and British Columbia’s commitments under the umbrella of Sustainable Forest Management including, but not limited to:

- National Biodiversity Strategy;
- Canada Forest Accord;
- Species at Risk Act.; and,
- Kyoto Accord -- Canada’s commitments for 2008 to 2012.

Mitigating the impacts of the epidemic goes well beyond normal forestry activities or the capabilities of the forest industry or local communities. Given the scope of the epidemic and the impending impact on communities and individuals, there is a public expectation that senior governments are actively working to mitigate both the biological/environmental and socio-economic impacts of the epidemic.

Implementation of the strategy and key actions outlined below will require a concerted effort of all parties, including co-operation and resources from the federal government.

C. The Mountain Pine Beetle Strategy – Key Initiatives

The province and the forest industry are focusing timber management efforts in the epidemic area as follows:

- harvesting the leading edge of the infestation;
- redirecting harvest from green timber to beetle-damaged wood;
- developing new tenure opportunities (targeted at alternatives to conventional lumber) to harvest beetle-damaged wood;
- increasing the allowable annual cut in the epidemic areas; and,
- implementing forest health treatments, including prescribed burns, tree removal, and falling/burning beetle-infested trees.
The intent in the short term is to address this epidemic in a manner that captures the best value of beetle-killed forests while respecting the other forest values and objectives identified in land use plans. Equally important is to begin implementing measures that will help communities deal with the mid to long-term economic and social impacts.

Despite these efforts, and due to the current economic conditions, absorptive capacity of the market and limited time frame, there will remain a significant amount of killed forests that will not be harvested, and therefore not reforested by the forest industry as required by British Columbia law after harvest. This will result in decreased future timber volumes, decreased employment in the forestry sector, a significant reduction in carbon sequestration, an increased likelihood of Canada not meeting its Kyoto commitments, and an increase in fire hazard and fuel loading from dead stands. On these non-harvested areas, government must put in place a program to maintain and restore productivity in a manner that reduces the risk of future losses.

1. Reforestation/AAC Mitigation

Of the beetle-killed forests that are not harvested and planted by the forest industry, most of the land will be left to reforest naturally. Natural regeneration of the forests is the preferred method of reforestation for less productive sites. However, for the higher quality sites, planting is the preferred method of reforestation. On these sites, compared to naturally regenerated forests, planted and managed forests can be brought to harvest size 7 to 20 years earlier with timber volumes improved by as much as 40 percent. In addition, strategic silvicultural investment in healthy immature forests can significantly mitigate the anticipated future shortfalls in timber supply by making these stands merchantable earlier and of higher value.

Other benefits to an aggressive reforestation and silviculture program include environmental considerations. These include protection of soil from erosion, restoration of habitat for endangered species and fisheries, and prevention of damage to streams, watersheds and water quality. Site preparation for planting will help mitigate increased fire threat to communities and other forest values. Accelerated growth rates in managed stands will also boost carbon sequestration and help to offset the release of carbon into the atmosphere from the decay of beetle killed trees that has effectively turned British Columbia from a carbon sink into a source, and threatens Canada’s commitment to the Kyoto accord.

To respond to the pressures placed on the environment and the economy by the Mountain Pine Beetle epidemic, the governments of Canada and of British Columbia need to implement a strategy for rehabilitating the damage. This strategy should include a two pronged approach to protect the environment and accelerate the regrowth of the pine forest areas by:

- Reforesting the best and most accessible sites not already being replaced by industry; and,
- Mitigating timber supply shortfalls through strategic silvicultural investments in immature forests that have escaped the Mountain Pine Beetle.

Reforestation

Provisional estimates of the area of beetle-killed forestland providing opportunity for planting range from 348,000 hectares today to over 800,000 hectares by 2013. This proposal targets a mid point of 500,000 hectares for reforestation activities that would include a
wide range of treatments aimed at working with nature to speed the reforestation of damaged sites. Treatments would include among others:

- Spacing of natural regeneration to ensure free growing forests at minimal cost;
- Brushing natural and planted sites to ensure young trees are free from competition;
- Planting of better quality sites with superior seedlings and species to enhance growth; and,
- Surveying of natural and planted areas to confirm success.

The estimated cost of reforestation based on this plan is $700 million over a 10-year period (although the actual work may take significantly longer to complete). A significant planting program will:

- Restore timber and ecosystem productivity of the land;
- Provide employment and strengthen community stability;
- Support the highest possible harvest levels over the mid- to long-term;
- Mitigate increased fire threat (through site preparation) to communities and other forest values;
- Rehabilitate the land for biodiversity, stabilise hydraulic regimes, reduce soil erosion; and,
- Increase carbon sequestration from the atmosphere to improve air quality and help meet Canada’s Kyoto commitment.

 Timber Supply Shortfall Mitigation

Provisional estimates of the area of healthy forests providing opportunity for mitigating timber supply shortfalls through strategic silvicultural investments range from 410,000 to over 500,000 hectares over 10 years.

Silvicultural investments to accelerate tree growth include:

- Brushing of existing plantations to improve growth;
- Fertilisation of growing stands to speed their development and increase merchantable volume;
- Spacing of young stands to make them available for harvesting sooner; and,
- Commercial thinning of suitable stands to allow an earlier harvest from younger stands.

The estimated cost of AAC mitigation activities based on this plan is $254 million over a 10-year period.

A significant investment program in mitigation treatments will:

- Increase timber productivity of the land beyond that achieved through natural regeneration or planting alone;
- Considerably enhance community employment and stability;
- Bring forward timber volume for harvesting sooner and mitigate the anticipated reduction in harvest in the 30 to 60 year period;
- Improve habitat, biodiversity and forest values such as visual quality and recreation; and,
- Accelerate carbon sequestration through accelerated growth rates..

A commitment to long term funding for these strategic silvicultural investments will maintain and restore forest productivity in a manner that reduces the risk of current future losses to the beetle epidemic and moves forward on Canada’s commitments for sustainable forest management. A total commitment of $954 million over a 10 year period ($95.4 million/year) is required to undertake both the reforestation and timber supply mitigation activities required on those areas affected by the Mountain Pine Beetle that are not harvested.
2. Community Stability

The province is working with forest dependent communities affected by the Mountain Pine Beetle epidemic to prepare for the economic, social and environmental consequences of the decrease in the timber supply projected to occur in 5 to 15 years. It is expected that these communities will be looking to senior governments for financial assistance to help with the inevitable adjustments that will be required.

The range of preparedness varies significantly from community to community. Larger centres like Prince George have well-developed economic development functions and are much better able to respond to change and opportunity. Other smaller rural communities and Regional Districts do not have significant economic development expertise or capacity in house. As a result they are unable to respond to significant changes like those being brought by the Mountain Pine Beetle epidemic. While the actual activities pursued will be community and region dependent it is expected that many communities will be requesting assistance for various activities including, marketing advice, feasibility studies, and economic research such as SWOT analysis and establishing baseline economic data. In addition, there may be requests for assistance in providing infrastructure related to project specific economic development opportunities. For example, this could include the cost sharing of the expansion of municipal services to facilitate the development of a new cogeneration plant, or mill.

Currently, the federal government does make some funding available for these types of activities through Community Futures Development Corp and through Western Economic Diversification. Programs include the Softwood Community Economic Adjustment Initiative, BC Canada Infrastructure Program, Western Economic Partnerships Agreement. However these programs are inadequate to meet the projected needs relating to the beetle epidemic. The Canada/BC Infrastructure Program has been fully allocated and projects funded under the Softwood Community Economic Adjustment Initiative must be complete by March 31, 2005. While the Western Economic Partnerships Agreement will be helpful it is limited to offers of $20 million in matching funding to be used over the whole province including the larger urban centres of Vancouver and Victoria. In addition all Western Economic Partnerships Agreement applications for funding must be received by March 31, 2008.

3. Innovative Forest Products and Science-Based Adaptive Management

B.C. Life Sciences Forest Sector Research Cluster proposal contains a forest health initiative that addresses fundamental science questions associated with the Mountain Pine Beetle infestation e.g. genetic structure, behaviour and dispersal of beetles, how to maintain genetic diversity, and impacts on ecosystems. The life sciences offer exciting opportunities to advance our basic understanding of underlying biological mechanisms and systems.

However, there are immediate practical realities of designing and implementing large-scale forest treatments, and adapting conventional wood processing systems to deal with the different characteristics of MPB-killed wood. This requires targeted applied research, science-based adaptive management and monitoring, synthesis and extension of available scientific and technical knowledge, which is designed and implemented as a partnership between applied science organisations and science users in government and industry. The life sciences research will be entirely complementary with this work.

The rehabilitation of large-scale Mountain Pine Beetle disturbed areas has never before been contemplated at such large scales. Best practices need
to be developed based on available knowledge, and implemented with an adaptive management framework, that will allow for a scientifically-based monitoring and evaluation, followed by refinement of best practices and continuous improvement. Development of these monitoring protocols, development and testing of indicators, establishment of benchmark testing areas, modelling alternative treatment prescriptions, and directed research are some of the many activities that need to be undertaken to ensure that the overall reforestation program is science-based. Funding will also include sufficient knowledge synthesis work, and development of extension products for field practitioners in government and industry.

From the standpoint of wood utilization, MPB wood can be considered as a new type of wood due to its dryness, brittleness, high permeability, high resin acid content and lower bondability with water-based adhesives. These characteristics all have implications as they relate to the future uses of this fibre for finger-jointed lumber, plywood, oriented strand board, particleboard, pulp and other forest products. Clearly focussed research is needed to address these significant challenges to conventional wood utilisation.

Product diversification is also needed to avoid market overload and to make full use of available wood fibre. This includes partnering with organisations that create research networks and partnerships, such as Biocap, to undertake targeted research and pilot testing of innovative approaches to MPB wood utilisation in British Columbia (e.g. development of bio-fuels and other bio-products, and the associated fibre gathering and transportation systems).

Natural Resources Canada’s Mountain Pine Beetle Initiative research program is expected to only partially meet the expected needs for technology and new knowledge.

All work in this section will be approached using a collaborative, goal-driven model that will attract teams of the best available science and innovation talent from government, industry, institutes, academe and other groups.

A commitment of $5 million/year for ten years is necessary to provide the necessary adaptive management and product diversification tools to assist in responding to the impact of the beetle epidemic.

Communities that are in the immediate path of the Mountain Pine Beetle:

1. Smithers
2. Telkwa
3. Houston
4. Burns Lake
5. Vanderhoof
6. Fraser Lake
7. Endako
8. Fort St. James
9. MacKenzie
10. Bear Lake
11. McLeod Lake
12. Nazko
13. Isle Pierre
14. Prince George
15. Hixon
16. Strathnaver
17. Quesnel
18. Wells/Barkerville
19. McBride
20. Valemount
21. 100 Mile House
22. Lac La Hache
23. Marguerite
24. Likely
25. Horsefly
26. Lone Butte
27. Canim Lake
28. Redstone
29. Tatla Lake
30. Nimpo Lake
31. Anaheim Lake
32. Ashcroft
33. Kamloops

Other communities that are in the medium to long-range path of the pine beetle are located in the Peace River, Thompson Okanagan, and the Kootenay Districts.
Proposal for a Federal-Provincial Fish Agency

1. Background

Fisheries management directly affects the magnitude and distribution of fishery benefits to British Columbians and the overall performance of the British Columbia economy.

Constitutionally, natural resources are a provincial responsibility but fisheries are a federal responsibility. However, regulation of freshwater fishing has historically been delegated to the province. The federal government manages all fisheries in the ocean and they manage salmon and salmon habitat in fresh water. Increasingly, federal fisheries officers are involving themselves in management issues involving other freshwater species. This often means both levels of government review proposals or activities involving fish, fish habitat or water use.

The New Era direction commits the province to “Push for provincial control over the management and revenues of British Columbia’s offshore fisheries, to improve fisheries management and protect fishery jobs.” Subsequent provincial Cabinet direction to the Ministry of Agriculture, Food and Fisheries and the Intergovernmental Relations Secretariat was to actively seek effective influence over the Pacific fishery through negotiation of an interest-based joint decision-making fisheries structure. The Premier has confirmed British Columbia is searching for institutional, not constitutional reform.

British Columbia attempted to begin dialogue with the Department of Fisheries & Oceans (DFO) via a July 19, 2002 letter from Ministers Van Dongen and Halsey-Brandt to federal Ministers Dion and Thibault. The letter outlined principles that would form the basis of a joint policy framework to guide future fisheries decisions. Those preliminary communications failed to materialize into a lasting interest-based dialogue process.

As a first step towards the goal of achieving such a joint-decision making structure, Canada and British Columbia negotiated a Pacific Council of Fisheries & Aquaculture Ministers (PCFAM) to strengthen cooperation and coordination on fisheries matters. The council provides a forum for dialogue from which a new relationship can emerge.

Both Canada and British Columbia will benefit from better decisions and a partnership approach to fisheries decision-making. An effective new institutional arrangement will improve this decision-making, deliver on recent federal commitments for enhanced federal-provincial relations, and cultivate a more positive public image. A new federal/provincial fisheries management arrangement would directly contribute to the Prime Minister’s stated objective to address ‘western alienation’.

DFO is currently undergoing a comprehensive program review that is expected to have significant budgetary and structural alignment implications. This review process offers a unique opportunity for the department to consider new approaches to how it delivers its mandate.

Our long, natural ocean coastline provides access to a range of marine resources and a near-shore ocean environment that supports our economy through recreation opportunities, fishing and aquaculture. Recently, the province has begun to look at exploiting the potential for offshore oil and gas. Staff are working with the federal government on some marine parks proposals and there is an Oceans MOU with the federal government. However, it is vital that the province be able to advance its interests and objectives with the federal government in a coordinated and structured manner.

Freshwater resources are experiencing increasing development pressure. Industrial and agricultural water users often compete for scarce supplies while those with historic entitlements cannot justify their allocation in today’s world. Aquatic ecosystems are continually challenged with less water, contaminated water, loss of nutrients, shade and filtration from loss of riparian vegetation, damage to fish habitat, and the threats posed by increasing temperatures.

Public policy must recognize the importance of water resources, effectively manage competing demands to use the resources, and ensure that water use contributes to sustainable economic development while
conserving and protecting the natural environment of British Columbia and ensuring the survival and growth of the fishery, both in the ocean and in freshwater.

The public expects the federal and provincial governments to cooperate in delivering the optimum benefits from the oceans, fresh water and the fishery these resources support. Ultimately, both governments must account to the same people: the citizens of British Columbia.

This paper looks at a new approach to management of the oceans, fish habitat and the fisheries of British Columbia by proposing a joint federal-provincial agency to discharge this responsibility.

2. Process

The substance of the work of the agency will follow in the next sections. First however, this paper outlines the process that will be necessary to create such an agency.

Step 1.
The Premier and the Prime Minister sign an agreement that sets the process in motion and lays out the steps to create the new approach to fisheries management.

Step 2.
The Pacific Council of Fisheries & Aquaculture Ministers develops a charter that sets out the scope and duties of the Agency.

Step 3.
Concurrent with Step 2, the Ministers choose a Chief Executive Officer to head the new Agency. This CEO hires a small union-excluded executive staff and begins discussions with the Unions and the various Public Service Agencies to create the conditions for transferring staff from provincial ministries and federal departments to the new Agency. These discussions will also inform the process of drafting enabling legislation.

Step 4.
Each government enacts legislation authorizing the Agency, creating the authority for it, and delegating powers to it.

Step 5.
Staff are transferred and the Agency is created.

3. Federal/Provincial Agreement

The agreement signed by the Premier and the Prime Minister could contain the following commitments:

- Canada and British Columbia confirm that we share common interests with respect to the management of the Pacific Ocean and the rivers and streams of British Columbia. This includes the desire to have a vibrant Pacific fishery and healthy rivers and streams in order to maximize economic opportunities, cost effective management regimes that provide opportunities for stakeholder involvement in decision-making, and fishery revenues flowing to the Crown.
- Canada and British Columbia confirm a mutual interest to work together to effectively address fisheries management interests.
- Canada and British Columbia confirm that achieving an effective joint-decision making structure and a joint management structure is the most cost-effective and efficient way to provide value to taxpayers and citizens.
- Canada and British Columbia recognize that effective fishery management requires effective habitat management and this can best be achieved by managing the use of fresh water and the ocean to optimize the mix of fisheries habitat protection and a wide range of other uses that are made of fresh water and the ocean.
- Canada and British Columbia agree to create a new Crown agency to manage fish, fish habitat, and the ocean on behalf of both levels of government.

4. The Charter

The Pacific Council of Fisheries & Aquaculture Ministers could be assigned the task of developing a charter that sets out the scope and duties of the Agency. Discussions of the design and funding for the new Agency should be guided by an agreed-to mandate and principles. These would inform future bilateral meetings of Ministers leading to the development of a formal joint Charter describing the institutional arrangement for fisheries management. This Charter would be the public document that describes the Agency and would also be the document that informs the legislative process whereby the legal entity for the Agency is created.
Mandate

The Agency’s mandate should be comprehensive in scope and include all aspects of fisheries management including habitat protection, fish science, fish stock management, harvest quota setting, licensing and enforcement.

Only governance functions would remain with government. Government role would be limited to providing strategic direction through policy setting and through the legislation. The Agency would be mandated to carry out the operations in a seamless process of policy, programs and operational decisions. The Agency would be an arms-length authority, staffed by experts that carry out the day-to-day operations of fisheries management within the governance framework established by the enabling provincial and federal legislation. The Agency should be required to ensure low management costs relative to the values of the resources it manages and to lay out a plan to get to full cost recovery from the users of the resources.

There is a built-in conflict in the Agency with the preservation and conservation side of the Agency being in conflict with the licensing and use side of the Agency. Decision-making principles will need to be developed and placed in the legislation to give appropriate direction to decision makers to ensure that economic development can occur but not at the expense of the fishery resource. An example of an applicable principle is “no net loss” which allows habitat to be degraded or destroyed in one area to permit economic development provided equivalent habitat of equal or better quality is restored or created elsewhere to ensure the particular affected stock does not lose its habitat quantity or quality overall.

The mandate would be the subject of some negotiation but would include transference to the Agency of:
• most of the responsibilities of the federal Department of Fisheries and Oceans,
• most of the fisheries responsibilities of the Ministry of Water, Land and Air Protection,
• most of the aquaculture and fisheries management responsibilities of the Ministry of Agriculture, Food and Fisheries.

Principles

Canada and British Columbia would benefit from reaching agreement on principles that would form the foundation for a lasting relationship. Some key principles to guide negotiation might include:
• Governments bringing their respective authorities together to address fisheries in an integrated fashion can secure better fisheries outcomes.
• A joint policy framework should guide direction for the new structure.
• A new agency structure should be codified in legislation to ensure lasting and stable performance.
• Activities of the Agency should be principles-driven.
• Fish habitat management will follow the no net loss principle.
• Decisions should be outcome- and interest-based, efficient, accountable, consistent, and transparent.

Issues

Certain issues would need to be resolved around the mandate and are best left to further study and negotiation. These issues include:
• The degree to which the Agency is involved in the activities currently carried out by the Canadian Coast Guard such as aids to navigation and marine rescue.
• Leaving the provincial Conservation Data Centre intact to maintain the registry and monitor the status of rare and endangered fish species.
• How enforcement would be carried out and the relationship between the Agency’s enforcement officers (formerly of DFO) and the provincial Conservation Officer Service.

5. The Agency

A Crown agency would be created by legislation enacted both federally and provincially to empower the agency to operate like a corporation. A Board of Directors would provide strategic direction. A President and Chief Executive Officer (CEO) and an executive group would manage day-to-day operations. Both federal and provincial staff would join the agency to carry out its mandate.

The Board of Directors provides the strategic management and oversight function of the Agency. The Board would be composed of seven members, three each appointed by the federal and provincial governments and a Chair jointly chosen jointly by the governments. The functions of the Board include setting the major strategic directions of the Agency, approving the annual operating plans, approving the
budget, resolving major corporate issues, and approving the Agency’s annual report.

The Chair of the Board reports to the Pacific Council of Fisheries & Aquaculture Ministers, who as elected officials, represent the shareholders of the agency: the people of British Columbia. An annual “shareholders’ meeting” would be held where the Chair reports to the Ministers on the accomplishments of the previous year and tables the plans for the new year. The Ministers would then table these reports in Parliament and the British Columbia Legislature.

The President as the CEO of the Agency oversees the day-to-day operations of the Agency. The CEO would be a deputy ministry level position who would be accountable to the Board for the operation of the Agency and for achievement of the Agency objectives. The CEO would be assisted by an executive consisting of Vice- Presidents who would each be accountable to the CEO for delivery of an aspect of the Agency mandate.

6. Other models:

There are other jurisdictions where complex and overlapping jurisdictional issues have been resolved in favour of an integrated management structure with clear accountabilities. One example is Australia’s approach to fisheries management. Another model is the approach to offshore oil and gas development and management off Canada’s east coast.

Australian Fisheries Management Authority:

- Expert based
- Arm’s length
- Oversees the day-to-day management of fisheries for both the States and Commonwealth of Australia
- Government retains ultimate high-level responsibility and authority
- Mandated to achieve efficiency and a seamless web of operational policy, programs and operational decisions
- Successes:
  - Full-cost recovery
  - Low management costs relative to the value of the fisheries
  - Cooperation and coordination among industry and all orders of government
  - Stakeholders involved in day-to-day operational management
  - An internally-competitive, dynamic fishing industry

Canada-Nova Scotia Offshore Petroleum Board:

- Created via a federal-provincial accord
- Administered via a joint board of federal and provincial members
- Manages offshore oil and gas resources
- Issues licenses for offshore exploration and development
- Evaluates resources, collects and distributes data
- Successes:
  - Safe conduct of offshore operations
  - Protection of environment during offshore petroleum activities
  - Industrial benefits and employment opportunities
  - Revenue collection and sharing
The Case for British Columbia’s Life Sciences Strategy

Canada’s West Coast Economy

The government of British Columbia has worked over the past four years to establish a New Era for research activity in the province. Millions of dollars in investments have been made in research at universities and research hospitals through the Leading Edge Endowment Fund for BC Leadership and Regional Innovation Research Chairs, Genome BC, the Michael Smith Foundation for Health Research and the British Columbia Knowledge Development Fund (matching Canada Foundation for Innovation awards) and other initiatives specific to the environment and social health of British Columbians. The result is that we have created a solid foundation for accelerated research activity in the province.

These investments are already showing results in terms of spin-off companies and worldwide recognition for advancements in genomics research. The University of British Columbia (UBC) has been particularly successful in terms of the number of spin-off companies created and, in 2001, was second only to the Massachusetts Institute of Technology in North America in this area. UBC also holds more U.S. patents than any other Canadian university. Simon Fraser University and UBC both rank in the top three Canadian universities for start-up companies formed per $1 million investment, according to the 2001 survey by the Association of University Technology Managers.

Building on the synergy created by these accomplishments, we are now looking ahead to generating new research, particularly in the areas of life sciences, alternative energy, wireless communications and ocean sciences, where British Columbia is well-positioned to play a world-leading role.

Planning has already begun to establish a mechanism to ensure that our research dollars bring both economic and social returns to the West Coast, and that they go full circle to benefit individual citizens through new products, a better quality of life and new jobs.

To vault British Columbia and Canada onto the leading edge of the global economy, we must cooperate to reinforce these trends. The federal and provincial governments must work together with universities, investors and private companies to discover new knowledge and to maximize the benefits of the commercialization.

British Columbia’s Life Sciences Research Strategy for the Forestry, Fishing, Mining, Agriculture and Biomedicine Sectors

British Columbia is demonstrating its expertise in the life sciences. Together, Canada and British Columbia have the opportunity to build on this expertise to create a life sciences cluster that will exponentially increase research productivity and returns on investment. Moreover, our proposed life sciences strategy spans many sectors of the economy, revitalizing and modernizing forestry, fisheries, agriculture and mining, supporting new developments in the wine industry, and fostering the development of products and services in the biotechnology and health care sectors.

Increased federal investments, added to the British Columbia government’s extensive investments, will drive the development of innovation clusters of worldwide stature with spin-off benefits in natural resource and health-related sectors across the country. This will help all Canadians to achieve a key objective as an innovation country, rich with economic opportunity and an unparalleled quality of life.
Three Strategic Reasons
British Columbia merits funding of its Life Sciences Strategy for three strategic reasons:

1. Regional and Industrial Development:
The proposed Life Sciences Strategy funding will help meet two long-term needs of the British Columbia economy. First, the proposed funding will help ensure the competitiveness of the province’s current economic drivers—forestry, fisheries, mining, and agriculture—through enabling development of solutions to major threats as well as creation of new sources of value-added. Second and concurrently, the Life Sciences Strategy funding will strengthen the province’s existing biomedical industry, its leading high technology cluster.

2. Return on Investment:
British Columbia has “done more with less”—both in terms of pure research outputs and in generating economic impacts. This means that the federal government is maximizing tax payer value from its expenditures in British Columbia science. Moreover, a modest investment in British Columbia’s life sciences strategy has the potential to improve the global competitiveness of key industrial sectors located in every region of the country. Both the provincial government and the private sector in British Columbia have made a commitment to science R&D, meaning federal funding will be well-leveraged.

3. Equity:
Over the past decade, the Government of Canada has demonstrated its commitment to research and innovation by investing heavily in regional and industrial development in other regions of the country. These investments include the Atlantic Investment Partnership and recent commitments to the automotive and aerospace sectors. British Columbia has historically lagged other provinces in the amount of federal investment, including investments to support science research. As a result, the federal investment gap in British Columbia (the difference between actual federal discretionary spending in British Columbia and the province’s per capita share of federal spending) is conservatively estimated to be about $2 billion per year and growing.

Supporting evidence for these three claims include the following:

1. Regional and Industrial Development
   • Strengthening Leading Industries: Life sciences research funding will help address the growing Mountain Pine Beetle catastrophe, a major threat to British Columbia’s regional economies, and will increase the competitiveness of British Columbia’s producers in the fisheries, forestry, mining, and agriculture sectors. The research will provide them with solutions to current threats to their sustainability (e.g., disease, environmental change) that also have applicability to Canada and the global marketplace. Moreover, life sciences research is also essential to enabling these industries to further add value to products to further strengthen employment and revenues for the province and Canada.

2. Return on Investment
   • Accelerating Life Sciences Job Growth: The life sciences industry in British Columbia is rapidly emerging and needs additional research investment to reach its potential. From 1993-2003, employment in biotechnology, pharmaceuticals, and medical instruments grew faster in British Columbia than in Ontario or Quebec. Continued investment in life sciences research in the province will accelerate the diversification of the British Columbia economy. Leading biotech executives from around North America have relocated to British Columbia, including Paul Hastings of QLT, and Jeffrey Bacha, CEO of Inimex. Top research scientists are also being attracted to British Columbia; for example, of the six new Canada Research Chairs at the University of Victoria, five were recruited from outside Canada. Investing in British Columbia’s life sciences strategy will build on this momentum and further strengthen British Columbia’s largest high technology industry.

3. Equity
   • Effectiveness at Commercialization Means Investment Will Build for the Future: Life sciences research in British Columbia is a wise investment for the future economy of the province and Canada. The life sciences industry is in British Columbia to stay. Despite its lower levels of academic R&D funding, British Columbia has nurtured home-grown companies like QLT to a position of global leadership. Strong regional competencies, like the ability to effectively
commercialize university research, has been a major reason for this success. British Columbia universities have been more effective at creating start-ups than their counterparts in other provinces; over the past twelve years, British Columbia universities have generated more start-ups per million dollars of research than universities in Ontario, Alberta, or the Prairie provinces. Seventy per cent of British Columbia biomedical companies are spin-offs from the province’s research universities and affiliated teaching hospitals. And while British Columbia has only 6% of Canada’s Venture Capital holdings, it has attracted 20 percent of Canada’s venture capital investment in Life Sciences. British Columbia has all of the ingredients needed to maximize the economic impact of the Life Sciences Strategy over the long term.

2. Return on Investment

• **British Columbia Research Benefits all Canadians:** Life sciences research in British Columbia is not only creating new scientific knowledge, it is directly leading to innovative technologies and therapies that benefit society. One measure of the commercial value of British Columbia research is patents. The University of British Columbia possesses more U.S. patents than any other university in Canada. Moreover, over the past 12 years, British Columbia researchers as a whole have been awarded more U.S. patents, per dollar of R&D investment, than their counterparts in Alberta, Ontario, or the Prairie provinces.

• **Leveraging Provincial and Private Sector Investments:** The strategy will build upon $600 million already invested in life sciences in the province, and more investment is on the way. The British Columbia government has already made a commitment to increase the number of seats at its universities and colleges by 25,000. This will translate into a substantial rise in the number of funded research faculty in the life sciences. At the same time, the strategy will be complemented by rapidly-increasing private sector R&D investment in British Columbia. From 1993-2000, industrial R&D grew more rapidly in British Columbia than in Quebec, Alberta, Ontario, or leading U.S. technology producing states like Massachusetts or California.

• **Doing More With Less:** Life sciences researchers in British Columbia are highly productive, given the research investment that they receive. Overall, for every million dollars of academic science funding that British Columbia researchers receive, they generate on average 3.1 publications. In other provinces, the totals are substantially lower; only 1.7 articles per million dollars in Ontario, and only 1.45 in Quebec. This means that increased life sciences investment in British Columbia is going to have a larger impact on knowledge generation in Canada.

• **Influential Research:** There is evidence that British Columbia research is more influential than research conducted in other provinces. Science citation frequency is a measure used to determine importance of scientific results. This can be determined by counting the number of times, on average, that a scholarly publication in the life sciences is cited by other researchers. The average British Columbia publication in life sciences is cited more often than other provinces such as Ontario and Alberta. Quebec is comparable, but the corresponding figure is only 8.3 in Alberta, and 8.7 in Ontario. This can be interpreted to mean that the life sciences research in British Columbia has a greater impact on the scientific world.

3. Equity

• All parts of Canada have the potential to benefit from increased federal investment in life sciences research, yet British Columbia has significantly trailed other parts of the country in what it has received in the past. Academic R&D expenditures, which are primarily funded by the federal government, are highly unevenly distributed across the provinces. In the year 2000, for example, Quebec received $221 per capita in academic R&D, and Ontario received $198 per capita. Alberta received $182 per capita, but British Columbia only received $123 per capita. This is partly due to a smaller public post-secondary system in British Columbia, which the province is addressing through the addition of 25,000 new seats and almost doubling the number of medical school spaces by 2009/10. These provincial commitments to expand the capacity for research in the public post-secondary system should be enhanced through investment in British Columbia’s Life Sciences Strategy. This imbalance can and should be corrected with this investment in British Columbia’s Life Sciences Strategy.
Conclusion

British Columbia has significantly invested in its life sciences research and innovation capacity and has the potential for worldwide stature in the life sciences research clusters. In doing so, British Columbia will continue to revitalize the West Coast economy and generate spin-off benefits in natural resource and health-related sectors across the country. In order to maximize this potential, the federal and provincial governments, universities and the private sector must work together. Added to British Columbia’s investments, increased federal investments will assist British Columbia in becoming a world leader in life sciences.
British Columbia’s Life Sciences Strategy Research Cluster Summaries

Forest Sector Research Cluster

Achieving Sustainable Growth in a Changing Climate

Importance of Forestry

The forest sector is the primary driver of the British Columbia economy, accounting for 50 percent of British Columbia’s export revenue and 22 percent of total provincial employment. For this reason, the many pressures the forest sector has faced in recent years have had a profound impact on provincial revenues and employment. Also, forest practices on the West Coast have gained an international profile in the last decade, more so than forest practices elsewhere in Canada. Here, issues of sustainable forestry and community stability are critical, due to effects on product markets. However, global economic growth is creating an expanding marketplace as well as an increasingly competitive environment in which British Columbia’s forest sector can thrive. For this to take place, the forest sector will need to accelerate the pace of its innovation across the province. Life sciences issues are at the centre of this challenge. They are also at the heart of social and economic challenges facing the province’s rural communities. Life sciences research applications have the potential to enable improvements across the forest sector’s value chain—from forest seed to marketable forest products—helping the industry to cope with the changing market and environmental conditions under which forestry will take place—and as sustaining our communities.

Forestry-Life Sciences Research Challenges

Three life sciences challenges must be addressed if British Columbia’s forestry sector is to manage and thrive in the expanding global marketplace and its changing climate:

1. Ensuring Forest Health:

British Columbia’s forest industry produces 60 percent of all sawn wood exports from Canada and plays a key role in maintaining community stability throughout the province. Therefore, the question of how to maintain healthy and abundant forests is a fundamental economic challenge. Specifically, determining how to control disease organisms and deciding what to grow in the face of climate change and the secondary consequences (floods and fire) is a critical scientific and economic challenge. There has been some scientific progress on how to cope with insect and disease trends, but there is much yet to be known. The impact of the pine beetle epidemic is nothing less than a catastrophe. 5 million hectares are affected—the size of Ireland and Israel combined. 1.2 billion cubic meters of lodge pole pine is at risk—80 percent could be killed. If current problems spread to Jack Pine, the problem will escalate. These patterns are indicative of a likely flow of changes related to climate that may dramatically reduce future forestry health and yield. Insights and solutions will likely apply to species across Canada.

2. Adapting to Climate Change:

British Columbia is a “living laboratory” for research on the challenges in forestry created by climatic change. British Columbia has a wider range of biological, geological and climatic regions than other parts of Canada. While the Mountain Pine Beetle is an immediate threat it is also a harbinger of an uncertain future. Should Canadians replant the same trees? What other trees and species will be impacted and what can be learned? What do we need to do differently to avoid the problems of pests and changing growing environment? How can the forest industry address land management challenges that arise from secondary consequences, such as increasing fires? Scientific research focusing on biodiversity management in light of climate change and, specifically, how British Columbia’s forest ecologies will survive as climate change are central concerns. Changes in fires, insects, and disease that impact forest resource and biodiversity...
conservation need research translated to practical solutions. A long-term outcome may be effective capacity to take advantage of biodiversity, insects, animals and plants to design forests that are adaptive to climate change and can continue to generate wealth for all Canadians.

3. Product Diversification and Value-Added:

There are three life science challenges that British Columbia’s forest sector faces in ensuring long-term competitiveness. The first is improving and customizing the nature and length of wood fibre to meet market need as well as to develop new products. Life sciences research can be used to explore improved technologies for processing cellulose and fibre, carry out lignin synthesis, and apply it new markets. The second challenge is to make discoveries that generate more diverse and higher value-added bioproducts from forests—including biofuels and bio-energy. Third, there is the opportunity to explore applications to mitigate pollution impacts of forest products and increase productivity of operations through improved enzyme pulping, biobleaching, biotreatment of residues. All these will contribute to a more diverse and profitable forest sector as well as a softer footprint on the land.

Forestry Research Strengths

Western Canada is one of the three potential world-class centres of forestry research. Moreover, British Columbia has a strong endorsement from the Canadian Forest Products Association of Canada (FPAC) to be one of 10 research clusters proposed by the federal government—focusing on forest research. British Columbia has a skilled research community with a high degree of willingness to work in a collaborative way with other researchers and industry. This wealth of capability includes:

- **A strong university-based forest R&D community.** Examples: University of British Columbia Treenomics Program, funded by Genome BC on mechanisms of disease and insect resistance; Simon Fraser University’s Centre for Sustainable Community Development; and and UVic’s Centre for Forest Biology.
- **Institutes:**
  - Forintek: A Canadian Corporation that is federally, provincially and industry- funded. Solid wood products. Wood processing, wood products.
  - PAPRICAN: Industry funded focusing on pulp and paper. Together with the University of Northern British Columbia and UVic, PAPRICAN is establishing EVALUTREE, a world-leading centre for wood and fibre analysis.
  - FERIC – Forest Engineering Research Institute of Canada
    - **Ministry of Forests,** focusing on forest genetics and tree improvement (both supported by the Forest Genetics Council), growth and yield modelling, and ecology and earth sciences research.
    - **Silviculture Expertise:** Strong silviculture contracting industry (site preparation and maintenance) with expertise in variable retention silviculture.
    - **Canadian Forest Services (CFS), Pacific Forestry Centre:** Largest laboratory in the country, located in Victoria, focusing on fire, insects, disease, national forest inventory.
    - **Forest Companies that conduct research:** Canadian Forest Products, Ltd., Lignum Ltd., Riverside Forest Products Ltd., Weyerhaeuser Company Ltd.
    - **Primary and Secondary Wood Products Partners:** Companies in the pulp and paper and dimensional lumber and secondary industries that produce products.
    - **Forestry-focused Biotech Firms:** Cellfor, Forbes Meditech, Northern MillTech, BC Chemicals.
    - **Forestry Investment Account** (now the Forest Science Program): Funds research conducted by university faculty, provincial and federal scientist, industry and consultants.
    - **Forest Innovation Investment Limited:** Product development and markets.
    - **Forest research cluster initiatives** between Natural Resources Canada and British Columbia to further develop cooperation and collaboration, forming a strong basis for the Life Sciences Strategy forest cluster.

Forestry Research Strategic Directions

As British Columbia’s largest economic export producer, forestry deserves systematic attention to its threats and opportunities. As part of the British Columbia Life Sciences Strategy a network of three interrelated strategic directions have been proposed for research, building on current strengths:
• **Forest Health Initiative:** British Columbia needs more than early warning to adapt to ongoing climatic changes and their consequences—the province needs new tools and methods for predicting the adaptation of seed stock or suitability of new candidates for cultivation, including the possibility of trees that will have insect or pathogen resistance, and for enabling prevention and treatment of problems. A research network is proposed focusing on immediate research needs, such as: The genetic structure, behaviour and dispersal of beetles; their impact on the forest ecosystem; and how to use new research to sustain habitats and maintain pools of genetic diversity in forests.

• **Adaptive Silviculture Initiative:** In addition to the challenges associated with climate change, British Columbia’s forest sector will face rising competition from nations and alternative materials over time, leading to questions such as: What should today’s trees be replaced with tomorrow? How do ecological factors, social values, and market pressures shape strategies for silviculture? How can British Columbia extract more value from fibre? What non-timber forest ecosystems products will provide value-added while supporting biodiversity (e.g., mushrooms, natural health products, bioenergy)? British Columbia has extensive reforestation underway with 200,000 hectares harvested a year. There is a large seed orchard program in British Columbia with 230 million seedlings planted. This part of the value-chain will be carefully integrated into research on adaptive silviculture.

• **Competitive Forest Bioproducts Initiative:** Competitiveness in forestry calls for a deeper examination of sources of value-added. A research network is proposed to go beyond ongoing federal research on greenhouse gas sequestration, focusing on research on how to further expand the environmentally compatible value of forests in British Columbia and translate that knowledge into economically viable practices for forests and allied businesses. Life sciences research would focus on several key areas: Biofuels, particularly from timber killed by Mountain Pine Beetles; developing alternative to petro-chemical based resins, glues and adhesives; new enzymatic processes to reduce fibre loss during debarking and to increase efficiency of pulping, including increasing recovery and reduction of waste; and, mitigation of pollution during pulping from enzyme pulping, biobleaching and biotreatment of residues. This research has great potential to help Canada meet its Kyoto Protocol commitments.

### Fisheries/Marine Research Cluster

**Probing Beneath the Surface**

#### Importance of Fisheries and Aquaculture

British Columbia’s marine resource industries generate more than $1.9 billion in provincial revenues and add more than $600 million in annual gross domestic product, employing over 20,000 in the province. Stakeholders from across the region from economic development organizations to First Nations see substantial future opportunities in aquaculture—both finfish and shellfish and in sustainable fisheries. Yet, challenges to the health and conservation of fish are increasing. Life sciences research to measure and monitor the health of fish species, the variability in response to changes—both natural and anthropogenic—are needed to guide management and regulation of fisheries and the surrounding environment as well as consumer safety. Further, research is needed to generate solutions to these challenges—whether for interventions, such as vaccines for aquaculture or means of preserving genetic diversity to sustain healthy fisheries.

#### Fisheries-Life Science Research Challenges

The province’s ministries, universities and government have identified three life sciences challenges, which must be addressed to sustain and grow British Columbia’s captive and wild fisheries:

1. **Preserve Fish Health:**

Ensuring the health of captive and wild fish is a priority challenge for British Columbia. Strategic life sciences issues in aquaculture include improved diagnostics, fish nutrition, animal welfare, and development of effective vaccines and biological controls. In wild fisheries, health research issues include aquatic pathogen distribution and their effects on fish population size in a changing
climate. The scale of these concerns is no small matter. The Auditor General of British Columbia recently found that there are severe risks to the province’s wild salmon fishery.

2. Conserve Fish Stock:
The conservation of British Columbia’s fish stocks is fundamental to its fishery industries. Patterns of fish population change—due to fishing, climate and environmental factors—are exerting continual pressure on size and vitality of specific fish populations. Developing analytic tools for tracing genetic differences in stock to understand the dynamics of fish populations and the causal chains between environmental change and genotype change is central to conserving fish stock and protecting genetic biodiversity.

3. Protect the Fisheries Environment:
The health and abundance of fish stocks is critically dependent on the health of their environment. Human activity and natural variation in climate factors exert an important impact upon freshwater quality and quantity and ocean ecosystems. For example, water withdrawals, flooding, erosion, loss of riparian and estuarine and wetland areas, reduced in-stream habitat, and introductions of chemicals, waste or invasive aquatic species all exert important effects on fish populations, especially salmon. Plankton blooms and other ocean events all have the potential to exert negative impacts. Research to analyze these patterns and to develop new tools to measure and manage unwanted impacts is needed.

Fisheries and Marine Research Strengths
British Columbia has a strong set of capabilities to apply to these challenges and has already made headway in taking action, including projects such as “The Sea Around Us” and “Coasts Under Stress”. Among the key fisheries and maritime life sciences research competencies are:
- **UBC Centre for Aquaculture and Environmental Research (CAER)**: Fish physiology and nutrition, application of performance-based standards to fish health, vaccine development, aquaculture/environment interactions, and water temperature impacts.
- **Centre for Aquatic Health Sciences (CAHS)**: Field-oriented research capacity for disease surveillance and diagnostics and technology testing.
- **SFU**: Genomics Research on Atlantic Salmon Project (GRASP) funded by Genome BC and conducted jointly with the University of Victoria, with a growing focus on application of genomics to conservation, adaptation and conservation. In addition, SFU’s Biological Sciences Department and Centre for Coastal Studies focus on salmon conservation and management. SFU’s School of Resource and Environmental Management Fisheries Group and Cooperative Resource Management Institute also have strengths in fisheries research.
- **UVic**: Research relating to salmon genomics (GRASP) jointly with SFU, aquaculture sustainability, parasitology and sea lice, water temperature impacts, and Coastal Environments research.
- **Malaspina University College, Centre for Shellfish Research (Nanaimo)**: Development of ecologically sustainable shellfish aquaculture.
- **SFU and UBC**: History of fish populations, such as the Strait of Georgia fish population pre-contact.
- **Bamfield Marine Station**: Wide ranging research on marine ecosystems and processes.
- **Federal Fisheries and Oceans Canada**: Fish health, conservation and sustainable fisheries management science.
- **Commercialization**: Strengths in commercialization capacity through existing technology companies.

Fisheries and Marine Research Strategic Directions
The British Columbia Life Sciences Strategy proposes a network of three interdependent areas for collaborative life sciences research on fisheries and the marine environment. They include:
- **Fish Health Initiative**: Research to measure and monitor the health of fish species, including the variability in health indicators in response to natural and anthropogenic changes, and to accelerate development of required genomic information and vaccines to address fish health threats. This initiative would build on the activities of CAER, including temperature controlled quarantine and rearing capacity to enable research on shifting temperature regimes and their effect of fish survival. This would
also include research on fish welfare and new fish diets to improve health and reduce use of fish derived protein. Performance-based standards would be evaluated as an effective management tool for environmental health of the aquaculture sector.

- **Fish Conservation Initiative**: This initiative would expand the activities of GRASP by developing a Consortium for Genomic Research on All Salmonids Project (at UVic and SFU) to go beyond Atlantic Salmon to address aquaculture issues and wild stock management for all Canadian salmonids, including Pacific Salmon. This initiative could lead to improved knowledge of how natural populations of salmonids adapt to local conditions and refine salmon stock management. It would also provide advancements in aquaculture to improve growth rates, disease resistance and quality. In particular, this initiative would examine patterns of gene expression in response to environmental factors, pathogens and pollutants that can be applied to conservation, growth and environment. CAHS would be a central resource for this research initiative with its field capacity for diagnostics, wild and farmed fish health assessment, disease monitoring, prevention and control. This initiative would also link to the Centre for Shellfish Research to foster new techniques for sustainable shellfish farming—along the whole British Columbia coast. The results of this initiative will contribute to selectivity in fisheries to address sustainability as well as the commercialization of technologies to enable effective habitat mapping and stock assessment.

- **Fisheries Environment Initiative**: This initiative on environment would focus on the analysis of anthropogenic and natural change on fisheries environments and the translation of these insights into management policies and practices, adding to the existing initiatives on fish health and conservation in British Columbia. This initiative would take an ecosystem approach to examine the life sciences dimensions of environmental management as it applies to coastal zones, freshwater systems, aboriginal fisheries and risk management with respect to consumer safety. New technologies developed through genomics research would find broad application in monitoring and responding to environmental change.

### Agriculture Research Cluster

#### Protecting Value in a Time of Change

#### Importance of Agriculture

With its diverse ecosystem situated on the Pacific Rim, British Columbia’s agricultural economy is being dramatically impacted by the forces of climate change, biosecurity and competitive global markets. In this rapidly changing environment applied life sciences research will play a crucial role in preserving and increasing the contribution of agriculture to the economy of British Columbia and Canada. Strategic efforts are vital not only to sustaining agriculture but to taking advantage of new opportunities to serve commercial markets for agriculture commodities, food beverages and products. British Columbia already has a combined agri-food economy over $21 billion in consumer sales annually, employing over 270,000 across all segments of the industry. Beyond food, the enormous diversity of animal and plant life in British Columbia offers a natural advantage in developing new non-food bio-products, bio-fuels and processes. Historically, research in agriculture pays off, generating a 10 to 50 percent return annually. There is continuing incentive to do so now. Existing research and genome sequencing infrastructure is well established in British Columbia, and it can be leveraged beyond medical science applications to support applied life sciences research and subsequent commercialization of new products and processes vital to our agricultural industries.

### Agriculture-Life Sciences Research Challenges

The strategic challenges on which British Columbia proposes to focus have been chosen to protect and grow this value. These challenges are to:

1. **Enable Plants Adaptation:**

   British Columbia supports a greater variety of biogeoclimatic regions, soils and plant than any other province in Canada. British Columbia’s plants are an “early warning” laboratory for Canada and an opportunity to learn and apply science to understand
and address the stresses and impacts of environmental change from climate to industrial growth.

2. Enhance Agriculture Bio-security:

The diversity of British Columbia agriculture also means that its plants and animals experience threats from domestic and external diseases and pests. Avian flu and agricultural weeds are two examples of threats to animal and plant health, additions to the ecology and environment that must be detected and managed. Increasing concern about the impacts of confinement systems for animals and birds and chemical treatments of plants require research and innovation in production systems for livestock, and biologics for plants.

3. Harness Agriculture Diversity:

British Columbia produces over 120 agricultural commodities province-wide. Within those products is the potential for adding value as well as new opportunities to contribute to the health and well being of Canadians. There is similar untapped potential for value-added among the flora, livestock and fisheries of the province. Research and commercialization is required to identify and develop agriculturally-based products and processes that will generate new value for the global marketplace.

4. Improve Agriculture Sustainability:

British Columbia’s is known as a “green” province because of its natural features and focus on renewable resources in its economy. However, the province is facing increasing pressure to achieve greater sustainability. New research is needed to achieve sustainability across the province’s plant and livestock production segments, to generate bio-products from agricultural wastes to replace petroleum based products and reduce greenhouse gases and, in doing all this, create new value-added goods and employment.

Agriculture Research Strengths

British Columbia has well-established strengths in life sciences-related research in plant and animal agriculture, including research facilities and intellectual capability. Moreover, the province has federal laboratories whose presence in British Columbia provides a strong platform for collaborative research and development. Some of the strengths on which agricultural life sciences research can build are capacities at the following institutions:

- UBC Agriculture and Food Sciences Laboratories.
- UBC Wine Research Centre.
- Pacific Agriculture Research Centre (PARC) - Summerland.
- UBC Dairy Education and Research Centre at PARC–Agassiz.
- Grapevine Genomics Project between Genome Espana and Genome BC.
- UBC-Okanagan (UBC-O).
- UNBC Soils Research Network.
- SFU Biological Sciences Department.
- SFU Department of Earth Sciences – research on groundwater contamination due to nitrates with particular reference to agriculture.
- British Columbia Institute of Technology (BCIT) Food and Biotech Centres.
- UVic Biology Department.
- Numerous Botanical Gardens and Plan Nurseries with in-house R&D.
- Natural Health Products Research Cluster (UBC, BCIT, PARC, hospitals).
- BC Functional Food and Nutraceutical Network.
- BC Science and Innovation Fund for Agriculture, Food and Bioproducts.

Agriculture Research Strategic Directions

As part of its Life Sciences Strategy, British Columbia proposes to build a research and technology commercialization network in agriculture that will address critical challenges facing British Columbia and Canada. The following interdependent initiatives are proposed:

- **Plant Adaptation Initiative:** A network of researchers will develop new genomics tools and techniques to understand how natural selection adapts species to diverse environments. This will include the first phosphoproteomics platform in Canada for use in identifying and predicting climate and environmental impacts on plant and tree yields and measuring tolerance to drought, frost, salinity and pollution. Furthermore, using the many outputs and by-products of the plant/horticulture sectors, British Columbia researchers will develop new products and industries, adding value to existing...
products and processes, including the non-food side of the industry.

- **Biosecurity Initiative**: A network of researchers will focus on developing new techniques for the detection and control of animal disease and biological control of pests and weeds impacting farmed and greenhouse plants using insects and microbes (soil bacteria and fungi), and focusing on targeted weeds such as green foxtail and wild oats. This network will leverage existing federal funding to produce applications to identify threats as well as environmentally sensitive biological controls.

- **Natural Food Innovation Initiative**: A network of researchers focusing on enhancing the discovery, development and commercialization of value-added foods and extractions from British Columbia’s diverse plant community. This network will also conduct research on wine genomics to increase the ability to identify and grow grapes and produce quality wine for global markets. This network will also screen bioactive compounds in British Columbia plants for efficacy relative to chronic disease conditions (antioxidants, glucose control, cholesterol oxidation), develop novel plant extraction methods, undertake genetics research to improve food product quality characteristics, establish pilot plant prototypes, and transfer intellectual property to Canadian enterprise and new commercialization ventures.

- **Biomitigation and Resource Recovery Initiative**: A network of researchers will focus on applied science solutions to natural biomass emphasizing the development of new techniques for mitigating production of greenhouse gas and waste products from agricultural and food processing sources. This research initiative will focus on new directions for improving efficiency and management of biomass conversion, including the development greenhouse gas mitigation technologies that will enhance agricultural productivity, filters that will improve mitigation of greenhouse gas emissions from landfills and stored agricultural waste, and develop ways to recapture energy and nutrient resources in wastes. Other initiatives will include the development of crops designed to remediate soils contaminated by hydrocarbons, heavy metals and other industrial by-products.

- **Diversity Commercialization Initiative**: A network of researchers and industry will undertake research and commercialization initiatives to create new food products, nutraceuticals, bioproducts, biofuels and bio-processes from the province’s diversity of plants, livestock, fish, marine plants, and trees.

# Biomedical Research Cluster

## Expanding and Accelerating a Rising Star

### Importance of Biomedicine

Biomedicine is one of the fastest growing fields of science and industry globally. British Columbia’s biomedical cluster is a small but rapidly growing centre of development that will expand and diversify Canada’s participation in the global biomedical marketplace and build new economic opportunities along the full range of health products and services, including pharmaceuticals and biotechnologies. Strategically located on the Pacific Coast, the industry has a strong track record of collaboration and innovation within and across research institutions and industry, with rising international investment. Institutions, such as Genome BC, with the support of Genome Canada, the Canada Foundation for Innovation, Canadian Institutes of Health Research, and the Natural Sciences and Engineering Research Council have fostered growth of this research cluster in British Columbia. This has led to development of a world-class infrastructure now able to recruit and retain internationally recognized scientists and business partners. This, in turn, is providing a strong return on investment (ROI) for federal and provincially sponsored research in the economy. Universities in the province are highly productive in transforming research into start-ups, and are continuing to increase their scale of research activity to feed this innovation pipeline. This higher scale of research will pay off through a higher volume of spin-offs. One example is the success that Aspreva has had in attracting $57 million in private financing from U.S. investors—the largest amount in Canada in four years. Life sciences entrepreneurship is strong in British Columbia—25 percent of all life sciences firms are under three years of age. However, British Columbia also faces the challenge of sustaining its powerhouse of start-ups into mature global ventures.
Biomedicine-Life Sciences

Research Challenges

British Columbia faces three challenges in bringing its biomedical research cluster to its full potential:

1. Scaling-Up Drug Discovery Research:

Today, new health threats and potential pandemics emerge quite rapidly from unknown sources. British Columbia’s life sciences researchers demonstrated their capacity to identify and screen a candidate vaccine for SARS in record time. Despite recent improvements, the scale of funding for the discovery and screening of new molecules and processes for biomedical applications remains low—increasing research funding remains key to generating continued innovation in biomedicine, particularly in diagnostics and vaccines.

2. Infrastructure Clinical Development and Integration:

British Columbia’s fast growing biomedical cluster is still in its early stage. The time and costs for initial development of a drug is very high. These factors create a competitive disadvantage in British Columbia compared to international leaders who are better resourced. To ensure that findings from genomics, proteomics, and bioinformatics flow through to application in clinical settings, there is a strong argument for building the clinical research support infrastructure across the province’s universities and teaching hospitals. Building on existing capacity, this infrastructure would, for example, carry out further development of drug candidates, including pre-clinical trial toxicology and preparation of pilot samples to prepare therapeutic drug candidates for licensing to existing firms or start-ups.

3. Enabling Maturation of Biomedical Enterprise:

Globally, the majority of biomedical firms will not survive to maturity, as most candidate drugs do not achieve their intended result. Bringing a molecule or biological product through each phase of clinical trials to market readiness will require years and multiple rounds of funding—and most biomedical firms fail or are acquired along this path. Enabling British Columbia biomedical firms to conserve their resources and increase their readiness and focus on commercialization tasks could be achieved through providing earlier support as described above, as well as access to services for contract production of drugs and efficient management of clinical trials. Funding expansion of external resources to support biomedical enterprise development will maximize the prospects for the survival of new ventures arising from university spin-offs in British Columbia.

Strengths in Biomedicine

British Columbia has aggressively developed its life sciences research cluster over the past four years providing strong support to its universities and teaching hospitals. The unique strengths of the province include:

- A distinctive culture of innovation with excellent commercialization results that are being reinforced and scaled-up over time.
- Research strengths in infectious diseases, immunology, cancer, diabetes, nutrition, HIV, cognitive development and heart disease.
- High conversion of life sciences intellectual property into start-ups by universities, generating spin-offs that harness genomics, proteomics and bioinformatics.
- Genome BC: $171 million in approved projects for large-scale research at provincial universities and teaching hospitals.
- Michael Smith Foundation for Health Research: Investment of over $110M, including the SARS Accelerated Vaccine Initiative (SAVI).
- New Life Sciences Facilities at three universities: Investment of $134M.
- ICORD (Spinal Cord Research Centre).
- Brain Research Centre at UBC.
- Recruitment of top researchers by Canadian Institute for Advanced Research
- Top leaders heading biomedical research centres: BC Cancer Agency; Extreme Genetic Disease (Huntington’s) and Pathogenomics (bioinformatics, biostatistics).
- Longitudinal data base on health outcomes from Public Health Authorities.
- Genome Sequencing Centre that provides rapid response capability.
- Pacific Centre for Advanced Materials and Microstructures and 4D-Labs (SFU and UBC) that develop new technologies based on material sciences.
- Discovery Parks: Research parks and infrastructure support technology enterprise attraction and growth at British Columbia universities.
Biomedical Research Strategic Directions

Through its Life Sciences Strategy British Columbia is seeking to strengthen its rapidly growing biomedical cluster, building a research network that will focus on two interrelated strategic directions:

- **Diagnostics and Vaccines—Fast Track Innovation:** The emergence of new infective agents, such as SARS, West Nile Virus and Avian flu has increased the need for rapid development of detection tests and vaccines. British Columbia has a network of high performance researchers who can do this by deciphering the genome of diseases, identifying the targets, and generating test vaccines. This multidisciplinary initiative—from genomics to materials science—will focus on early detection and prevention, strengthening and institutionalizing British Columbia’s capacity to serve this national need. This initiative would develop tools, improve processes and institutionalize cross-institution capacity to delivery fast track innovation on diagnostics and vaccines.

- **Therapeutics Discovery and Development Infrastructure:** A new Centre for Drug Research and Development will be established to respond to the challenge of assuring British Columbia’s rising position in global drug development. This multi-institutional network will offer systematic capability to identify, screen and develop drugs at the early stages and take them through to commercialization, creating more candidates, building on existing strengths and history of successes, such as QLT, Angiotech, Xenon, Cardiome, Aspreva and Anormed. The Centre will: Establish diverse libraries for drug screening, so that small firms would not need to do so; offer robotic facilities for automated screening; provide functional genomics and proteomics, pathogenomics and pharmacogenomics tools and expertise to enable definition of highly targeted therapeutic candidates; and develop early stage therapeutics for particular genotypes or possibly phenotypes. This initiative already has a test case in process for HIV-1 and the goal is to scale-up and formalize the necessary organization, facilities, linkages and protocols. This infrastructure would provide the capacity to put the spectrum of university-based talents and testing facilities to work in an manner that is large enough to cover important development steps, but still small enough to be agile in responding to opportunities that can then be spun-off into the economy with a higher survival rate.

- **Clinical Support Platforms:** Building on existing genomics, proteomics and bioinformatics capacity for basic research, the clinical support platforms will provide the essential test bed capacity to assess safety and effectiveness and to validate the cost-benefit of new health products and services for introduction into our health system. This initiative will invest in key clinical support platforms such as tissue banking, clinical trials, data base integration and technology assessment that are required to develop, apply and integrate health technologies into our health system and to create a globally competitive biomedical sector.

Mining Reclamation and Biotechnology Research Cluster

New Paths to Value and Sustainability

Importance of Mining Reclamation and Biotechnology Tools

The needs of the mining industry have historically been a driver of major technological innovations from the steam engine to the electric battery. Today, life sciences research offers an important new avenue for the achievement of innovations that can increase mining value and minimize environmental impacts. Mining and minerals are British Columbia’s second largest industry and operate under some of the most advanced environmental regulations in the world. In 2001 mining in British Columbia produced coal, copper, gold, silver, zinc, lead and industrial minerals and construction aggregate valued at $2.9 billion and employing 12,000. There remains great economic potential for mining in British Columbia, including increasing activity and profitability of existing markets and opening up of new ones. British Columbia has a strong international reputation in mineral exploration and mine development, which offers opportunities for
application of new technologies for mining reclamation arising from innovation in this sector.

Mining Reclamation and Biotechnology Life Sciences Challenges

Life sciences research offers new means for addressing three interrelated challenges which British Columbia’s mining industry faces—and by extension Canada and the world—as it enters the 21st century. These challenges are:

1. Extracting New Value:
The search for new and more cost-effective means for obtaining minerals from sources has been a continuing challenge for the mining industry globally. The opportunity to use biological processes to achieve extraction objectives is an important innovation, as yet not fully developed. However, specific opportunities exist in applied life sciences to identify and develop enhanced strains of natural bacteria for use in mining. In British Columbia, research is being undertaken to develop alternatives to conventional metals recovery and concentration technologies, based on bacterial leaching of sulphide mineral. There are major markers for applications such as these globally. Moreover, British Columbia’s researchers are already world leaders in geochemical and bio-geochemical technologies, many of which are already applied internationally in mineral exploration. New life sciences discoveries will play a continuing role in enable mining, including phyto-mining and bioprospecting.

2. Reducing Impacts:
Life sciences innovations have the potential to increase the extent to which mines can be environmentally-friendly. Research on methods for eliminating harmful bacteria may be helpful in controlled bacteria-induced acid rock drainage, which remains the biggest environmental issue within the mining industry. Applied research to develop the ability to produce large populations of naturally-occurring bacteria that converts soluble toxic elements to the metal form could enable safe and efficient clean up of water courses. Similarly, improving strains of sulphate-reducing bacteria that could be more easily introduced into wetlands adjacent to mining operations could also help address clean water issues. Problems related to inadequate process optimization with existing bacteria will be resolved by sophisticated modeling and development of detailed understanding sulphate reducers under British Columbia conditions. These technologies for reducing mining impacts will be developed for export to the benefit of British Columbia companies.

3. Ecosystem Recovery:
Separate from extraction and environmentally sound operations of mines are a host of life science research challenges related to mine reclamation and closure. Returning a mining land base to a near natural or improved state calls for a broad range of life sciences innovations. Multidisciplinary research in biology, geology, earth systems sciences and other fields of science are required to understand and discover solutions to mine reclamation and closure requirements. Interdisciplinary research and collaboration in land reclamation and ecosystem restoration is already taking place and is encouraged across British Columbia universities.

Mining Reclamation and Biotechnology Strengths

British Columbia has distinctive competencies in mining reclamation-related biotechnology research and application:
- **BioreQ**, one of the foremost companies in the world using biological treatment of acid rock drainage, is located in British Columbia.
- **UNBC - Natural Resources and Environmental Studies** research in the areas of environmental assessment, aggregate mining and reclamation, and land use planning. UNBC’s Northern Land Use Institute works in partnership with private and public sectors, assisting northern communities to develop effective land use policy and fostering social, economic, and environmental development in the region.
- **UBC - Department of Mining Engineering and Centre for Environmental Research in Minerals, Metals and Materials (CERM3).**
- **Ministry of Energy and Mines**: Reclamation team of experts with on the ground experience with reclamation and mitigation of environmental impacts related to mining. Key organizers for annual mine reclamation conference and other
technical workshops. Some of the best global examples of modern sustainable mining.

- **Natural Resources Canada** – Internationally-renowned acid mine drainage expert based in Smithers, British Columbia.

### Mining Reclamation and Biotechnology Research Strategic Directions

British Columbia’s stakeholders from across provincial government, industry and universities believe that life science holds the promise for achieving an even more productive and environmentally sustainable mining industry in the future. Moreover, as a centre of leadership in mining with companies active worldwide, there is a strong economic argument for using the province’s mining sector as a model for innovation. For this reason British Columbia’s Life Sciences Strategy proposes a multidisciplinary and multi-institution network to focus on three interrelated mining themes:

- **Bioextraction Initiative**: A network to conduct applied research and development to identify, test, demonstrate and apply bio-based techniques for mineral extraction. This initiative will build on the current expertise in bacteria-based technologies, focusing on development of environmentally compatible applications.

- **Biosolutions Initiative**: A network to conduct applied research and development to identify, test, demonstrate and apply bio-based techniques for reducing or eliminating negative environmental impacts of mining, such as selenium in water supply. This initiative would produce a portfolio of proven and safe biosolutions that can be applied in British Columbia and globally—by and through British Columbia and Canadian enterprise.

- **Biorecovery Initiative**: A network to conduct applied research and development to identify, test, demonstrate and apply bio-based techniques for mine reclamation and closure. This initiative will create a package of techniques that can be applied in different combinations to address different mine deactivation requirements on sites and surrounding lands, and become the basis for expanded remediation services based in British Columbia serving national and global markets.

### Implementing the BC Life Sciences Strategy

The province of British Columbia proposes to carry out the objectives of its Life Sciences Strategy by establishing a Life Sciences Network that will administer the funding, coordinate the cluster research and optimize collaboration among existing research capabilities while strengthening and adding those that are required. The province of British Columbia proposes that the Life Sciences Network have the following attributes:

- **Structure**: A Life Sciences Network managed by an independent non-profit society with its own board and advisory council. Board and council membership will ensure representation from key stakeholders, including the federal government, provincial ministries, life sciences related industries and post-secondary institutions. The structure of this organization will draw from the successful models, such as Genome BC.

- **Mission**: The Life Sciences Network will support applied collaborative research by universities, laboratories and companies within targeted clusters designed to achieve direct impacts on specific industries of British Columbia and Canada, and in so doing, move life sciences discoveries to the marketplace. The Life Sciences Strategy implementation will be guided by a mission that focuses on pre-competitive applied life science and technology development that is not typically funded by federal agencies or by individual firms. To accomplish its mission the Life Sciences Strategy will enable the development of a series of “hub and spoke” research and development networks around research cluster themes.

- **Performance Management**: The Life Sciences Strategy will use rigorous screening and selection of proposals as well as ongoing tracking of the performance and outcomes of funded research initiatives. Performance will be managed against strategic near and medium-term goals using appropriate measures, with strong industry stakeholder consultation throughout. Specific measures will be used to track improvements in life sciences output from research (expenditures, disclosures, patents, citations), to commercialization (licenses, spin-offs and start-ups), enterprise growth (early stage capital, formation rates, clustering), to
globalisation (survival and internationalization of companies).

- **Research Facilities Investment:** Through a $125 million investment, the Life Sciences Strategy will fund enhancement of existing research facilities across each of the research clusters, capitalizing on investments that have already been made, and it will fund new infrastructure where it is required to create a distributed provincial life sciences innovation system. Facility investments will be evaluated in terms of how they address the science and technology applications for the life sciences fields in which a given research cluster will focus. There will be a strong emphasis on development on leveraging national and corporate R&D facilities and on structuring facilities to encourage and support collaboration between institutions and with industry. The outcome will be a strengthened and highly focused network of research facilities serving the Life Sciences Strategy objectives.

- **Life Sciences Innovation Fund:** Funding of $75 million over 5 years will be awarded on a competitive basis to collaborative proposals focusing on strategic research cluster themes. The final form of these research and development themes will be crafted using a process involving scientists, industry and government stakeholders. Proposals may be joint submissions from multidisciplinary networks or consortia research teams from across British Columbia’s universities, with federal and industry laboratory partners. The review and selection process will be structured to ensure that the highest quality applied science will be achieved by the most appropriate team of investigators and their partners. Each initiative funded will be required to support an integrated set of applied R&D objectives that are designed, from the start, to move life sciences discovery to the marketplace or to improved management or policy initiatives or to healthier and more sustainable communities in British Columbia and Canada.

- **Life Sciences Commercialization and Technology Development Fund:** The Life Sciences Strategy will provide $50 million of funding over 5 years for commercialization and technology development, focusing on accelerating identification, development and deployment of innovations from each of the research cluster themes. This will include activities to seek out strategic innovations that may have been missed in the past as well as new sources of ideas. The fund will also will play a crucial role in enabling British Columbia’s life sciences cluster to better survive the challenges of early stage growth. The need for this was documented during the recent life sciences cluster strategy sessions for the BC Integrated Technology Initiative. Collaborative sessions with the life sciences industry, universities and investors reinforced a consensus that obtaining early stage capital—both pre-seed and seed—remains a fundamental impediment to British Columbia’s life science enterprises, despite improvements. By securing new sources of early stage capital British Columbia life sciences enterprises will be better able to attract domestic and international investors and continue their growth. This fund will have strong guidance from industry stakeholders to ensure that funds are used to mine life sciences innovation and build bridges to well-timed commercial investment. The structure of the commercialization and technology development fund activities will include:

  - **“Innovation Mining” Grants:** Funding will be provided to professionals with distinctive scientific and technology expertise who team with a cluster research network to systematically seek applicable intellectual property from within, across and outside of universities. The goal of these awards is foster efforts to purposefully find and strengthen innovation related to cluster research and development themes. The professionals will be funded by $5 million over 5 years to use a co-development approach in which they will serve as required as a broker between universities and companies. These “innovation miners” will seek ideas from appropriate sources that can be brought into each network for further development to add value. This fund will not compete with other funding sources. Innovations brought into a network by an “innovation mining” professional for development may then become candidates for prototype or pre-seed funding.

  - **Prototype and Pre-seed Capital Grants:** Funding of $10 million over 5 years for the preparation of an innovation for spin-offs will be provided to faculty and collaborators through a peer review process with both scientists and industry representatives. This review will require that applicants briefly demonstrate a developmental path for the prototype and pre-
seed funding that is effectively linked to the research cluster networks commercialization needs and objectives. This will include ensuring that the prototype or pre-seed activity documents participation by stakeholders—as research partners, funders, or licensees.

- **Challenge Fund:** This fund of $35 million will be designed to build an financial “bridge” to first round venture capital by providing “pre Series A” investment. As “first money” this capital will reduce risk for prospective investors and thereby attract or leverage additional capital for each deal. The key to effective operation of the Challenge Fund will be to maintain a continuous developmental path in which potential users or investment partners are identified early on and become committed to spin-off or new venture capitalization.