Technical Appendix

An Examination of Alberta Labour Markets – Labour Supply and Demand under Three Scenarios

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July 2013

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Contents

Executive Summary

Overall, aggregate labour shortages represented 2.3 per cent of total provincial labour demand in 2012 in the base scenario, and are forecast to reach as high as 10 per cent by 2016 if labour trends continue as anticipated. Using optimistic, high-scenario economic assumptions, shortages are projected to represent as much as 14.2 per cent of total labour demand by 2016. Even when pessimistic, low-growth scenario assumptions are imposed over the forecast, aggregate shortages grow from 2.1 per cent to 2.7 per cent of labour demand between 2012 and 2016.

In the base scenario, the GDP costs imposed on industries as a result of these labour shortages are projected to steadily increase from a 0.44 percentage point annual growth reduction in 2012 to 1.11 points in 2016. In the High scenario, annual GDP reductions are even greater, increasing from 0.51 percentage points in 2012 to 1.64 points in 2016. GDP costs in the low-growth scenario are significantly less, reaching a maximum of a 0.46 percentage point reduction in 2013.

Conclusion

The results of the analysis indicate that, while distributed unequally, projected labour shortages are a widespread issue throughout all of Alberta's industries and within the majority of occupational categories; even when considering a relatively pessimistic near-term provincial growth scenario. No region is expected to be immune to these shortages, and the near-term GDP implications could be substantial if these concerns are not addressed.

While the model provides explicit numerical demand, supply and shortage labour estimates across each occupation, industry and region, conclusions involving the general scope, magnitude, and location of labour shortages should be of greater interest to stakeholders. A member of Alberta's labour force may be more likely to undertake a specific type of education or training when possessing the information that their skills will be in high demand in Alberta. Similarly, employers are less vulnerable to production and productivity losses if they are able to plan in advance for recruitment and training, particularly if they are interested in filling positions for which skilled labour is in short supply. Lastly, governments and related institutions possess the incentive to hold labour imbalances at a minimum as their revenues partly depend on keeping unemployment rates low and productivity levels high.

As such, due to the myriad of factors influencing Alberta's labour market which may impact the specific time-sensitive results of the model, the results presented here should act as a broad signal to workers, employers and policymakers as to where their efforts should be focused to alleviate shortages (or surpluses) where they are found to be substantial.

1.0 Introduction

Alberta has been generally viewed as the engine of Canada's economic growth in recent years due to its abundant natural resources, accommodative business climate and multitude of employment prospects. The province is sitting on the third largest proven global crude oil reserve, which has laid the foundations for a prosperous and resilient economy. This has been both the key contributor to Alberta's economic success and the main factor for the cyclical ups and downs in the economy.

Due to rapid oil sands expansion, the energy sector remains the dominant force shaping Alberta's economic fortunes. While the province is not immune to economic downturns and is vulnerable to conditions of weak global demand for energy products, volatile oil and gas prices, and a limited ability to access new energy markets, it has experienced two decades of remarkable growth. Alberta posted the highest provincial average of real gross domestic product (GDP) growth between 1991 and 2011 at approximately 3.4 per cent per annum[1] despite the lasting impact of the 2008 recession. Economic diversification has also been underway with focus gradually shifting from the dominant energy sector to other sectors of the economy such as finance, real estate, business services, and construction,[2] in turn generating varied employment and investment opportunities.

Recent socio-economic trends continue to indicate that Alberta is a stable and thriving economy despite the challenging global backdrop. In 2012, Alberta remained a leader in national growth and recorded a GDP growth rate of 3.7 per cent - a pace nearly double that of the averages observed throughout the other provinces and the U.S.[3] Alberta's thriving economy has encouraged strong population growth and in 2012 posted the highest rate of growth among Canadian provinces at three per cent, primarily fuelled by migration.[4] On the employment front, Alberta churned out approximately one third of total job growth in Canada during 2012, and posted the highest level of employment growth across all provinces. In 2012, Albertans also enjoyed the lowest provincial unemployment rate of 4.6 per cent, which has steadily declined since peaking at 6.6 per cent in 2009. Alberta also posted the highest provincial participation rate in the country at 73.4 per cent in 2012.[5]

Despite the positive outlook, there are concerns that Alberta's booming economic growth may soon face dampened prospects due to a scarcity of labour, limiting the potential for growth in affected industries. Conversely, if global economic conditions deteriorate or geopolitical conflicts escalate, the potentially muted oil and gas prices may translate into a weaker provincial economy with a surplus of available workers.

Regardless of Alberta's economic outlook, significant labour shortages or surpluses impose a challenge to employers, labour force participants, as well as policymakers and researchers, as they signify an imbalance in the labour market. Given Alberta's recent economic performance, a labour shortage is the more likely scenario in the coming years, particularly if socio-demographic factors continue to impact Alberta's pool of available labour.

While growing at a solid pace and exhibiting strong participation rates, Alberta's labour force is aging – like that of other regions of Canada and other developed nations. It is estimated that between 2011 and 2021, the percentage of Albertans age 65 and older will increase from 11 to 15 per cent. By 2031, one in five Albertans will be of retirement age.[6] The cohort of baby boomers planning to exit Alberta's labour force, coupled with robust job creation and a subdued unemployment rate, implies the potential for ever-increasing labour demand with a potentially smaller pool of labour available to accommodate that demand. At the same time, the province has not fully tapped into its pool of available under-employed labour (i.e. aboriginal workers, youth, persons with disabilities), which could play a key role in mitigating labour shortages. Although Alberta's aboriginal population represents the fastest growing and

[1] Government of Alberta, Facts on Alberta, Living and Doing Business in Alberta, October 2012, p.2.
[2] Ibid.
[3] Calgary Chamber of Commerce Luncheon, Honourable Doug Horner, President of Treasury Board and Minister of Finance, January 2013, p.2.
[4] Statistics Canada, Quarterly Demographic Estimates, October to December 2012, vol. 26 no. 4, March 20, 2013.
[5] Government of Alberta, Alberta Labour Market, March 2013, http://eae.alberta.ca/media/350138/labour%20market%20outlook%202013.pdf
[6] Government of Alberta, Aging Population Policy Framework, November 2010.

youngest segment of Alberta's population,[7] this group has traditionally experienced lower participation and employment, and higher unemployment rates relative to provincial averages.

Although the 2008 recession and its lasting economic impacts have alleviated some of the pressure in Alberta's labour markets, worker and skill shortages are re-emerging as the economic recovery continues. Moreover, the resource-rich neighbouring economy of Saskatchewan is also facing a relatively tight labour market, entering into direct competition for labour with Alberta and placing further pressure on the available pool of labour.

> "Alberta's single greatest challenge to competitiveness is labour supply … the labour shortage will be structural and sustained, driven by demographic forces such as an aging population. Alberta will not be alone. Other developed economies are facing the same challenges and will be competing aggressively for the same workers. Alberta will face an ongoing battle for talent, both skilled and unskilled. Industry will need to adapt their business models, and deal with labour shortages as the "new normal."[8]

The Government of Alberta (GoA) *Occupational Demand and Supply Outlook* projects that Alberta's demand for labour will expand by 607,000 workers over the period 2011-2021, growing at an average annual rate of 2.4 per cent. Over the same period, a net increase of 492,000 workers is expected to join the labour force, growing at an average annual rate of 1.9 per cent. The forecast estimates that the province will face a cumulative labour shortage of approximately 114,000 workers over the ten year period.[9] If not addressed, this shortage may slow growth in heavily affected industries and trickle-down through the economy, costing jobs and government revenue.[10]

However, researchers and industry groups have suggested that labour shortages may be significantly larger than anticipated by the GoA, particularly within skilled occupations.

> "The government of Alberta has estimated that there will be a skills shortage of over 114,000 openings over the next 10 years, primarily in trades, science and technology, health care and business. But what we are hearing from industry leads us to believe the shortage in Alberta will be far greater."[11] *Dr. Glenn Feltham, President and CEO of the Northern Alberta Institute of Technology (NAIT)*

Similarly, the growing retail and food and accommodation sectors have also faced significant shortages of labour, which have often been mitigated through the employment of temporary foreign workers.[12]

However, policymakers could counter-act the looming labour shortages using a variety of methods. Traditionally under-represented groups such as mature workers, youths, the aboriginal population, and females could be engaged to participate in the labour force. For occupations that require a higher degree of skill, specific types of education could be encouraged. As well, migration from other regions of Canada and abroad could be promoted for workers possessing needed occupational skills.

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[7] Alberta Chambers of Commerce, Aboriginal Labour Force Strategy – Tapping into an Underutilized Pool of Labour Supply, July 2011.
[8] Alberta Competitiveness Council, *Moving Alberta Forward*, May 2011, p.3.
[9] Government of Alberta, Alberta's Occupational Demand and Supply Outlook 2011-2021, December 2, 2011, p.5.
[10] Alberta Coalition for Action on Labour Shortages, Coalition of Alberta Business Associations Call for Government Action on Labour Shortages, March 1, 2012.
[11] The Canadian Chamber of Commerce, Canada's Skills Crisis: What We Heard, September 27, 2012.
[12] CBC News, Alberta labour shortage blamed for influx of foreign workers, April 10, 2013.

1.1 Project Objectives

The main purpose of this part of the study is to estimate industry and occupation-specific demand for labour and how it relates to the potentially available supply of labour in the province. In particular, cases where labour demand outstrips the available supply, occupational labour shortages will result. Labour shortages can be costly, therefore the model also aims to estimate the economic impact of scarcity of workers on industry growth by developing two cases of labour demand – unconstrained and constrained.

Unconstrained labour demand assumes that even if encountering labour shortages, industries continue to grow at their predicted rate. As such, the unconstrained estimation allows for an analysis of the aggregate labour shortages if Alberta's economy is permitted to grow at its full potential. Conversely, constrained labour demand estimates the industry-specific growth costs associated with labour scarcity. Subsequently, the costs faced by affected industries limit their potential growth, translating into an overall loss of provincial output due to inter-industry relatedness.

Since labour demand is directly correlated to the growth prospects of Alberta's industries, the model considers three economic scenarios - base, high, and low. These scenarios incorporate various global, domestic and regional economic assumptions intended to encapsulate the ups and downs of Alberta's economy.

This analysis will assist governments, industries, workers and educational institutions in their strategic planning choices involving hiring, education, training and investment in Alberta's labour force – decisions central to alleviating future labour market imbalances.

The occupational forecast may provide insight on a variety of questions, including:

- Which occupations are in high demand? Which occupations are in excess supply?
- What types of skills, education and training correspond to highly demanded occupations?
- Which regions of Alberta are likely to experience the highest proportion of shortages/surpluses?
- Which industries are expected to encounter the largest shortages/surpluses?
- If labour shortages remain untended, what is the expected impact on industry growth?

2.0 Approach to the Analysis

The purpose of this sub-section is to highlight the basic theory underlying the model. As in most occupational forecasting estimations, this model focuses on exploring the functioning and dynamics of Alberta's labour market under various economic scenarios.

In the context of this model, the labour market can be thought of as the process by which labour demand (the number and type of available jobs) is matched with labour supply (the number and type of available workers). This matching process involves the interactions that take place between employers (demanders of labour) and workers (suppliers of labour). Labour services are exchanged through negotiations between demanders and suppliers, which in part determine the placement of workers into specific jobs, and the corresponding wages, benefits and terms of employment.

Employers estimate the number of workers required for an occupation by considering the cost of labour, the productivity of their workforce, and the current and anticipated levels of production.[13] This decision-making process on the part of the employer is defined as "occupational demand for labour". In this model, occupational demand includes the number of workers currently employed, as well as any additional vacancies that open as a result of industry growth or attrition. The sum of all jobs demanded across all industries and occupations in an economy is the aggregate demand for labour.

[13] Ministry of Training, Colleges and Universities, Guide to Using Labour Market Information in Ontario, August 2008, p.3.

The number of individuals currently employed or actively seeking employment is the "occupational supply of labour". Occupational supply is determined by the size and growth rate of the population, the share of the population willing to participate in the labour force, and the skills and training of the workforce. Other socio-economic factors shaping the supply of labour include the age distribution of the population; the retirement, migration and education choices of the labour force; the prevailing economic climate; and individuals' choice of allocating time between work and leisure.[14] The sum of all workers participating in the labour force in an economy is the aggregate supply of labour.

According to basic economic theory, equilibrium in a labour market is achieved when occupational demand and supply are perfectly matched. However, if a divergence between supply and demand occurs, the labour market becomes imbalanced. There are two types of imbalances - excess supply (which typically results in unemployment) and excess demand (which results in shortages of labour).[15] Labour market imbalances may be of a cyclical (short-term), structural (long-term) or demographic nature. Imbalances may also be triggered by inefficient educational or training choices on the part of the labour force.[16]

Labour markets tend to undergo adjustment when the demand and supply of labour are significantly imbalanced. For example, employers may address labour shortages by raising the wage rate, training their workforce to improve productivity, substituting labour with capital (if possible), or even relocating production to a different region. Conversely, workers may adjust to existing and expected labour market conditions by undergoing training for "in demand" skills, or relocating to areas where their skills are in greater demand. However, the described adjustment process takes place over time, as employers, workers and regulatory institutions do not possess perfect information and foresight regarding the ever-changing labour market conditions. For example, adjustments to worker training decisions (particularly for higher skilled occupations) and re-assessing institutional barriers to occupational placement could be a long-term process; implying that at any given time and place, it is almost a certainty that some degree of shortage or surplus will exist in a labour market.[17] Due to the long-term and potentially costly nature of labour market re-balancing, economists have developed tools to forecast and warn stakeholders of future labour market imbalances.

Occupational forecasting has become a key instrument in predicting labour market imbalances. At the base of most occupational models (including the model outlined in this report) is the Manpower Requirements Approach (MRA), which first gained widespread recognition in the 1960s when employed by the OECD for educational planning purposes.[18] This approach requires the estimation of two typically independently forecasted components: occupational demand and occupational supply. The occupational demand and supply forecasts are compared and if the supply does not match the demand, labour market imbalances are forecasted. These types of models rely on a number of economic assumptions, and among them is the premise that different occupations are not substitutable. This means that the supply of workers associated with one occupation has no immediate effect on the supply of workers in another occupation, even if the occupations require similar sets of skills. Hence, the elasticity of substitution is assumed to be zero.[19]

However, in reality, workers from different occupations may be fully or partly substitutable, provided that they possess identical or similar skill sets. Hence, the elasticity of substitution for occupations could vary between zero and one depending on the similarity of skill requirements. Taking a more realistic approach to analyze the functioning of Alberta's labour market, this study aims to consider inter-occupational mobility

[14] Ibid.
[15] Centre for the Study of Living Standards, El Achkar, S., CSLC Research Report 2010-07, August 2010, p.4.
[16] Ibid, p.3-4.
[17] Ibid, p.4.
[18] Research Centre for Education and the Labour Market, Eijs, Patrick van, The Manpower Requirements Approach, April 1993, p.4.
[19] Centre for the Study of Living Standards, El Achkar, S., CSLC Research Report 2010-07, August 2010, p.4.

by developing a job matching mechanism, taking into account the factors that influence worker and employer decisions.

The job matching mechanism employed in this study is broadly based on the "search and matching theory" which has been heavily influenced by the Nobel Prize winning work of Peter Diamond, Dale Mortensen and Christopher Pissarides. These researchers analyzed markets with search frictions and have been credited with the development of modern search and matching theory of unemployment.[20]

> "Search frictions are particularly important in the labor market ... Unemployed workers look for jobs at the same time that firms look for workers to fill their vacancies. It takes time and effort for a worker to find a suitable employer; similarly, a firm incurs costs while trying to hire a suitable employee. One reason these search costs arise is because the labor services being traded are not standardized. Some workers are more qualified than others, some firms' jobs require more skill than others, and often there is an important idiosyncratic component to the value of a prospective match between worker and firm. Another reason is that there are coordination frictions. Sometimes a worker applies for a job that would have been a good match had the firm not hired another worker in the meantime. Similarly, sometimes a firm finds a good worker for the vacancy it wants to fill only to find that he or she has been hired elsewhere."[21]

In this analysis, a job seeker searches for suitable employment considering factors important to the individual such as job suitability, remuneration, relative tightness of the labour market, as well as the manner of job separation from previous employment (seeking a higher wage/benefits, layoff, fired, etc.).

At the same time, an employer searches through potential candidates possessing certain attributes and compares them with a variety of criteria reflecting the skills required for the vacancy. Employers may also consider the relative tightness of the labour market as well as other variables, such as the fit of the candidate to the work environment and the manner of the candidate's separation from prior employment. Hence, the job matching mechanism can be broadly described as a comparison of the attractiveness of the job opportunity (from the point of view of the job seeker) and the attractiveness of the worker (from the point of view of the employer) with consideration given to general labour market conditions.

> "At each stage of the process a job seeker is paired with a position. The job seeker decides whether to apply for the position on the basis of its attractiveness. The employer then decides whether to call the applicant to interview on the basis of the application (his attractiveness). A job matching occurs after the interview only by mutual consent. These final decisions are based on both the attractiveness and character of the prospective partners. At equilibrium each individual uses a strategy appropriate to their type."[22]

Search and matching theory emphasizes the costs and benefits of the job search by the prospective employee. The job seeker does some internal analysis of the benefits of accepting employment versus continuing the search and the likelihood of a better opportunity on the horizon. Similarly, the employer conducts a similar benefit-cost analysis based on the quality of candidates available to fill a position at the time, compared to their expected prospects of finding a better-qualified candidate. These benefit-cost equations will vary depending on the conditions in the labor market and overall economy.

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[20] The Royal Swedish Academy of Sciences, Markets with Search Frictions, compiled by the Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, October 11, 2011, p.1.
[21] Albrecht, James, Department of Economics, Georgetown University, Washington DC, The 2010 Nobel Memorial Prize in Search Theory, February 2, 2011, p.2. http://www9.georgetown.edu/faculty/albrecht/SJE%20Survey.pdf
[22] Ramsey, David M. & Kinsella, Stephen, A Labour Market Matching Model with Multiple Criteria, 2009. http://www.stephenkinsella.net/2009/02/19/a-labour-market-matching-model-with-multiple-criteria/

2.1 Framework for the Analysis

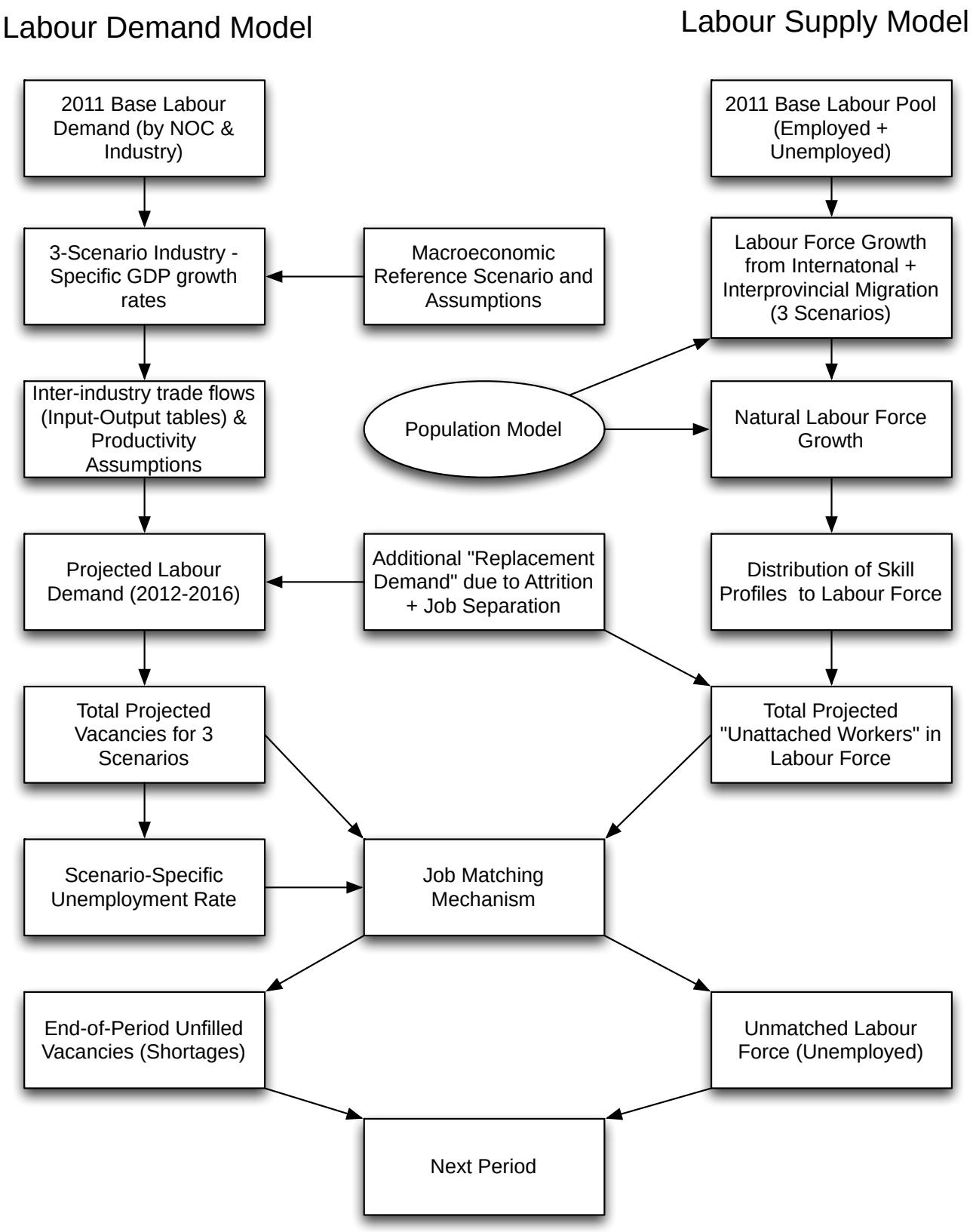
The forecasting model is comprised of three general sub-components. These sub-components include an estimation of labour demand, an estimation of labour supply, and a job matching mechanism that estimates the suitability of matching across various occupations, discussed in greater detail in the previous section.

The general outline of the model is as follows: Industry and occupation-specific vacancies created through expansionary industry activity are estimated, along with vacancies created due to job separation and attrition. The existing pool of labour is then transitioned into these vacancies based on estimated suitability and type of worker. Occupation vacancies continue to be filled until there are no suitable workers in the supply of labour to perform the available position; any unfilled position is considered a shortage.

Workers transition into employment until they cannot find a job that they are able (or willing) to fill; any worker unable to transition into an occupation is considered unemployed and remains in the pool of labour until the next period when he may adjust his expectations in the next round of skill matching.

It should be noted that the model assumes the labour market to be in a state of equilibrium (with the exception of a pool of unemployed workers) at the beginning of 2012. That is, any existing labour shortages that may exist prior to the forecast period (2012 to 2016) are not included in the estimation.

Figure 1 provides an outline of the structure and overall functionality of the model.


Labour Demand Model
Labour Supply Model
2011 Base Labour Demand (by NOC & Industry)
2011 Base Labour Pool (Employed + Unemployed)
3-Scenario Industry - Specific GDP growth rates
Macroeconomic Reference Scenario and Assumptions
Labour Force Growth from Internatonal + Interprovincial Migration (3 Scenarios)
Inter-industry trade flows (Input-Output tables) & Productivity Assumptions
Population Model
Natural Labour Force Growth
Projected Labour Demand (2012-2016)
Additional "Replacement Demand" due to Attrition + Job Separation
Distribution of Skill Profiles to Labour Force
Total Projected Vacancies for 3 Scenarios
Total Projected "Unattached Workers" in Labour Force
Scenario-Specific Unemployment Rate
Job Matching Mechanism
End-of-Period Unfilled Vacancies (Shortages)
Unmatched Labour Force (Unemployed)
Next Period

2.1.1 Unconstrained Demand for Workers

The unconstrained labour demand model estimates aggregate National Occupation Classification (NOC) specific job creation figures according to industry GDP growth rates in Alberta. "Unconstrained" means that in the model's estimation, the industry will grow by its predicted rate even if the industry encounters labour shortages. The unconstrained model is built on the premise that labour shortages exist, but do not impose any direct cost to industries, or alternatively that industries immediately determine a strategy to overcome these costs (e.g. by increasing the productivity of its labour) and grow as if no scarcity of labour was present. The purpose of this model is to estimate the number of each type of worker that would be required to support potential industry growth. Further, the estimation of the "unconstrained" demand is necessary for the calculation of the "constrained" labour demand.

2.1.2 Labour Market Constrained Growth

The constrained labour demand analysis estimates an output-related cost associated with any labour shortage that an industry encounters in the forecast. For example, if an industry is expected to grow by five per cent in a given year and encounters a shortage of 500 workers, the industry may grow by just four per cent instead due to production being limited by labour constraints. This consideration may lead to reduced growth in other Alberta industries due to the impacted industry engaging in less-than-anticipated trade with its supporting industries, initiating a chain of negative growth shocks through the provincial economy across time. So, in the constrained scenario, an industry may post a lower-than-expected level of output growth (and subsequently, lower-than-expected effective labour demand) even if it doesn't encounter any labour shortages; this would occur if the industry receives less revenue than expected from inter-industry purchases. Contrary to the unconstrained model, the constrained estimation assumes that industries incur costs due to labour shortages, and these costs drag down overall provincial GDP and labour demand due to inter-industry relatedness.

2.2 Employment Demand Model

Demand for labour is estimated using annual percentage output growth projections for 61 industries in Alberta for the period 2012 to 2016. Depending on the growth scenario (base, high or low), these projections were derived from sources including forecasting and government institutions as well as records of historic industry-specific growth. Based on these output projections, the occupational composition of an industry's labour force in 2011 and assumptions regarding annual labour productivity growth, the number of net vacancies available in each type of position for each industry is estimated across the forecast period. These occupational vacancy projections can be thought of as positions generated through economic growth (or potentially destroyed in the case of very low or negative projected output growth).

An input-output estimation is also used in conjunction with output-driven labour demand to determine the impact of inter-industry relatedness in terms of driver/support industries. For example, an industry exhibiting higher-than-anticipated growth will also purchase more inputs to production from its supporting industries, generating growth in the supporting industry, which in turn generates growth in second-tier supporting industries, and so forth. As such, due to inter-industry relatedness, the initial boost experienced by the first industry initiates a ripple effect that impacts the overall economy over time, and additional employment opportunities across industries are potentially generated.

Similarly, a general inter-provincial input-output estimation is also used to analyze how a shock to growth to an Alberta industry will impact inter-provincial trade flows. For example, higher growth in an Alberta

industry may result in that industry engaging in more purchases of inputs to production from industries in other provinces. The increase in inter-provincial purchases, triggered by an industry in Alberta growing beyond expectations, leads to higher growth in a recipient industry in a different province, subsequently resulting in a greater amount of aggregate national purchases as industries trade with one another both locally and inter-provincially. The intensified activity occurring in other provinces ripples back to Alberta industries over time, generating additional growth and employment opportunities across industries in Alberta. For the purpose of the model, the latest available input-output data for 2008 was obtained from Statistics Canada's *Systems of National Accounts*.

Also estimated are the number of net vacancies opening in each occupation and industry due to job separation and attrition. These vacancies are generated through factors such as Alberta's population dynamics (retirement or mortality), the prevailing provincial economic conditions (i.e. a tight labour market may lead to some workers opting to separate from their position to seek a higher wage), and firings.

2.3 Labour Redistribution (Supply) Model

The supply of labour is estimated by beginning with industry and job-specific employment (and unemployment) in Alberta's 2011 labour force, and applying a variety of population-related considerations through the forecast period. These considerations include age-specific participation rates as the population structure changes across time, net migration to Alberta (international and interprovincial), individuals leaving school and entering the labour force, and individuals leaving the labour force due to retirement or other reasons.

Worker-specific skill and education levels are typically assigned in the model based on the current or most recent position filled by the worker. New entrants to Alberta's labour force are assigned skill and education levels based on the nature of their entrance (migration, leaving school, etc.). In order to develop occupational profiles for sub-populations for whom the most recent position filled was unknown (unemployed, migrants), sources such as the *Labour Market Outlook* by the GoA as well the *Canadian Occupational Projection System (COPS)* by Human Resources and Skills Development Canada (HRSDC) were utilized.

2.4 Occupational Matching Mechanism

The matching mechanism estimates the suitability of a job candidate across all positions in Alberta, based on the set of skills and education assigned to the candidate. The theoretical underpinnings of this model are discussed in greater detail in section 2.1 of this report.

The job candidate who has separated from prior employment for some reason seeks employment based on a number of criteria including skill type and level, educational attainment as well as the manner of their job separation (e.g. voluntary separation, firing, layoff, etc.) - a factor heavily influencing the worker's wage expectations. In a similar fashion, firms seek to fill vacancies by selecting the most suitable candidate. Employers assess a candidate's skills and educational compatibility with the vacancy, as well as the applicant's reason for prior job separation.

The overall state of Alberta's economy is also a consideration when employers and job seekers interact. A worker is deemed suitable to fill a vacant position if a certain threshold of job matching is achieved in the model. This threshold varies according to the projected economic conditions in Alberta, with tighter labour market conditions generally allowing workers a greater degree of choice in occupation and a reduced inclination to accept low-skill or low-wage employment, and vice versa. The tightness of the labour market is primarily reflected by the unemployment rate.

To allow for greater realism in labour market interactions in the model, employers rank candidates based on the nature of their separation from prior employment. For example, if two candidates possess identical skill and education attributes but differing manners of job separation – the first was fired and the second left to pursue career advancement – the model assumes that the employer prefers to hire the second candidate due to the stigma typically attached to fired workers. Similar is the logic applied to new entrants to the labour

market applying for vacancies. Although new entrants may possess the required skills and education to fill a vacancy, an employer typically prefers to hire an identical candidate with strong motivation (*i.e.* separated from previous job to pursue career advancement) or prior work experience. Provided that top choice workers to employers are insufficient to fill all vacancies, employers will continue to hire workers, based on a ranking scheme as shown in the table below, until the vacancies are filled or the supply of candidates is depleted.

Workers form wage expectations for prospective occupations based on the wage they received in a previous occupation, the manner of their job separation, relative tightness of the labour market (as indicated by the unemployment rate) and their prior work experience. The table below also provides model assumptions regarding worker wage expectations according to reason for separation in a "standard" labour market environment (unemployment rate (U) between four and six per cent). In relatively tighter or looser labour market conditions, the model allows for adjustment to the presented wage expectations.

Reason for Separation from Origin Occupation (in order of employer preference)	Definition	Worker's Expected Wage (% of origin wage), Moderate Labour Market (4%<U<6%)
1. Career Advancement	An individual who has separated from prior employment and seeks to advance their professional development, even if it means a short-term wage cut.	Minimum 90% of origin wage required.
2. Pay/Benefits	An individual who has separated from prior employment in pursuit of better pay/benefits.	Minimum 110% of origin wage required.
3. Other (Voluntary Quit)	An individual who has separated from prior employment voluntarily for other general reasons such as care-giving, travel, interest in other opportunities, etc.	Minimum 100% of origin wage required.
4. Inter-Provincial Migrant	A new entrant to Alberta's labour market who may or may not possess prior work experience elsewhere in Canada.	Minimum 80% of origin wage required.
5. Layoff	An individual who has separated from prior employment due to a lack of work brought about by industry downturn or corporate re-organization.	Minimum 80% of origin wage required.
6. International Migrant	A new entrant to Alberta's labour market who may or may not possess prior work experience elsewhere. This may be a recent immigrant to Canada.	Minimum 80% of origin wage required.
7. School Leaver	A new entrant to Alberta's labour market who possesses little to no work experience related to their career path. This may be a student who has recently completed their degree.	Minimum 80% of desired wage required.
8. Unemployed	An individual who is jobless but actively seeking employment. For the purposes of the model, these are workers who were unemployed at the beginning of the forecast period or were unable to find employment through the matching process for at least one period.	Minimum 80% of origin wage required.
9. Fired	An individual who has separated from prior employment due to involuntary termination by their employer. Employers are least inclined to hire from this pool of labour due to a negative perception of their work ethic.	Minimum 80% of origin wage required.

The matching mechanism uses HRSDC Essential Skills Profiles, which are available for 350 occupations from the National Occupational Classification (NOC).

> "Essential Skills are not the technical skills required by particular occupations but rather the skills applied in all occupations. For example, writing skills are required in a broad range of occupations. The complexity and frequency of writing varies, of course. Some workers fill out

simple forms every day, while others write daily or monthly reports. Essential Skills enable people to do their work. For example, repair persons may have to read and understand written work orders before they can do the repairs."[23]

According to HRSDC, there are nine primary, essential skills which vary in usage and complexity depending on the occupation. In addition, each occupation is assigned most important essential skills (MIES) and a corresponding minimum and maximum required education level ranging from "no formal education or training" to "post graduate or professional degree".

HRSDC Essential Skills:

> Reading Text, Document Use, Writing, Numeracy, Oral Communication, Thinking Skills, Problem Solving, Decision Making, Critical Thinking, Job Task Planning and Organizing, Significant Use of Memory, Finding Information, Working with Others, Computer Use, Continuous Learning

Using this data, occupations are compared according to scores assigned to specific skill use, skill level and MIES.

2.5 Population Forecast

Demographic trends play a significant role in shaping the current and future supply of labour in Alberta. To estimate the size of the available labour supply, a population forecasting model spanning 2012-16 was developed. Annual population growth by age and gender cohorts was calculated through the two main determinants of population growth – natural increase and net migration. Age and gender-specific fertility, mortality, and participation rates were applied to the projected Alberta population structure. Natural increase does not play a substantial part in labour supply as this forecast only covers a five-year period; and net international migration is assumed to be steady over the forecast due to institutional regulations. The model assumes that the largest population and resulting labour supply increases come from inter-provincial migration, as has generally been the case for Alberta. Depending on the growth scenario, net inter-provincial migration to Alberta is adjusted to reflect the relative attractiveness of the Alberta labour market. Robust provincial economic growth is assumed to encourage a larger flow of inter-provincial migrants, with relatively fewer migrants in the low growth scenario.

Other population considerations include the age, gender, participation and skill profiles of individuals leaving school, new international and inter-provincial migrants, and the existing pool of unemployed workers at the beginning of the forecast period.

3.0 Growth Scenarios

Applications Management Consulting prepared three scenarios of economic growth and the associated demand and supply of workers required to support this growth. The three economic scenarios were designed to cover a wide range of potential economic activity, reflecting the cyclical nature of economic growth in the Alberta economy. Each of these scenarios covers a five-year forecast period beginning in 2012 and ending in 2016.

3.1 Base Scenario

The Base Scenario has been constructed to largely follow the Government of Alberta projections of economic activity over the next five years as outlined in the "Economic Outlook: Budget 2013". While economic growth has been moderating, the budget forecast projected relatively strong economic growth for Alberta. After an estimated growth rate of 3.8 per cent in 2012, real GDP is forecast to grow at an annual rate of between 2.8 and 2.9 per cent per year to the end of the forecast period.

Oil prices are a key forecast assumption, with oil sands and other energy sector development expected to continue to lead economic growth in Alberta. Economic growth in the United States is expected to remain

[23] HRSDC, Reader's Guide to Essential Skills Profiles. http://www.hrsdc.gc.ca/eng/jobs/les/profiles/readersguide.shtml

modest, but advance at a moderate pace. Other advanced economies are expected to continue to struggle to maintain growth. Eurozone debt and other international finance risks continue to hold worldwide economic recovery in check. This poses some limits for Alberta's growth as demand and prices for energy and other commodities are projected to remain moderate over the forecast period.

Oil prices are projected to range between $93.00 and $95.50 US$/bbl from 2013 and 2016. This forecast is generally more conservative than projections of West Texas Intermediate (WTI) oil prices over the same period. As noted by the Government of Alberta, the oil price differentials paid to Alberta producers compared to the WTI price has increased resulting in less revenues to producers and lower royalty revenues to the province. As well, the proportion of total oil production in Alberta is increasingly coming from non-conventional sources.

Natural gas prices are projected to increase modestly over the forecast period from $3.70 to $4.80 US$/MMBTU. This forecast is also relatively conservative when compared to most forecasting agencies.

Other key forecasting assumptions involve the US exchange rate, inflation and short-term interest rates. The value of the Canadian dollar is projected to hold roughly at par relative to the US dollar over the forecast period. This means that Alberta's exports to the US will remain roughly at their current competitive position. Inflation is expected to remain relatively subdued over the forecast period, ranging between 2.0 and 2.5 per cent per year to 2016. Finally, short term borrowing rates (three-month Government of Canada Treasury Bills) are projected to increase from the current rate of one per cent to approximately 2.75 per cent by the end of the forecast period.

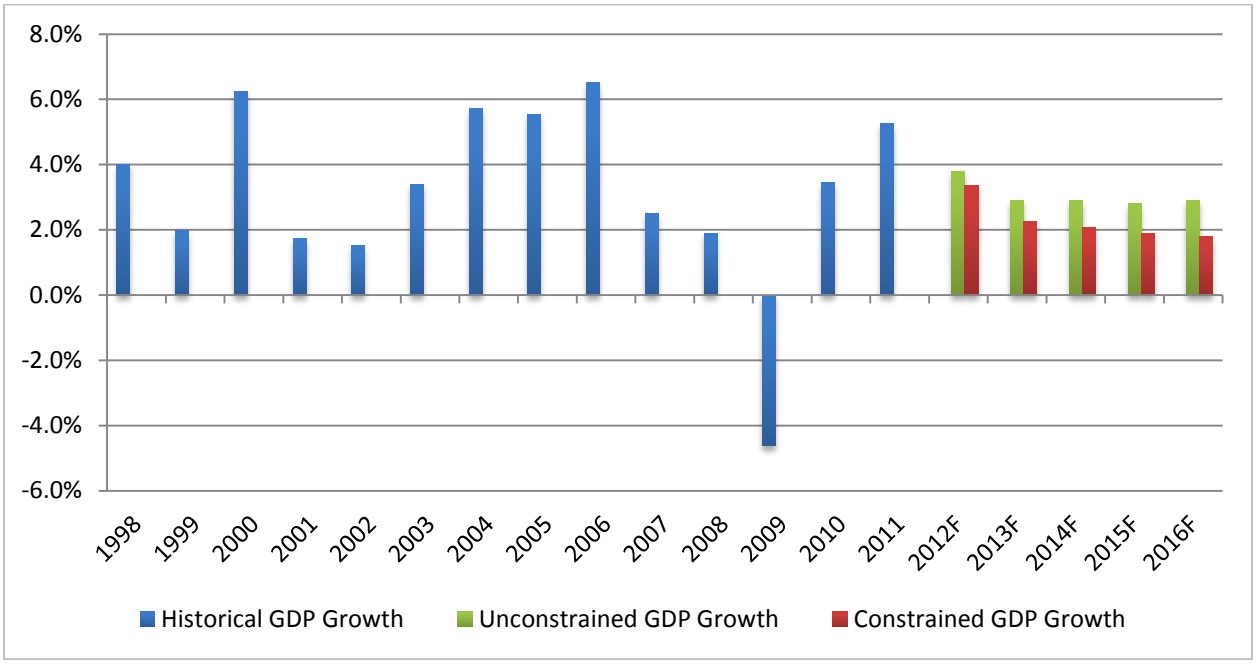
The economic growth projected for Alberta, both with and without constraints due to labour shortages, is provided in the table below.

Growth in Real GDP at Basic Prices (Base Scenario)

Real GDP	2012	2013	2014	2015	2016
Unconstrained Scenario	3.80%	2.90%	2.90%	2.80%	2.90%
Constrained Scenario	3.36%	2.25%	2.08%	1.89%	1.79%
GDP impact of labour supply constraint	0.44%	0.65%	0.82%	0.91%	1.11%

The "unconstrained" scenario implies that in the model's estimation, the industry will grow by its predicted (potential) rate even if it encounters labour shortages. In contrast, the "constrained" scenario estimates a GDP-related cost associated with any labour shortages that an industry encounters. Due to the inter-related nature of Alberta's industries, an industry may post a lower-than-expected level of GDP in the constrained scenario even if it doesn't experience any labour shortages. The impact of labour supply constraints on growth in the Alberta economy over the five-year forecast period grows over time, from a 0.44 per cent reduction of GDP in 2012 to a 1.11 per cent reduction of GDP by 2016. Over the five-year period, it is estimated that the opportunity cost of economic growth is equal to 3.5 per cent. The graph below presents these findings.

Alberta Real Annual GDP Growth Rate, Historic and Projected: 1998-2016 (Base Scenario)



Source: Cansim, Table 379-0025: Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS) and province, Chained 2002 dollars.

The total labour demand estimates in both the constrained and unconstrained estimations are provided in the table below. Also shown are the cumulative labour shortages as a share of unconstrained labour demand. Again, unconstrained labour demand may be interpreted as the labour required to accommodate potential industry growth in Alberta. Constrained labour demand may be interpreted as the amount of labour that industries are able to employ, after labour shortages and the inter-industry costs of those shortages are imposed.

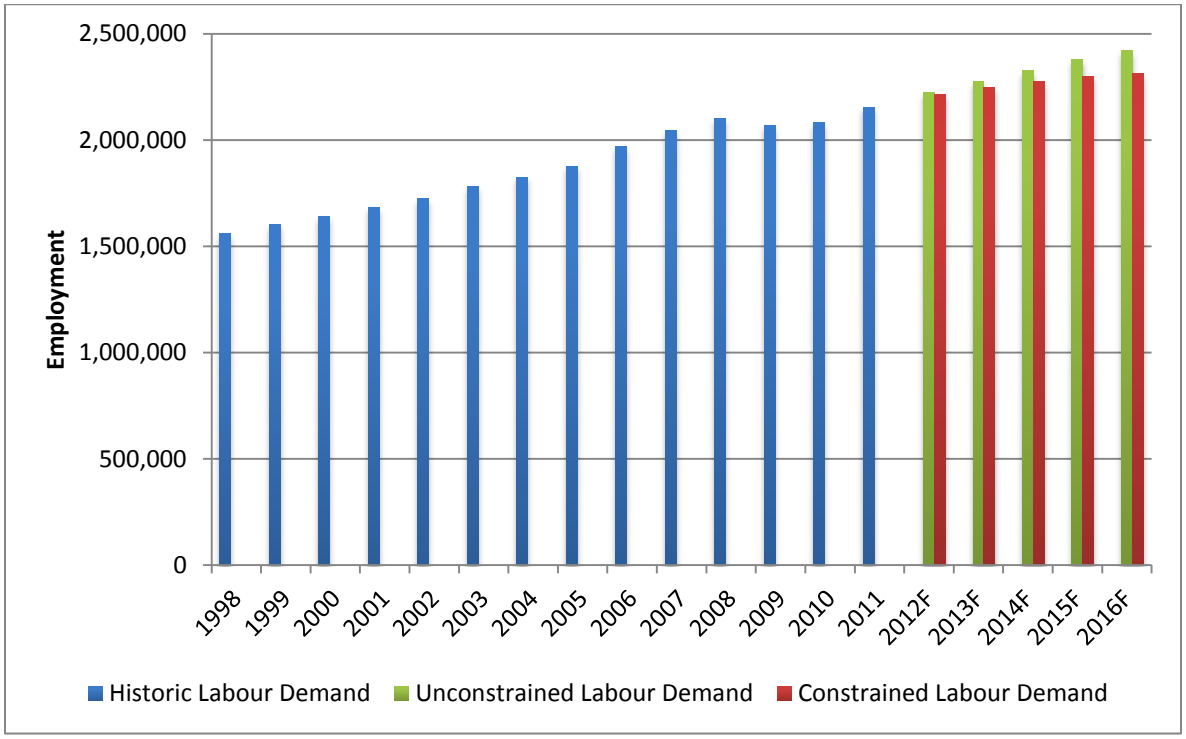
Projected Total Employment Demanded (Base Scenario)

Employment	2012	2013	2014	2015	2016
Unconstrained Labour Demand	2,224,285	2,275,151	2,328,188	2,377,595	2,423,247
Labour Shortages (Cumulative) as a % of Unconstrained Labor Demand	2.23%	4.2%	6.29%	8.11%	10.01%
Constrained Labour Demand	2,212,532	2,245,719	2,276,274	2,300,306	2,314,375

The unconstrained labour demand scenario assumes that industries in Alberta will expand at their predicted rate even if they face labour shortages. In other words, although labour shortages exist and accumulate over time, industries will continue to expand and trade with each other as expected. Conversely, the constrained model assumes that industries incur costs due to estimated labour shortages, and these costs drag down overall provincial GDP due to inter-industry relatedness. As such, in the constrained scenario an industry may have a lower-than-expected level of GDP (and also lower-than-expected labour demand) even if it doesn't experience any labour shortages. As a result, the reduced growth posted by industries will also lower

overall provincial demand for labour. The graph below presents historic employment data as well as projected unconstrained and constrained labour demand figures.

Alberta Employment Demand, Historic and Projected: 1998-2016 (Base Scenario)



Source: Cansim, Table 383-0010: Labour statistics by business sector industry and non-commercial activity, consistent with the System of National Accounts, by North American Industry Classification System (NAICS).

3.2 High Growth Scenario

The High Growth Scenario represents how the Alberta economy could grow over the next five years employing optimistic assumptions around most key factors that affect the province. This scenario is designed to determine the importance of an adequate supply of skilled workers that will be required to support relatively stronger economic growth in Alberta. The assumptions employed in this scenario include the following:

- World energy prices grow rapidly as a result of positive economic growth in mature and emerging economies.
- Some energy supply constraints emerge as a result of geopolitical unrest in key competitive regions that helps to put further upward pressure on energy prices.
- The Keystone and Gateway pipeline projects are approved and construction is fast-tracked to take advantage of strong energy markets and Alberta's large supply of oil.
- Alberta's chemical and petro-chemical sectors experience a renaissance and approved projects in Wood Buffalo and the Industrial Heartland proceed.
- US economic growth is fuelled by a rebounding housing market. This in turn creates a renewed demand for Alberta's forest products.

- Alberta's agriculture and food processing sectors experience growth in product acceptance and market share abroad.
- The rebounding world-wide economy results in an increase in Alberta's tourism sector.
- The growth and aging of Alberta's population results in high growth in the demand for health care services and the health care sector.
- Positive provincial economic growth and improved energy prices results in a return to pre-recession spending levels.

Oil prices in the High Growth Scenario are projected to grow to over $130 US$/bbl (WTI) by 2016. This forecast assumes that there is an increase in global demand for oil, fueled by strong economic growth in both mature and emerging economies. In addition, it is assumed that there will be disruptions in energy production among countries competing with Alberta in the export of oil.

Natural gas prices are projected to increase over the Base Scenario forecast period to $5.50 US$/MMBTU. This is only slightly higher than the rate assumed in the Base Scenario.

The value of the Canadian dollar is projected to drop relative to the US dollar over the forecast period with the Cdn/US exchange rate falling to $0.95 by 2016. This means that Alberta's exports will improve against their current competitive position in US markets. Inflation is expected to increase at a faster pace over the forecast period, reaching three per cent per year by 2016. Finally, short-term borrowing rates (three-month Government of Canada Treasury Bills) are projected to increase from the current rate of one per cent to approximately 2.75 per cent by the end of the forecast period.

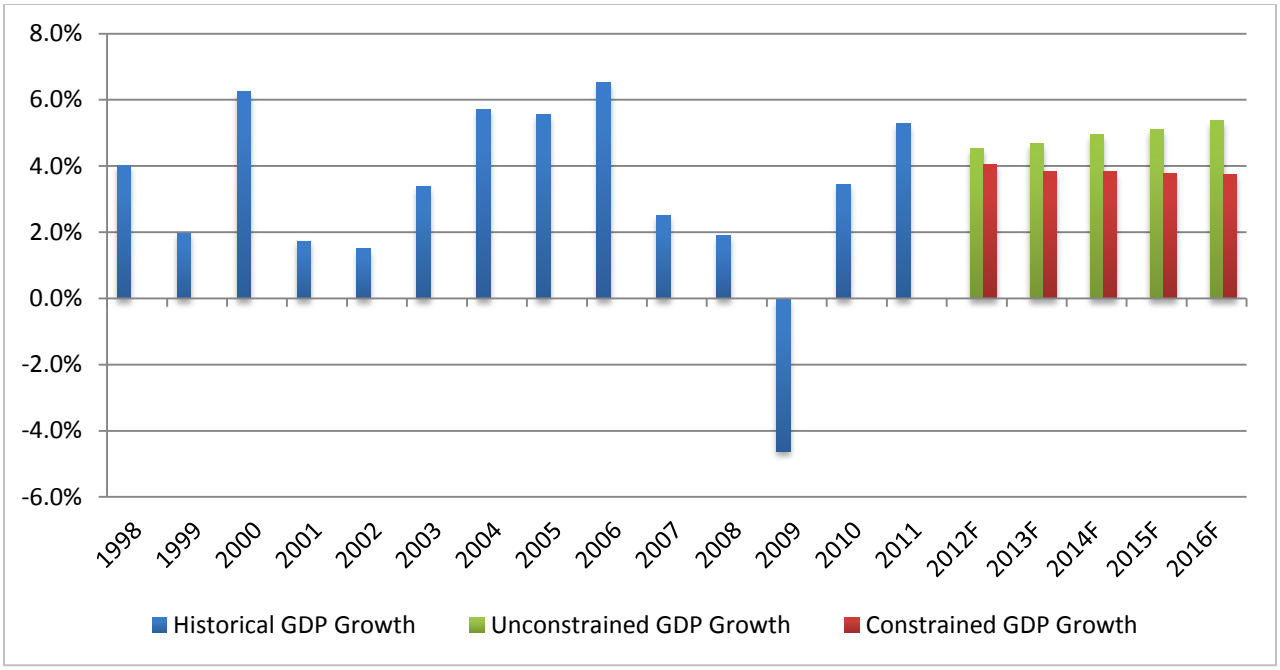
The economic growth projected for Alberta, both with and without constraints due to labour shortages for the High Growth Scenario, is provided in the table below.

Growth in Real GDP at Basic Prices (High Growth Scenario)

Real GDP	2012	2013	2014	2015	2016
Unconstrained Scenario	4.53%	4.68%	4.94%	5.09%	5.37%
Constrained Scenario	4.03%	3.83%	3.83%	3.78%	3.73%
Impact of labour supply constraint	0.51%	0.85%	1.11%	1.31%	1.64%

The "unconstrained" scenario implies that in the model's estimation, the industry will grow by its predicted (potential) rate even if it encounters labour shortages. In contrast, the "constrained" scenario estimates a GDP-related cost associated with any labour shortages that an industry encounters. Due to the inter-related nature of Alberta's industries, an industry may post a lower-than-expected level of GDP in the constrained scenario even if it doesn't experience any labour shortages. The impact of labour supply constraints on growth in the Alberta economy over the five-year forecast period grows over time, from a 0.51 per cent reduction of GDP in 2012 to a 1.64 per cent reduction of GDP by 2016. Over the five-year period, it is estimated that the opportunity cost of economic growth is equal to 4.9 per cent. The graph below presents these findings.

Alberta Real Annual GDP Growth Rate, Historic and Projected: 1998-2016 (High Growth Scenario)



Source: Cansim, Table 379-0025: Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS) and province, Chained 2002 dollars.

The total labour demand estimates in both the constrained and unconstrained estimations are provided in the table below. Also shown are the cumulative labour shortages as a share of unconstrained labour demand. Again, unconstrained labour demand may be interpreted as the labour required to accommodate potential industry growth in Alberta. Constrained labour demand may be interpreted as the amount of labour that industries are able to employ, after labour shortages and the inter-industry costs of those shortages are imposed.

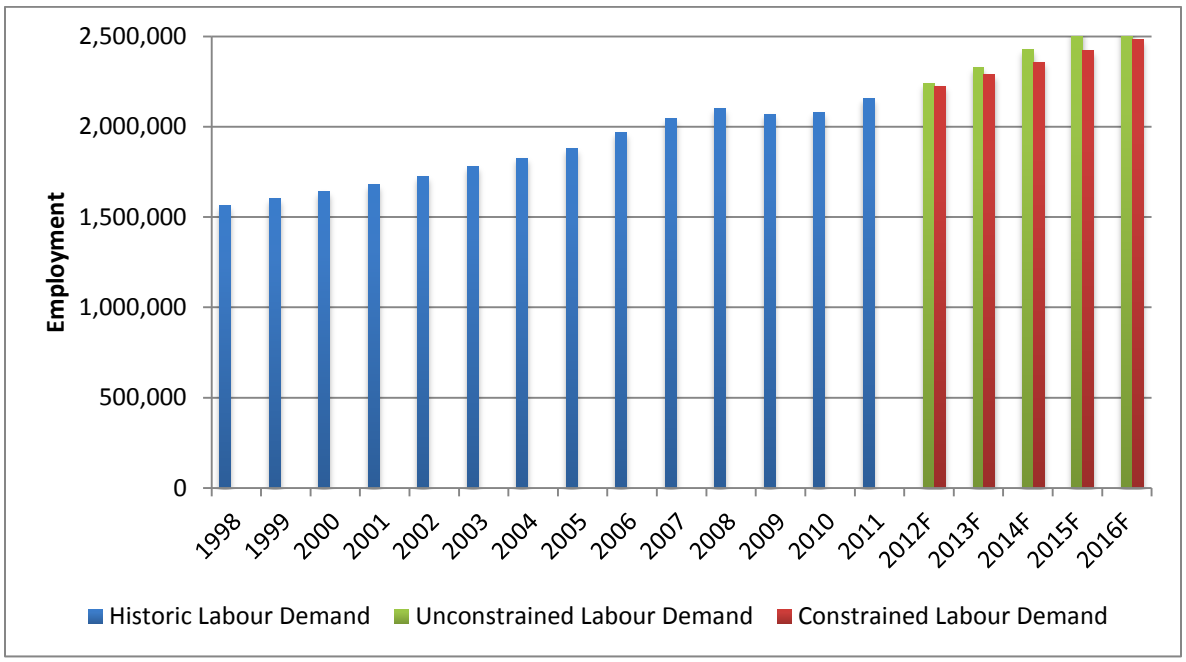
Projected Total Employment Demanded (High Growth Scenario)

Employment	2012	2013	2014	2015	2016
Unconstrained Labour Demand	2,238,169	2,326,795	2,426,372	2,529,841	2,638,306
Labour Shortages (Cumulative) as a % of Unconstrained Labor Demand	2.59%	5.35%	8.26%	11.37%	14.20%
Constrained Labour Demand	2,224,829	2,290,253	2,358,265	2,422,780	2,480,341

The unconstrained labour demand scenario assumes that industries in Alberta will expand at their predicted rate even if they face labour shortages. In other words, although labour shortages exist and accumulate over

time, industries will continue to expand and trade with each other as expected. Conversely, the constrained model assumes that industries incur costs due to estimated labour shortages, and these costs drag down overall provincial GDP due to inter-industry relatedness. As such, in the constrained scenario an industry may have a lower-than-expected level of GDP (and also lower-than-expected labour demand) even if it doesn't experience any labour shortages. As a result, the reduced growth posted by industries will also lower overall provincial demand for labour. The graph below presents historic employment data as well as projected unconstrained and constrained labour demand figures.

Alberta Employment Demand, Historic and Projected: 1998-2016 (High Growth Scenario)



Source: Cansim, Table 383-0010: Labour statistics by business sector industry and non-commercial activity, consistent with the System of National Accounts, by North American Industry Classification System (NAICS).

3.3 Low Growth Scenario

The Low Growth Scenario represents how the Alberta economy could grow over the next five years employing pessimistic assumptions around most key factors that affect the province. This scenario is designed to explore the impact on the labour market of a significant slowdown in the Alberta economy. The assumptions employed in this scenario include the following:

- Global economic growth continues to decline with the Eurozone continuing to be at best in no-growth status. The US economic recovery continues to slow and there is no improvement observed in key economic sectors, such as housing.
- Growth among emerging economies also continues to slow with Alberta's major export markets in malaise. The growth of China and India are not sufficient to compensate for the loss in export market growth.
- Global demand for energy products softens and prices fall due to declining economic growth. Supply of energy is not disrupted by any geopolitical issues, keeping downward pressure on prices.
- Enhanced energy recovery techniques expand the global supply of economically recoverable oil and natural gas resources.

- Technological breakthroughs in clean energy sources (e.g. wind, solar, geothermal) lead to an increase in the rate of substitution of clean energy for traditional carbon based resources.
- Slow economic growth results in reduced government revenues and fiscal restraint across all sectors.

Oil prices in the Low Scenario are projected to decline to $80 US$/bbl (WTI) by 2016. This forecast assumes that there is a general decline in economic growth and demand for energy, as well as increasing competition of supply from current producers and emerging producers of carbon and other green energy sources.

Natural gas prices are projected to decline over the forecast period to $3.50 US$/MMBTU, a slightly lower rate than assumed in the Base Scenario.

The value of the Canadian dollar is projected to increase relative to the US dollar over the forecast period with the Canadian/US exchange rate increasing to $1.05 by 2016. This means that Alberta's exports will cost more compared to their current competitive position in US markets. Inflation is expected to remain relatively stable over the forecast period, roughly averaging two per cent per year to 2016. Finally, short term borrowing rates (three-month Government of Canada Treasury Bills) are projected to remain just above current rates, approaching 1.5 per cent by the end of the forecast period.

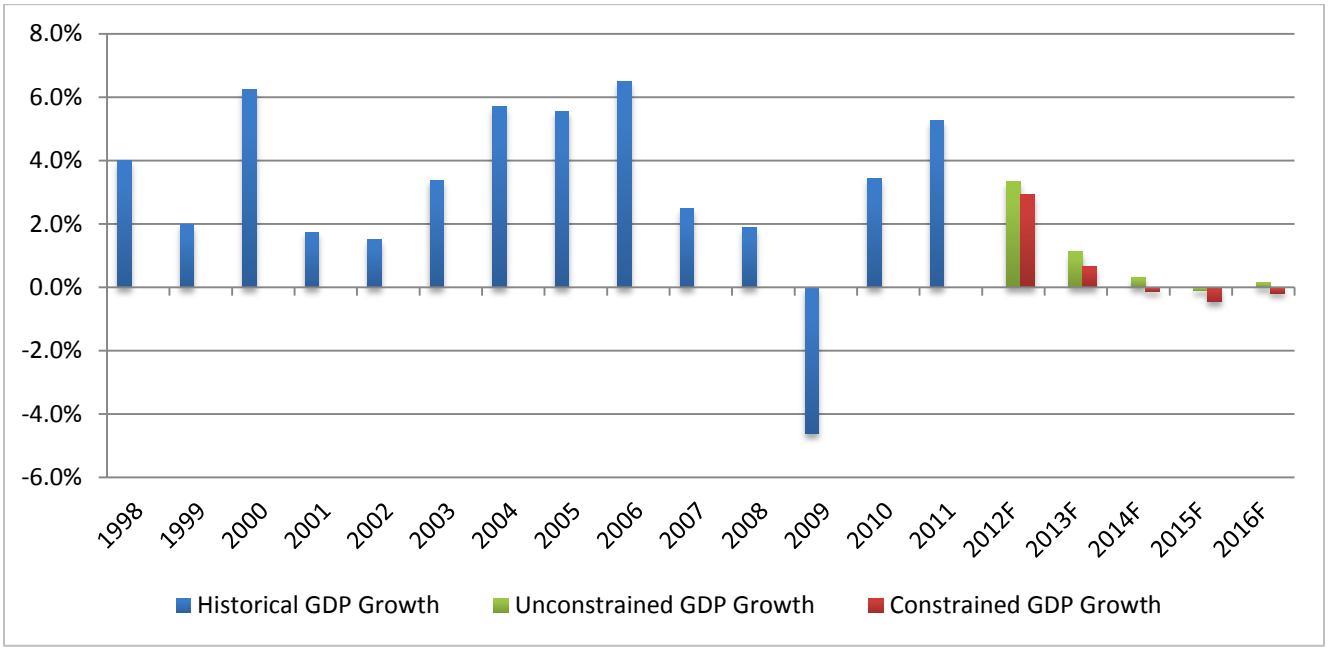
The economic growth projected for Alberta, both with and without constraints due to labour shortages for the Low Growth Scenario, is provided in the table below.

Growth in Real GDP at Basic Prices (Low Growth Scenario)

Real GDP	2012	2013	2014	2015	2016
Unconstrained Scenario	3.33%	1.12%	0.32%	-0.11%	0.16%
Constrained Scenario	2.94%	0.67%	-0.13%	-0.46%	-0.18%
Impact of labour supply constraint	0.39%	0.46%	0.45%	0.35%	0.34%

The "unconstrained" scenario implies that in the model's estimation, the industry will grow by its predicted (potential) rate even if it encounters labour shortages. In contrast, the "constrained" scenario estimates a GDP-related cost associated with any labour shortages that an industry encounters. Due to the inter-related nature of Alberta's industries, an industry may post a lower-than-expected level of GDP in the constrained scenario even if it doesn't experience any labour shortages. The impact of labour supply constraints on growth in the Alberta economy over the five-year forecast period remains relatively constant over the forecast period between a 0.39 per cent reduction in GDP in 2012 to 0.46 per cent in the most impacted year (2013). Over the five-year period, it is estimated that the opportunity cost of economic growth is equal to 1.6 per cent. The graph below presents these findings.

Alberta Real Annual GDP Growth Rate, Historic and Projected: 1998-2016 (Low Growth Scenario)



Source: Cansim, Table 379-0025: Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS) and province, Chained 2002 dollars.

The total labour demand estimates in both the constrained and unconstrained estimations are provided in the table below. Also shown are the cumulative labour shortages as a share of unconstrained labour demand. Again, unconstrained labour demand may be interpreted as the labour required to accommodate potential industry growth in Alberta. Constrained labour demand may be interpreted as the amount of labour that industries are able to employ, after labour shortages and the inter-industry costs of those shortages are imposed.

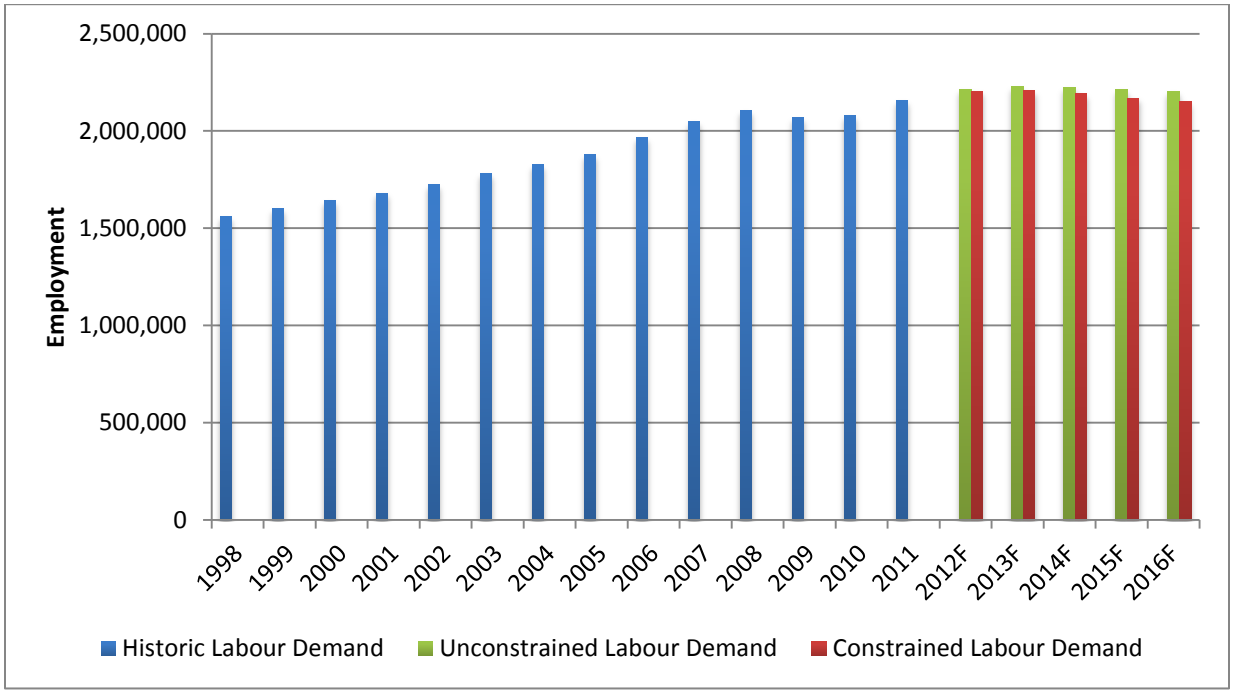
Projected Total Employment Demanded (Low Growth Scenario)

Employment	2012	2013	2014	2015	2016
Unconstrained Labour Demand	2,215,893	2,229,595	2,225,761	2,212,061	2,201,477
Labour Shortages (Cumulative) as a % of Unconstrained Labor Demand	2.07%	2.87%	3.41%	2.84%	2.73%
Constrained by labour supply	2,205,498	2,207,296	2,191,936	2,169,869	2,151,289

The unconstrained labour demand scenario assumes that industries in Alberta will expand at their predicted rate even if they face labour shortages. In other words, although labour shortages exist and accumulate over time, industries will continue to expand and trade with each other as expected. Conversely, the constrained model assumes that industries incur costs due to estimated labour shortages, and these costs drag down overall provincial GDP due to inter-industry relatedness. As such, in the constrained scenario an industry may have a lower-than-expected level of GDP (and also lower-than-expected labour demand) even if it doesn't experience any labour shortages. As a result, the reduced growth posted by industries will also lower

overall provincial demand for labour. The graph below presents historic employment data as well as projected unconstrained and constrained labour demand figures.

Alberta Employment Demand, Historic and Projected: 1998-2016 (Low Growth Scenario)



Source: Cansim, Table 383-0010: Labour statistics by business sector industry and non-commercial activity, consistent with the System of National Accounts, by North American Industry Classification System (NAICS).

4.0 Employment Forecasts (Unconstrained & Constrained)

The purpose of the unconstrained employment forecast is to provide estimates on the amount of each type of labour that would be required to support Alberta's industries growing at their respective predicted rates. The estimated labour shortages associated with these demand forecasts may be thought of as "cumulative", meaning that any unfilled vacancies typically carry over to the next period. Labour shortages may result from a specific lack of skilled labour, or from qualified workers being drawn to occupations offering a better skill match and/or more competitive wages.

The constrained employment forecast provides estimates on the amount and type of labour that will be available to accommodate labour demand, with labour demand adjusted according to costs involving labour shortages and inter-industry relatedness.

These forecasts are developed for three scenarios – base, high and low – which aim to encompass the potentially divergent growth paths that the province may experience over the forecast period. A more detailed description of these scenarios is provided in Section 3 of this report.

Both unconstrained and constrained 2012-2016 employment forecasts are available for 61 industries and 533 occupations from the 4-digit NOC. Occupation by industry data was obtained from Statistics Canada's 2006 Canadian Census (20 per cent sample) and extrapolated to the model's base year (2011) employing publicly available data from Statistics Canada, CANSIM.

4.1 Base Scenario

Unconstrained and constrained employment forecasts by industry and occupation were developed for three scenarios (base, high and low), aiming to encompass the potential expansions and contractions that may occur in Alberta as a result of global, domestic and regional developments. It should be noted that both the constrained and unconstrained employment figures associated with the base case are deemed to be most plausible due to the reliability of the five-year macroeconomic reference scenario obtained from the Government of Alberta 2013 Budget report.

4.1.1 Industry Breakdown

This model generates employment and real GDP estimations for 61 Alberta industries. The industry breakdown is largely based on the 3-digit North American Industry Classification (NAICS). The table below provides industry-specific employment projections. For presentation purposes, the 61 industries have been aggregated into 16 broader industry categories. A detailed outline of the 61 industries is available in Appendix B.

Base Case Employment Demand by Industry		2012				2016			
Industry	NAICS	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment
Agriculture	11	47,994	237	0.5%	47,909	50,864	1,083	2.1%	49,942
Mining, Oil& Gas Extraction	21	128,558	1,564	1.2%	128,228	139,248	7,738	5.6%	135,935
Utilities	22	10,791	146	1.4%	10,747	11,791	713	6.0%	11,340
Construction	23	276,769	3,800	1.4%	276,059	311,784	21,145	6.8%	303,748
Manufacturing	31-33	138,789	1,759	1.3%	138,080	152,322	8,275	5.4%	144,543
Wholesale and Retail Trade	41, 44-45	369,362	17,328	4.7%	365,781	415,514	65,752	15.8%	387,568
Transportation and Warehousing	48-49	102,058	1,529	1.5%	101,585	112,085	7,478	6.7%	107,402
Finance and Insurance	24	130,016	2,930	2.3%	129,317	137,582	13,387	9.7%	131,057
Professional, Scientific and Technical	54	150,574	2,542	1.7%	149,817	154,306	11,906	7.7%	147,339
Admin and Support, Waste and Remediation	56	93,751	1,614	1.7%	93,082	96,352	7,535	7.8%	89,770
Educational Services	61	124,692	1,837	1.5%	124,374	137,184	13,023	9.5%	133,469
Health Care and Social Assistance	62	157,318	4,060	2.6%	156,531	181,304	24,458	13.5%	173,149
Cultural & Information and Entertainment	71, 51	77,867	983	1.3%	77,594	77,711	4,244	5.5%	75,060
Accommodation and Food Services	72	148,826	5,486	3.7%	147,654	152,566	26,141	17.1%	142,524
Other Services (Except Public Administration)	81	138,930	3,299	2.4%	138,237	148,735	16,496	11.1%	142,320
Public Administration	91	133,040	2,563	1.9%	132,538	143,900	13,131	9.1%	139,209
Total Employment		2,224,285	51,679	2.3%	2,212,532	2,423,247	242,501	10.0%	2,314,375

The "Unconstrained Employment " section of the table above suggests that the wholesale and retail trade industry is projected to face the most significant labour shortages which are expected to grow from 4.5 per cent of labour demand in 2012 to 15.8 per cent by 2016. It should be noted that the estimated labour shortages for 2016 are cumulative and tend to accumulate over the forecast period. Other industries set to experience significant shortages are health care and social assistance, and accommodation and food services. In contrast, the agricultural sector is projected to face the least significant labour shortages over the forecast period. Overall, provincial labour shortages represent 2.3 per cent of the provincial labour demand in 2012, and are expected to reach 10 per cent if the provincial demand for labour remains unmet.

The "Constrained Employment" section shows how industry-specific employment demand is expected to change if scarcity of labour is not addressed. For example, as a result of labour shortages, the wholesale and retail trade industry will face costs to production, which will ultimately limit this industry's ability to grow. In tandem, as growth is limited by scarcity of labour, this industry's demand for labour will also decline. The constrained employment forecast provides estimates on the amount and type of labour that will be available to accommodate labour demand, with labour demand adjusted according to costs involving labour shortages and inter-industry relatedness. Hence, in this model, the constrained demand does not equal the unconstrained demand minus the corresponding shortages.

4.1.2 Regional Breakdown

The employment forecasts are also disaggregated regionally. This step is undertaken to provide insight on the labour market challenges that regions within the province may experience over the forecast period.

The regional breakdown is based on Statistics Canada's economic regions. An economic region is defined as a grouping of complete census divisions (CD) created as a standard geographic unit for analysis of regional economic activity.[24] The key advantage of following this approach to regional breakdown is the availability of socio-economic data by economic region. Statistics Canada identifies eight economic regions within Alberta. Provided below are the Base Case unconstrained and constrained aggregate labour demand figures for the period 2012-2016 by economic region.

Base Case Employment Demand by Region	2012				2016			
Economic Region	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment
Lethbridge-Medicine Hat	147,178	3,415	2.3%	146,407	151,098	14,855	9.8%	144,443
Camrose-Drumheller	107,516	2,339	2.2%	106,991	109,559	10,423	9.5%	104,962
Calgary	833,419	19,194	2.3%	828,996	901,025	89,483	9.9%	860,162
Banff Jasper Rocky Mountain House	54,078	1,320	2.4%	53,782	57,236	6,170	10.8%	54,527
Red Deer	110,029	2,520	2.3%	109,463	116,801	11,600	9.9%	111,720
Edmonton	756,707	18,104	2.4%	752,615	846,743	87,101	10.3%	807,980
Athabasca-Grande Prairie-Peace River	133,320	2,949	2.2%	132,652	140,783	13,291	9.4%	134,870
Wod Buffalo-Cold Lake	82,038	1,838	2.2%	81,625	100,004	9,577	9.6%	95,709
Total Employment	2,224,285	51,679	2.3%	2,212,532	2,423,247	242,501	10.0%	2,314,375

At the regional level, Edmonton and Banff-Jasper-Rocky Mountain House are projected to face the most significant labour shortages reaching 10.3 and 10.8 per cent of regional labour demand respectively by 2016. In contrast, the economic region of Athabasca-Grade Prairie-Peace River is expected to experience the least significant shortages of labour estimated at 9.5per cent of the region's labour demand by 2016.

4.2.3 Occupations in Demand

The model forecasts occupations that are demanded in support of industry growth. In cases where demand is unmet by supply, labour shortages are predicted. Provided that labour demand remains at least partially unfilled in a given forecast year, the shortage is "cumulative" in the sense that it carries over to the next period. While the analysis works at the 4-digit NOC level, in this section occupations are aggregated into ten broad categories for presentation purposes.

The table below presents the Base Scenario projected labour demand and shortages in Alberta according to occupation category. While the table does not display occupational data at the 4-digit NOC level, some of the specific occupations exhibiting the most significant projected shortages in absolute number include (but are not limited to) retail trade managers (NOC: 0621); financial auditors and accountants (NOC: 1111); bookkeepers (NOC: 1231); secretaries (except legal and medical) (NOC: 1241); general office clerks (NOC: 1411); registered nurses (NOC: 3152); and retail salespersons and sales clerks (NOC: 6421). Significant but more moderate shortages are projected for restaurant and food service managers (NOC: 0631); administrative officers (NOC: 1221); receptionists and switchboard operators (NOC: 1414); customer service, information and related clerks (NOC: 1453); early childhood educators and assistants (NOC: 4214); cashiers (NOC: 6611); food and beverage servers (NOC: 6453); food counter attendants, kitchen helpers and related occupations (NOC: 6641); carpenters (NOC: 7271); electricians (except industrial and power system) (NOC: 7241); welders and related machine operators (NOC: 7265); and truck drivers (NOC: 7411).

[24] Statistics Canada, Census Dictionary: Economic Region (ER), Last modified: April 12, 2012.

Base Case Occupational Demand

Occupational Group		Unconstrained Employment Demand		Change in Employment 2012-16	% Change in Employment 2012-16	Constrained Employment Demand		Change in Employment 2012-16	% Change in Employment 2012-16
		2012	2016			2012	2016		
A	Management	228,808	249,332	20,524	9.0%	227,468	237,358	9,891	4.3%
B	Business, Finance and Admin	412,903	446,145	33,242	8.1%	410,846	426,547	15,701	3.8%
C	Natural and Applied Sciences and Related	159,535	170,271	10,736	6.7%	158,855	163,550	4,695	3.0%
D	Health	102,094	116,486	14,392	14.1%	101,540	111,003	9,463	9.3%
E	Social Science, Education, Gov't. Services and Religion	151,562	166,229	14,667	9.7%	151,017	160,550	9,533	6.3%
F	Art Culture, Recreation and Sport	50,312	54,244	3,932	7.8%	50,095	52,145	2,050	4.1%
G	Sales and Service	512,919	554,862	41,944	8.2%	508,949	521,527	12,579	2.5%
H	Trades, Transport and Equipment Operators and Related	439,957	486,551	46,594	10.6%	438,207	469,069	30,861	7.0%
I	Unique to Primary Industry	100,248	107,112	6,863	6.8%	99,940	104,032	4,093	4.1%
J	Unique to Processing, Manufacturing and Utilities	65,947	72,015	6,068	9.2%	65,616	68,595	2,979	4.5%
	Total Employment	2,224,285	2,423,247	198,963	8.9%	2,212,532	2,314,375	101,844	4.6%

4.2 High Growth Scenario

Unconstrained and constrained employment forecasts by industry and occupation were developed for three scenarios (high, base and low) aiming to encompass the potential expansions and contractions that may occur in Alberta as a result of global, domestic and regional developments. It should be noted that both the constrained and unconstrained employment figures associated with the High Scenario are deemed to be optimistic, as most Alberta industries in the forecast exhibit significantly stronger growth performance relative to the forecasts in the Government of Alberta 2013 Budget report.

4.2.1 Industry Breakdown

This model generates employment and real GDP estimations for 61 Alberta industries. The industry breakdown is largely based on the 3-digit North American Industry Classification (NAICS). The table below provides industry-specific employment projections. For presentation purposes, the 61 industries have been aggregated into 16 broader industry categories.

High Growth Scenario Employment Demand by Industry		2012				2016			
Industry	NAICS	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment
Agriculture	11	48,600	267	0.5%	48,502	62,877	3,114	5.0%	61,208
Mining, Oil& Gas Extraction	21	129,664	1,837	1.4%	129,264	149,502	11,772	7.9%	144,542
Utilities	22	11,276	172	1.5%	11,225	13,006	1,082	8.3%	12,352
Construction	23	279,880	4,868	1.7%	278,961	349,501	40,602	11.6%	336,091
Manufacturing	31-33	140,106	2,006	1.4%	139,262	173,285	13,483	7.8%	161,076
Wholesale and Retail Trade	41, 44-45	370,296	18,039	4.9%	366,520	440,483	91,421	20.8%	404,432
Transportation and Warehousing	48-49	102,323	1,713	1.7%	101,792	122,212	12,354	10.1%	115,172
Finance and Insurance	24	130,730	3,206	2.5%	129,953	149,100	19,029	12.8%	139,948
Professional, Scientific and Technical	54	151,271	2,896	1.9%	150,451	164,845	17,769	10.8%	154,763
Admin and Support, Waste and Remediation	56	94,203	1,792	1.9%	93,455	104,673	11,448	10.9%	95,347
Educational Services	61	124,834	2,006	1.6%	124,483	143,786	20,133	14.0%	138,181
Health Care and Social Assistance	62	159,033	4,954	3.1%	158,050	201,251	40,065	19.9%	188,422
Cultural & Information and Entertainment	71, 51	73,022	1,074	1.5%	72,719	82,149	6,137	7.5%	78,508
Accommodation and Food Services	72	150,516	6,731	4.5%	149,095	175,515	45,758	26.1%	159,072
Other Services (Except Public Administration)	81	139,183	3,606	2.6%	138,418	155,879	22,977	14.7%	147,045
Public Administration	91	133,232	2,822	2.1%	132,678	150,294	17,566	11.7%	144,183
Total Employment		2,238,169	57,989	2.6%	2,224,829	2,638,306	374,711	14.2%	2,480,341

The "Unconstrained Employment " section of the table above suggests that the wholesale and retail trade industry is projected to face the most significant labour shortages which are expected to grow from 4.9 per cent of labour demand in 2012 to 20.8 per cent by 2016. It should be noted that the estimated labour shortages for 2016 are cumulative as they tend to accumulate over the forecast period. Other industries projected to experience significant shortages are health care and social assistance, finance and insurance, and accommodation and food services. In contrast, the agricultural sector is projected to face the least significant labour shortages over the forecast period. Overall, provincial labour shortages represent 2.6 per cent of Alberta's labour demand in 2012, and are expected to reach 14.2 per cent if the provincial demand for labour remains unmet.

The "Constrained Employment" section shows how industry-specific employment demand is expected to change if scarcity of labour is not addressed. For example, as a result of labour shortages, the wholesale and retail trade industry will face costs to production, which will ultimately limit this industry's ability to grow. In tandem, as growth is limited by scarcity of labour, this industry's demand for labour will also decline. The constrained employment forecast provides estimates on the amount and type of labour that will be available to accommodate labour demand, with labour demand adjusted according to costs involving labour shortages and inter-industry relatedness. Hence, in this model, the constrained demand does not equal the unconstrained demand minus the corresponding shortages.

4.2.2 Regional Breakdown

The employment forecasts are also disaggregated regionally. This step is undertaken to provide insight on the labour market challenges that regions within the province may experience over the forecast period.

The regional breakdown is based on Statistics Canada's economic regions. An economic region is defined as a grouping of complete census divisions (CD) created as a standard geographic unit for analysis of regional economic activity.[25] The key advantage of following this approach to regional breakdown is the availability of socio-economic data by economic region. Statistics Canada identifies eight economic regions within Alberta. Provided below are the High Case unconstrained and constrained aggregate labour demand figures for the period 2012-2016 by economic region.

[25] Statistics Canada, Census Dictionary: Economic Region (ER), Last modified: April 12, 2012.

High Growth Scenario Employment Demand by Region	2012				2016			
Economic Region	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment
Lethbridge-Medicine Hat	148,132	3,820	2.6%	147,259	165,810	23,200	14.0%	156,093
Camrose-Drumheller	108,233	2,617	2.4%	107,639	120,133	16,162	13.5%	113,482
Calgary	838,496	21,547	2.6%	833,470	978,795	137,625	14.1%	919,578
Banff-Jasper-Rocky Mountain House	54,441	1,502	2.8%	54,102	62,540	9,669	15.5%	58,553
Red Deer	110,752	2,833	2.6%	110,108	127,158	17,961	14.1%	119,788
Edmonton	761,342	20,282	2.7%	756,707	921,088	134,301	14.6%	864,986
Athabasca-Grande Prairie-Peace River	134,208	3,322	2.5%	133,448	154,238	21,009	13.6%	145,535
Wod Buffalo-Cold Lake	82,565	2,066	2.5%	82,096	108,543	14,786	13.6%	102,326
Total Employment	2,238,169	57,989	2.6%	2,224,829	2,638,306	374,711	14.2%	2,480,341

At the regional level, Edmonton and Banff-Jasper-Rocky Mountain House are projected to face the most significant labour shortages reaching 14.6 per cent and 15.5 per cent of labour demand respectively by 2016. In contrast, the economic region of Camrose-Drumheller is expected to experience the least significant shortages of labour estimated at 13.5 per cent of the region's labour demand by 2016.

4.2.3 Occupations in Demand

The model forecasts occupations that are demanded in support of industry growth. In cases where demand is unmet by supply, labour shortages are predicted. Provided that labour demand remains at least partially unfilled in a given forecast year, the shortage is "cumulative" in the sense that it carries over to the next period. While the analysis works at the 4-digit NOC level, in this section occupations are aggregated into ten broad categories for presentation purposes.

The table below presents the High Scenario projected labour demand and shortages in Alberta according to occupation category. While the table does not display occupational data at the 4-digit NOC level, some of the specific occupations exhibiting the most significant projected shortages in absolute number include (but are not limited to) retail trade managers (NOC: 0621); financial auditors and accountants (NOC: 1111); bookkeepers (NOC: 1231); secretaries (except legal and medical) (NOC: 1241); general office clerks (NOC: 1411); registered nurses (NOC: 3152); and retail salespersons and sales clerks (NOC: 6421). Significant but more moderate shortages are projected for restaurant and food service managers (NOC: 0631); administrative officers (NOC: 1221); receptionists and switchboard operators (NOC: 1414); customer service, information and related clerks (NOC: 1453); early childhood educators and assistants (NOC: 4214); cashiers (NOC: 6611); food and beverage servers (NOC: 6453); food counter attendants, kitchen helpers and related occupations (NOC: 6641); carpenters (NOC: 7271); electricians (except industrial and power system) (NOC: 7241); welders and related machine operators (NOC: 7265); and truck drivers (NOC: 7411).

High Growth Scenario Occupational Demand

Occupational Group	Unconstrained Employment Demand		Change in Employment 2012-16	% Change in Employment 2012-16	Constrained Employment Demand		Change in Employment 2012-16	% Change in Employment 2012-16
	2012	2016			2012	2016		
A Management	230,144	270,302	40,158	17.4%	228,643	253,258	24,615	10.8%
B Business, Finance and Admin	415,156	480,238	65,082	15.7%	412,830	452,343	39,513	9.6%
C Natural and Applied Sciences and Related	160,494	183,446	22,953	14.3%	159,709	173,711	14,002	8.8%
D Health	103,055	128,263	25,208	24.5%	102,384	119,879	17,495	17.1%
E Social Science, Education, Gov't. Services and Religion	152,097	176,213	24,115	15.9%	151,474	167,881	16,407	10.8%
F Art Culture, Recreation and Sport	50,468	57,680	7,212	14.3%	50,225	54,702	4,477	8.9%
G Sales and Service	515,641	605,025	89,384	17.3%	511,245	557,801	46,556	9.1%
H Trades, Transport and Equipment Operators and Related	443,398	534,456	91,058	20.5%	441,344	508,040	66,696	15.1%
I Unique to Primary Industry	101,119	121,627	20,508	20.3%	100,762	116,908	16,146	16.0%
J Unique to Processing, Manufacturing and Utilities	66,599	81,056	14,457	21.7%	66,212	75,818	9,605	14.5%
Total Employment	2,238,169	2,638,306	400,138	17.9%	2,224,829	2,480,341	255,512	11.5%

4.3 Low Growth Scenario

Unconstrained and constrained employment forecasts by industry and occupation were developed for three scenarios (high, base and low) aiming to encompass the potential expansions and contractions that may occur in Alberta as a result of global, domestic and regional developments. It should be noted that both the constrained and unconstrained employment figures associated with the Low Scenario are deemed to be pessimistic, as most Alberta industries in the forecast exhibit significantly weaker growth performance relative to the forecasts in the Government of Alberta 2013 Budget report. A detailed outline of the economic assumptions underlying the Low Scenario is provided in Section 3.3 of the report.

4.3.1 Industry Breakdown

This model generates employment and real GDP estimations for 61 Alberta industries. The industry breakdown is largely based on the 3-digit North American Industry Classification (NAICS). The table below provides industry-specific employment projections. For presentation purposes, the 61 industries have been aggregated into 16 broader industry categories.

Low Growth Scenario Employment Demand by Industry		2012				2016			
Industry	NAICS	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment
Agriculture	11	47,509	212	0.4%	47,432	41,688	277	0.7%	41,302
Mining, Oil& Gas Extraction	21	127,590	1,383	1.1%	127,301	123,870	1,995	1.6%	122,474
Utilities	22	10,755	133	1.2%	10,716	11,040	230	2.1%	10,817
Construction	23	276,357	3,437	1.2%	275,718	276,767	3,335	1.2%	273,892
Manufacturing	31-33	138,426	1,594	1.2%	137,800	127,545	1,517	1.2%	124,504
Wholesale and Retail Trade	41, 44-45	368,738	16,429	4.5%	365,363	380,319	20,630	5.4%	364,504
Transportation and Warehousing	48-49	101,884	1,370	1.3%	101,459	102,130	1,148	1.1%	100,199
Finance and Insurance	24	129,400	2,774	2.1%	128,760	127,609	6,231	4.9%	123,941
Professional, Scientific and Technical	54	150,144	2,293	1.5%	149,510	142,845	3,752	2.6%	139,425
Admin and Support, Waste and Remediation	56	93,420	1,397	1.5%	92,825	87,256	1,862	2.1%	84,043
Educational Services	61	124,559	1,567	1.3%	124,290	130,770	3,209	2.5%	129,334
Health Care and Social Assistance	62	155,610	3,092	2.0%	155,026	156,390	3,231	2.1%	154,016
Cultural & Information and Entertainment	71, 51	72,744	888	1.2%	72,408	73,166	949	1.3%	71,823
Accommodation and Food Services	72	147,166	3,906	2.7%	146,296	136,174	1,153	0.8%	133,368
Other Services (Except Public Administration)	81	138,711	3,008	2.2%	138,083	141,679	4,304	3.0%	138,717
Public Administration	91	132,880	2,347	1.8%	132,419	142,228	6,329	4.5%	139,129
Total Employment		2,215,893	45,779	2.1%	2,205,498	2,201,477	60,154	2.7%	2,151,289

The "Unconstrained Employment " section of the table above suggests that the wholesale and retail trade industry is projected to face the most significant labour shortages which are expected to grow from 4.5 per cent of labour demand in 2012 to 5.4 per cent by 2016. It should be noted that the estimated labour shortages for 2016 are cumulative as they tend to accumulate over the forecast period. Other industries projected to experience significant shortages are finance and insurance, public administration and other services (except public administration). In contrast, the agricultural sector is projected to face the least significant labour shortages over the forecast period. Overall, provincial labour shortages represent 2.1 per cent of Alberta's labour demand in 2012, and are expected to reach 2.7 per cent of the provincial demand for labour remains unmet.

The "Constrained Employment" section shows how industry-specific employment demand is expected to change if scarcity of labour is not addressed. For example, as a result of labour shortages, the wholesale and retail trade industry will face costs to production, which will ultimately limit this industry's ability to grow. In tandem, as growth is limited by scarcity of labour, this industry's demand for labour will also decline. The constrained employment forecast provides estimates on the amount and type of labour that will be available to accommodate labour demand, with labour demand adjusted according to costs involving labour shortages and inter-industry relatedness. Hence, in this model, the constrained demand does not equal the unconstrained demand minus the corresponding shortages.

4.3.2 Regional Breakdown

The employment forecasts are also disaggregated regionally. This step is undertaken to provide insight on the labour market challenges that regions within the province may experience over the forecast period.

The regional breakdown is based on Statistics Canada's economic regions. An economic region is defined as a grouping of complete census divisions (CD) created as a standard geographic unit for analysis of regional economic activity.[26] The key advantage of following this approach to regional breakdown is the availability of socio-economic data by economic region. Statistics Canada identifies eight economic regions within Alberta. Provided below are the High Case unconstrained and constrained aggregate labour demand figures for the period 2012-2016 by economic region.

[26] Statistics Canada, Census Dictionary: Economic Region (ER), Last modified: April 12, 2012.

Low Growth Scenario Employment Demand by Region	2012				2016			
Economic Region	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment	Unconstrained Employment	Shortage	Shortage as a % of Unconstrained Employment	Constrained Employment
Lethbridge-Medicine Hat	146,578	3,027	2.1%	145,897	136,385	3,585	2.6%	133,363
Camrose-Drumheller	107,049	2,078	1.9%	106,584	98,944	2,710	2.7%	96,786
Calgary	830,356	16,998	2.0%	826,445	819,802	22,424	2.7%	800,911
Banff-Jasper-Rocky Mountain House	53,824	1,132	2.1%	53,569	51,946	1,323	2.5%	50,767
Red Deer	109,582	2,233	2.0%	109,082	105,935	2,876	2.7%	103,596
Edmonton	754,025	16,072	2.1%	750,401	770,405	21,717	2.8%	752,455
Athabasca-Grande Prairie-Peace River	132,769	2,607	2.0%	132,179	127,234	3,117	2.4%	124,584
Wod Buffalo-Cold Lake	81,709	1,633	2.0%	81,342	90,826	2,402	2.6%	88,827
Total Employment	2,215,893	45,779	2.1%	2,205,498	2,201,477	60,154	2.7%	2,151,289

At the regional level, Edmonton is projected to face the most significant labour shortages reaching 2.8 per cent of labour demand by 2016. In contrast, the economic region of Athabasca-Grande Prairie-Peace River is expected to experience the least significant shortages of labour estimated at 2.4 per cent of the region's labour demand by 2016.

4.3.3 Occupations in Demand

The model forecasts occupations that are demanded in support of industry growth. In cases where demand is unmet by supply, labour shortages are predicted. Provided that labour demand remains at least partially unfilled in a given forecast year, the shortage is "cumulative" in the sense that it carries over to the next period. While the analysis works at the 4-digit NOC level, in this section occupations are aggregated into ten broad categories for presentation purposes.

The table below presents the Low Scenario projected labour demand and shortages in Alberta according to occupation category. While the table does not display occupational data at the 4-digit NOC level, some of the specific occupations exhibiting the most significant projected shortages in absolute number include (but are not limited to) retail trade managers (NOC: 0621); financial auditors and accountants (NOC: 1111); bookkeepers (NOC: 1231); secretaries (except legal and medical) (NOC: 1241); general office clerks (NOC: 1411); registered nurses (NOC: 3152); and retail salespersons and sales clerks (NOC: 6421). Significant but more moderate shortages are projected for restaurant and food service managers (NOC: 0631); administrative officers (NOC: 1221); receptionists and switchboard operators (NOC: 1414); customer service, information and related clerks (NOC: 1453); early childhood educators and assistants (NOC: 4214); cashiers (NOC: 6611); food and beverage servers (NOC: 6453); food counter attendants, kitchen helpers and related occupations (NOC: 6641); carpenters (NOC: 7271); electricians (except industrial and power system) (NOC: 7241); welders and related machine operators (NOC: 7265); and truck drivers (NOC: 7411).

Low Growth Scenario Occupational Demand

Occupational Group	Unconstrained Employment Demand		Change in Employment 2012-16	% Change in Employment 2012-16	Constrained Employment Demand		Change in Employment 2012-16	% Change in Employment 2012-16
	2012	2016			2012	2016		
A Management	228,006	227,510	-497	-0.2%	226,804	221,701	-5,104	-2.3%
B Business, Finance and Admin	411,465	409,428	-2,038	-0.5%	409,620	399,714	-9,907	-2.4%
C Natural and Applied Sciences and Related	159,007	155,496	-3,512	-2.2%	158,397	152,247	-6,150	-3.9%
D Health	101,153	101,963	810	0.8%	100,722	100,140	-582	-0.6%
E Social Science, Education, Gov't. Services and Religion	151,102	155,702	4,599	3.0%	150,637	153,267	2,630	1.7%
F Art Culture, Recreation and Sport	50,206	50,867	661	1.3%	50,013	49,855	-159	-0.3%
G Sales and Service	510,608	507,027	-3,580	-0.7%	507,112	491,360	-15,752	-3.1%
H Trades, Transport and Equipment Operators and Related	438,992	437,271	-1,721	-0.4%	437,409	429,635	-7,773	-1.8%
I Unique to Primary Industry	99,601	94,216	-5,384	-5.4%	99,326	92,800	-6,526	-6.6%
J Unique to Processing, Manufacturing and Utilities	65,753	61,998	-3,755	-5.7%	65,457	60,570	-4,888	-7.5%
Total Employment	2,215,893	2,201,477	-14,416	-0.7%	2,205,498	2,151,289	-54,209	-2.5%

5.0 Summary of Findings

This report describes the findings of an MRA-style occupational matching model developed by Applications Management Consulting for the purpose of analyzing the potential implications of Alberta's present and estimated future labour market imbalances. Generally, these findings are presented in the form of unconstrained labour demand estimates for Alberta's industries, the labour shortages correlated with these levels of demand, and the constrained labour demand that employers are expected to yield given the impact of labour shortages and their associated costs. Due to the precarious nature of industry-specific growth forecasts (particularly longer-term forecasts), these labour demand and supply estimates are considered in the context of three different provincial economic growth scenarios covering the 2012 to 2016 period.

Over the forecast period, the industries generally projected to experience the most significant scarcity of labour are wholesale and retail trade, accommodation and food services, and health care and social assistance. It is interesting to note that these industries belong to the service sector category where output growth and labour demand are directly influenced by population growth. As Alberta's population continues to grow at a considerable pace through the forecast period, it is unsurprising that demand within service sector industries also steeply increases. Similarly, as is the case in many economically mature nations, the aging of Alberta's population places a higher level of demand on health care and social services, creating higher levels of labour demand and a greater likelihood of shortages predicted in the industry. A number of other industries are projected to experience moderate labour shortages including finance and insurance, public administration, construction, oil and gas and mining, and other services. Provided that industries are unable to resolve these estimated labour shortages, labour scarcity may affect the ability of these industries to grow at their potential rate. Further detail regarding industry-specific labour projections are presented in Section 4 of this report.

The economic regions of Alberta projected to face the most significant labour shortages across all three scenarios are Edmonton and Banff-Jasper-Rocky Mountain House. Positive but relatively fewer labour shortages (in percentage magnitude) are predicted in the economic regions of Camrose-Drumheller and

Athabasca-Grande Prairie-Peace River. Further details regarding region-specific labour projections are presented in Section 4 of this report.

Occupational categories within Alberta projected to exhibit the greatest degree of scarcity over the forecast period generally include business, finance and administration; sales and services; and health. Minimal amounts of scarcity are projected within categories such as art, culture, recreation and sport; occupations unique to primary industry; and occupations unique to processing, manufacturing and utilities. Further details regarding occupation-specific labour projections are presented in Section 4 of this report.

While the model provides explicit numerical demand, supply and shortage labour estimates across each occupation, industry and region, conclusions involving the general scope, magnitude, and location of labour shortages should be of greater interest to stakeholders. A member of Alberta's labour force may be more likely to undertake a specific type of education or training with the information that their skills will be in high demand in Alberta. Similarly, employers are less vulnerable to production and productivity losses if they are able to plan in advance for recruitment and training, particularly if they are interested in filling positions for which skilled labour is in short supply. Lastly, governments and related institutions possess the incentive to hold labour imbalances at a minimum as their revenues partly depend on keeping unemployment rates low and productivity levels high.

As such, due to the myriad of factors influencing Alberta's labour market which may impact the specific time-sensitive results of the model, the results presented here should act as a broad signal to workers, employers and policymakers as to where their efforts should be focused to alleviate shortages (or surpluses) where they are found to be substantial.

6.0 Appendix A

6.1 Model Assumptions

The analysis was conducted using an extensive model incorporating four inter-related sub-models – a Labour Demand Model, Labour Supply Model, Job Matching Mechanism and Population Model. A number of assumptions were employed within each sub-model to derive results. Specific assumptions involving the base, high and low economic growth scenarios can be found in Section 3 of this report.

Labour Demand Sub-Model Assumptions:

- A "dollar-in, dollar-out" pattern of industry behaviour was assumed. This means that if an industry receives an additional dollar of revenue through a positive growth shock, the industry spends the dollar based on its marginal spending behaviour. For example, if 40 per cent of an industry's purchases go toward provincial inter-industry trade, 40 per cent of any new revenue is allocated toward inter-industry trade. Other spending destinations include wages and salaries, indirect taxes and extra-provincial trade. The spending decisions of an industry are static, based on 2008 input-output profiles.

- Productivity shocks unrelated to growth scenario were not employed, as this is a relatively short-term model with no significant changes to methods of production assumed.

- The input-output table for Alberta industries was generated using the Canada input-output profile. It was assumed that an Alberta industry trades in patterns similar to that of the national average. The Canadian input-output table was utilized because it contains a finer level of industry-specific detail in comparison to the Alberta input-output table.

- The reference data used to develop industry-specific growth in the Base Case scenario was assumed to not have accounted for labour shortages in their percentage growth forecasts.

- The structure of the labour force demanded by each industry was based on 2006 Census data. This means that if 10 per cent of an industry's labour demand was clerical supervisors in 2006, this remains unchanged through the forecast period. Similarly, if an industry posts negative growth, occupation-specific layoffs occur such that the industry's labour demand structure is maintained. In this sense, technological progress and its influence on the type of occupations demanded as well as their respective productivity levels are not a consideration in the model. This assumption was made due to a lack of very recent data; and a lack of information in regard to future technology that may impact production.

- Missing or suppressed 2011 industry labour data was extrapolated using historical industry-specific GDP growth rates.

- Missing or suppressed provincial industry-specific GDP data was extrapolated using national GDP percentage allocations from larger-aggregation industries. For example, the "support activities for mining and oil and gas extraction" sub-industry accounted for 7.37 per cent of the total output of the larger-aggregation "mining and oil and gas extraction" industry on a national level.

- The base scenario forecast used in the model was generated using Government of Alberta industry-specific and provincial growth forecasts. In cases where a sub-industry was not available, larger-aggregation industry growth rates were used.

- The base forecast does not use the input-output tables. Only unanticipated changes to growth/revenue are run through the input-output tables to estimate how growth in one industry will reflect in growth to other industries. The assumption was that the initial forecasts already accounted for inter-industry relatedness in their projections.

- It was assumed that unanticipated inter-industry purchases revenue generated through positive growth shocks was not spent in the period in which it is received. Additional revenue does factor into current-period GDP but the recipient industry does not engage in the resulting increased inter-industry trade

until the following period. This assumption was necessary to avoid a cycle of infinite inter-industry trade/growth.

- Extra-provincial trade was assumed to operate similar to inter-industry trade within Alberta. If an Alberta industry purchases more from other provinces, those provinces receive the revenue in the current period. However, provinces do not engage in higher rates of import from Alberta's industries until the following period.

- Growth in relatively smaller support industries was assumed to be generally unconstrained. This means that shocked "driver" industries may engage in inter-industry trade that brings about even greater change (on a percentage basis) in smaller support industries than was the impact of the shock itself. A five per cent production shock to a driver industry may result in a 10 per cent production shock in a support industry which also receives more revenue from increased activity in other industries. However, these rates of production are percentage-based, meaning that the resulting absolute GDP/labour impact in a smaller support industry should similarly be smaller than is observed in the relatively larger driver industry. The large percentage growth rates may be misleading, due to the fact that some industries are significantly smaller. For example, the 10-person industry of fishing, hunting and trapping experiencing a 20 per cent growth rate may only translate to two more jobs demanded (dependant on productivity), which may have been initiated by a five per cent shock to crop and animal production, which is a much larger industry with a much higher absolute labour demand impact resulting from the five per cent shock.

Labour Supply Sub-Model Assumptions:

- It was assumed that job seekers (and employers) possess imperfect information. A pool of job seekers possessing similar traits apply for positions based on the percentage likelihood of matching according to the matching mechanism. If a worker is unable to find employment according to this percentage distribution, they search for positions according to their top five matching occupations and accept the first suitable vacancy available. In this sense, a job seeker may not necessarily search through every position available to them, particularly in cases where the job seeker possesses skills that allow for a great number of occupational choices. Workers unable to find employment after this "second stage" of matching remain unemployed until the next period, at which time the job seeker may adjust their expectations to allow for a greater likelihood of successfully finding a vacancy. This assumption was made due to the imperfect nature of a realistic labour market.

- Migrants to Alberta were assigned occupational profiles based on the Occupations of Migrants study by the Government of Alberta, August 2009.

- The pool of unemployed workers at the beginning of the forecast period (2012) was assigned occupational profiles based on the Alberta Labour Market Outlook study by the Government of Alberta, March 2012.

- The voluntary job separation rate (which includes separations for career advancement, pay/benefits, or other) only accounts for separations that result in a period of temporary unemployment, and does not include workers who separate in order to transition into jobs for which they were already hired.

- Skill profiles assigned to migrants, emigrants and those leaving school, as well as the occupation profiles of retiring and deceased workers, were assigned according to the "Canadian Occupational Projection System" (COPS) developed by HRSDC. In the application of this data, it was assumed that Alberta's labour force possesses a similar structure to that of the Canadian average.

- Due to the assumption of the labour market being in equilibrium prior to the forecast period (2011), workers employed in positions for which they are over or under qualified at the beginning of the model is not a consideration. For example, a worker in reality possessing an advanced degree but underemployed in a position requiring little to no education is assigned the skill and education traits of their position upon separating from their employment.

Job Matching Mechanism Sub-Model Assumptions:

- The voluntary job separation rate (which includes separations for career advancement, pay/benefits, or other) only accounts for separations that result in a period of temporary unemployment, and does not include workers who separate in order to transition into jobs for which they were already hired.
- The tightness of the labour market affects the decisions of both job seekers and employers. In a tight labour market, job seekers are less inclined to accept an undesirable position and employers are more inclined to hire a relatively under qualified worker; and vice versa. It is assumed that a labour market is relatively tight if the provincial unemployment rate is less than four per cent; relatively slack if the provincial unemployment exceeds six per cent; and relatively neutral with a moderate rate between four per cent and six per cent.
- Generally, unemployment rates throughout the model forecast period are based on projections from the Government of Alberta.
- All else being equal, job seekers were assumed to have no industry-specific preference when assessing the relative attractiveness of a vacancy. For example, an accountant is assumed to be indifferent between accepting a job in the oil and gas industry and a job in the manufacturing industry, even if they possess prior experience in one of the industries.
- Certain high-skill and/or high education occupations were granted unique status to limit mobility in and out of the occupation. Such occupations typically involved some type of specialized education or regulation. For example, while physicians and judges possess similarly high educational requirements, no mobility between the two occupations was permitted.

Population Sub-Model Assumptions:

- Population levels (and the labour force estimates drawn from these levels) for the period 2012 to 2016 were calculated using age and gender specific data. The age and gender specific participation rates associated with these population levels were retrieved from Statistics Canada and remain fixed across the forecast period.
- Static fertility, mortality and migrant population profiles were assumed over the forecast period.
- Net international migration was assumed to increase at a fixed annual average rate of 3.7 per cent across each growth scenario. This in-flow of labour was assumed to remain steady over the forecast period due to institutional regulations.
- Net inter-provincial migration is assumed to be the primary determinant of Alberta's labour force growth, as inter-provincial migrants possess a high degree of mobility across provinces. High economic growth in Alberta attracts a larger number of inter-provincial migrants, while weak growth results in an outflow of migrants to other provinces.
- Inter-provincial migration was assumed to grow at an annual average rate of 1.4 per cent in the Base Case; 4.3 per cent in the High Case, and -0.5 per cent in the Low Case.

6.1.1 Labour Productivity

Productivity provides a measure of the efficiency with which inputs (capital and labour) are used in an industry to produce goods and services, and may be measured using a variety of methods. Labour productivity is commonly defined as a ratio between the volume of output (gross domestic product) and a measure of input use (total hours worked or total employment).[27]

The model assumes that positive incremental labour productivity gains occur in each industry every year. An underlying assumption is that productivity gains are lower in the high scenario relative to those for the base

and low, as employers will likely be competing for both labour and capital resources, which will bid their costs up. Under this scenario, employers will possibly be forced to hire under-qualified and generally less productive workers due to a tighter labour market. Conversely, the productivity gains associated with the low scenario are assumed to be higher as employers will likely face less competition for labour and capital resources. Under this scenario, employers (industries) will possibly benefit from hiring over-qualified and more productive workers due to the slack in the labour market. The base scenario assumes an annual productivity gain between the low and high scenario gains.

Labour productivity was calculated based on final GDP and labour totals estimated for 2011. Any adjustments or shocks to labour productivity during the forecast period are based on changes to these 2011 productivity figures.

Detailed tables of highlights from 3 scenarios are available on IPE's website. .