Appendix C

Socioeconomics

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Converse County EIS
Technical Supplement for Socioeconomic Analysis

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1.0 Economic, Demographic and Housing Assumptions

The key economic, demographic, and housing need assumptions that underlie key elements of the socioeconomic assessment are summarized below. The assumptions reflect recent experience with large-scale oil and gas development in the Powder River Basin, the Bakken Region of North Dakota, the Green River Basin of south-central Wyoming, and the Piceance Basin of northwestern Colorado. The assumptions also reflect experience gained during development of the 2005 BLM Powder River Basin Cumulative Coal Review and the subsequent 2012 update.

2.0 Employment

The direct employment associated with the proposed oil and natural gas development, extending from pre-development approval and permitting through drilling, completion, production, and reclamation is a key driver of the socioeconomic impacts of the Converse County Oil and Gas Project (Project). Direct development and operations jobs would support additional indirect and induced jobs in the local economies, all of which would create additional demand for labor; promote economic migration and population growth; increase demand for housing, public facilities, and services; and affect local social conditions. Over time, field operations and production employment would increase to service additional wells and haul higher volumes of produced water and condensate. However, employment during operation and production is substantially lower than that during development such that the overall labor needs decline after the development phase is completed.

Project-related direct employment estimates were developed from information provided by the OG for the Proposed Action (Alternative B) (OG 2015a) and on information from the U.S. Census Bureau, U.S. Bureau of Economic Analysis, and Wyoming Department of Workforce Services. Direct employment estimates were the primary input used with the IMPLAN economic model, calibrated using data for Converse and Natrona counties to derive changes in total employment from the Project that drive changes in other economic and demographic variables.

2.1 Direct Employment

As part of Alternative B, the OG provided information regarding the timing/phasing of development activities, duration of activities, and approximate numbers of employees, including both company and contractor employees, for typical wells for the CCPA. Separate development profiles were provided for single-bore vertical wells and for multiple-bore directional wells from a single location. These profiles were the basis for estimating direct on-site employment during field development. Construction employment for the ancillary facilities and infrastructure, post-completion truck hauling, and production employment also were estimated.

2.1.1 On-site Employment

The overall level of employment associated with a single well is relatively small, although not trivial from a socioeconomic impact assessment perspective. Information provided by the OG indicated that development of a single well on its own pad, from staking, access road and pad construction through installation of surface production facilities and gathering lines, would span 109 days.

These estimates are based in part on the concept of a work crew, which reflects the fact that direct on-site employment at an individual well site varies over time, ranging from a single field biologist doing pre-development site clearance to as many as 30 service workers during completion operations. Some development activities are of relatively short duration (a matter of hours), while others extend over a period of days on a 24-hour basis. This also means that many oil and gas service crews work on multiple

wells during a week, while others are on site for an extended period of time. Additionally, vendor project managers, state and federal regulatory and resource management staff, and others occasionally may visit an individual well site, but are not included in the OG summary of on-site employees. The estimated numbers of employees, average duration, and average number of workers per development activity with the new well development for the Project over the 109-day period are shown in **Table 2-1** and **Figure 2-1**.

Table 2-1 Summary of Direct On-site Effort to Develop a Single Well and Pad

Development Phase	Range of Persons on Site	Total Person-days On-Site To Complete Well	Typical Activity Duration (days)
Location staking/surveying	4	12	3
Cultural/biological clearance	2	2	1
Location construction, including access and electricity	6	114	19
Rig mobilization/setup	11 to 20	81	5
Drilling	24 to 30	764	31
Completion	9 to 21	150	10
Rig demobilization/move	11 to 20	81	5
Tank battery and wellhead/ production equipment setup	5 to 30	699	40
Interim reclamation	2	2	1
Engineers and other staff	1	19	19
Totals	**1 to 30**	**1,924**	**109**

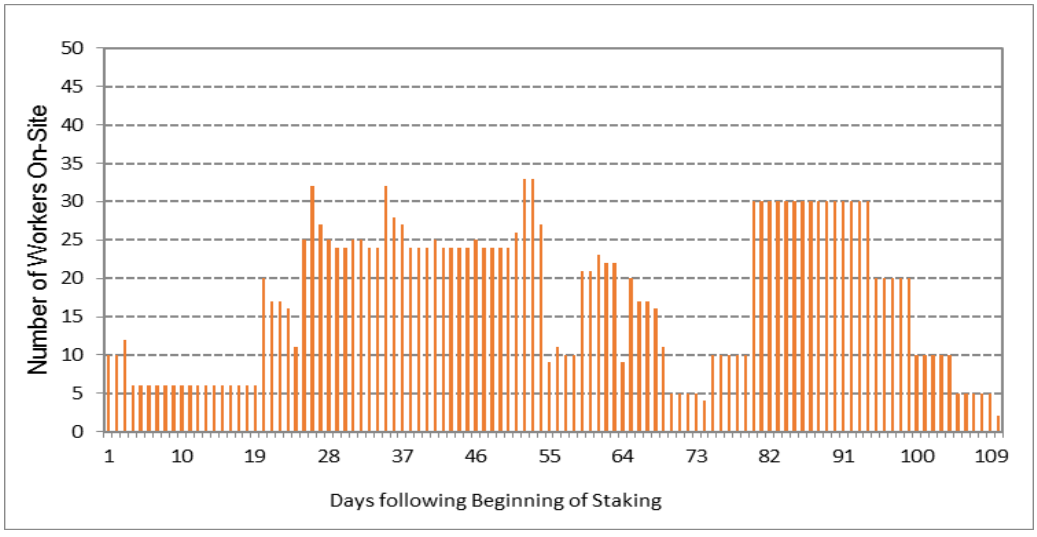

Figure 2-1 Daily On-site Workers to Develop a Single Well and Pad

The number of worker days and the duration to complete multi-well pads would be higher, but not proportionately higher to the increase in the number of wells located on such pads. For example, a 4-well multi-well pad would require an estimated 5,962 on-site worker days. Development duration for the multi-well pad would be an estimated 243 days. The time and labor savings would arise from reductions in rig mobilizations and demobilizations and sequential completions of all wells on a pad, thereby reducing the setup times associated with four individual pad sites. The employment and development timetable for a 4-well multi-well pad are summarized in the **Table 2-2** and **Figure 2-2**.

Table 2-2 Summary of Direct On-Site Effort to Develop a 4-Well Pad

Development Phase	Range of Persons on Site	Total Person-days On-Site To Complete Well	Typical Activity Duration (days)
Location staking/surveying	4	12	3
Cultural/biological clearance	2	2	1
Location construction, Including access and electricity	6	96	16
Rig mobilization/setup	11 to 20	81	5
Drilling	24 to 30	3,935	110
Completion	9 to 21	714	30
Rig demobilization/move	11 to 20	81	5
Tank battery and wellhead/ production equipment setup	5 to 30	995	40
Interim reclamation	2	2	1
Engineers and other staff	1	44	19
Totals	**1 to 30**	**5,962**	**243**

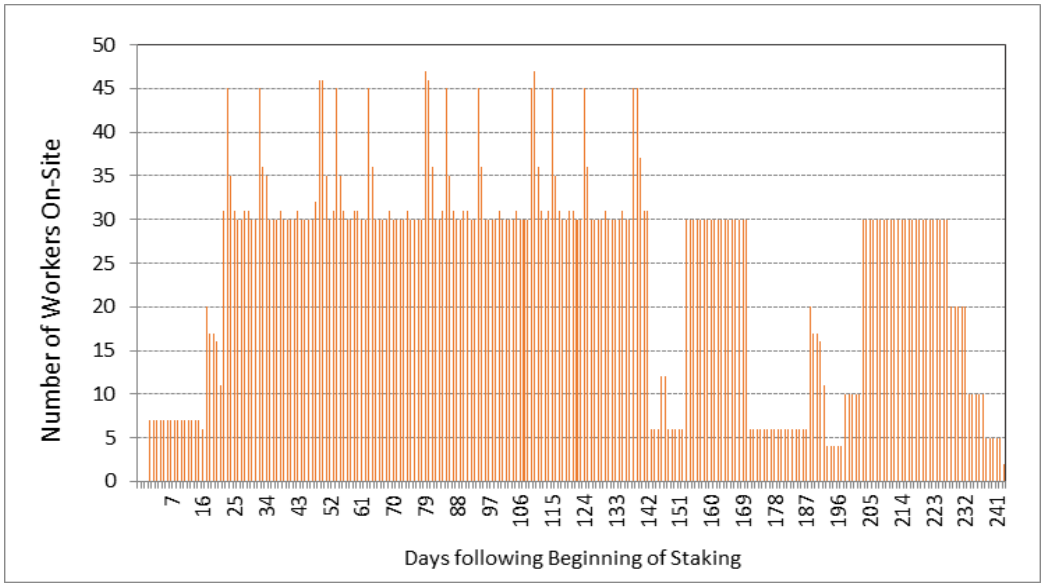

Figure 2-2 Daily On-site Workers to Develop a 4-well Pad

Applying the concept of work crews to the proposed development of 500 new wells per year would yield a daily estimate of direct employment over the course of a year (**Figure 2-3**). These estimates do not include the employment associated with ancillary facility development, water and oil hauling, production, or the allowances for additional residential, commercial, and infrastructure construction. Those estimates are addressed separately in Section 2.2.

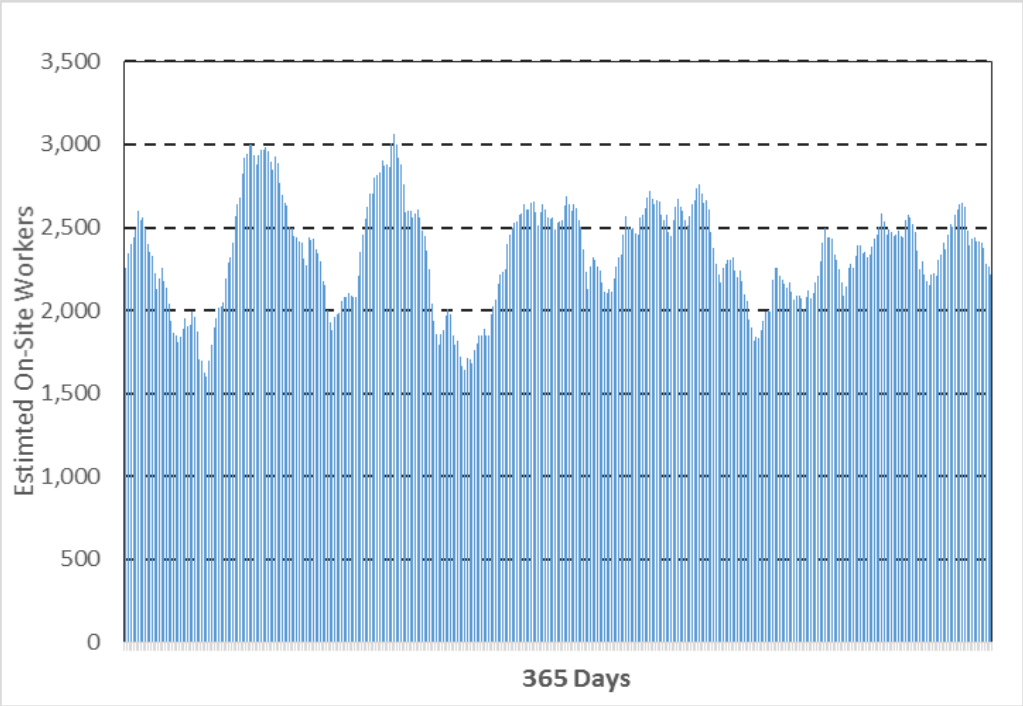

Figure 2-3 Estimated Daily On-Site Employment for Development of 500 New Wells per Year in the CCPA

Over a typical year, on-site employment within the CCPA would average approximately 2,350 workers in conjunction with new well development and completions, with an estimated range of daily on-site workers of approximately 1,600 to 3,000 workers. The variation primarily would result from differences in the number of rigs actively drilling and the number of completions occurring across the field.

2.2 Ancillary Facility and Infrastructure Construction Employment

Based on data supplied by the OG regarding the number of facilities, the approximate number of on-site worker-days to complete each facility, and an allowance for material, water, and other deliveries, the estimated total employment would be 126,979 worker days for Alternative A and an additional 916,294 worker days for Alternative B. Allowances for that employment was included in the first 8 years of the assumed development timetable. **Table 2-3** summarizes that employment by alternative and major facility type.

Table 2-3 Estimated On-site Worker-Days for Ancillary Facilities and Infrastructure Construction

Ancillary Facilities and Infrastructure	On-site Worker-Days		
	Per Unit	Alternative A	Alternative B
Gathering system (miles)	91	13,662	264,132
Electrical system (miles)	167	0	250,560
Production pad (number)	224	4,480	84,000
Water source well pad (number)	10	0	475
Well pad access road (miles)	17	6,670	27,302
Primary collector road (miles)	40	0	15,444
Gas plants (number)	36,000	72,000	72,000
Oil/condensate storage sites (number)	86	0	518
Centralized processing facilities (number)	112	0	224
Produced water injection well / disposal sites (number)	7	33	195
Compression facilities (number)	240	3,360	12,000
Equipment / pipe storage yards (number)	800	0	800
Electrical substations (number)	48	0	576
Workforce facilities (number)	128	256	128
Fresh water make-up ponds (number)	96	672	2,880
Water processing /recycling facilities (number)	450	450	1,800
Transportation/delivery add-on (25 percent of the above)	NA	25,396	183,259
Total On-site worker days	**NA**	**126,979**	**916,294**

2.2.1 Production Employment

Direct on-site employment was estimated in conjunction with ongoing production and field operations. The primary activities associated with operations would be the ongoing monitoring, maintenance and servicing of the wells, and occasional well workovers. The numbers of production employees would increase over time as the cumulative number of producing wells increased; however, it would then decline as the overall production declined. Future production employment was estimated assuming one employee per 20 producing wells during the initial development and the first 10 years of production. Thereafter, production employment would be estimated to decline as a function of long-term production declines. Field production employment excluding transportation workers would peak at 250 employees under these assumptions.

2.2.2 Off-site Administrative, Support, and Allowances for other Workers

The 24-hour drilling and scheduling requirements of some other activities would result in a considerable level of activity on weekends and require additional employees to sustain work crews during holidays, scheduled times off, illness, injury, or labor market inefficiencies (job/employee turnover). A 15 percent allowance above the average on-site employment was used as an assumption for this analysis. The direct workforce estimates included a further 20 percent allowance for administrative, management, maintenance, clerical, and other support employees working locally for the company and contractors to support the on-site workers. These two allowances would provide for as many as 1,200 additional workers supporting the in-field activities. This number would decline substantially once the development phase is completed.

2.2.3 Transportation Employment

The estimated numbers of transportation workers needed were a function of the estimated produced and flowback water and oil production; quantity of fluids to be hauled; destination; and typical capacity of each truck. Some producers may develop piping systems to handle produced water, which would reduce the number of employees required. However, the extent of such systems is unknown at this time. Consequently, an all truck haul scenario was assumed for analysis with respect to transportation and socioeconomics. The assumptions underlying the estimates of transportation employment are presented in **Table 2-4**. As with the development employment, the estimates of transportation employment included allowances to account for 7-day-per-week staffing for hauling crude and 6-day-per-week staffing for hauling flowback and produced water. Trucking operations were assumed to operate on a 24-hour basis on days when it would occur. Delivery drivers associated with drilling water were assumed to have been included in the OG estimates of direct employment associated with completion.

Table 2-4 Assumptions Affecting Transportation Employment

Type of Fluid	Average Quantity per Well	Duration of Hauling	Truckload Capacity (barrels)	Round-Trips/Day	Days/Year	Average Number of Trucking Company Employees / Truck
Produced oil over life of well (barrels)	274,033	Life of the well	180	10[1]	365	5
Drilling water (acre-feet)	13.1	Completion	180	10	365	5
Flowback (acre-feet)	7.8	Within 1 year	120	10	312	4.5
Produced water (acre-feet)	1.2	20 years	120	10	312	4.5

[1] Assumes each truck would complete 10 round-trips per day.

Under these assumptions, truck transportation employment would climb and peak at more than 1,500 workers. Of that total, 1,265 workers would be associated with Alternative B, and the remainder would be associated with production from existing wells and those completed under Alternative A. These totals do not reflect the water deliveries associated with well drilling, hydraulic fracturing, and other completion activities, which were assumed to be captured in the on-site workforce estimates provided by the OG.

2.2.4 Additional Residential and Commercial Development Construction Employment

Many communities affected by an upsurge in oil and gas development have experienced an increase in residential and commercial development construction activity. Some of this activity was occurring in Douglas and Glenrock in 2013 and 2014 in conjunction with the oil and gas development activity in the area. Although the IMPLAN multipliers include some provisions for such employment, the levels of employment typically are viewed as those associated with maintenance and remodeling rather than new construction triggered by an increase in local activity. Information provided by the OG for Alternative B did not directly address such construction. However, an extensive base of private real estate and public sector infrastructure exists in the analysis area, unlike in communities that have no prior history with natural resource development and would require the need for substantial new development. Future development would be stimulated by development under Alternative B as real estate developers and individual investors, landowners, and business owners would seek to address specific market needs. Existing construction firms would address some or all of those needs; however, an allowance of 400 additional general non-oil and gas construction workers during the first four years of Project development was assumed for this analysis. This allowance was added to the number of direct Project workers and

was the basis for estimating additional indirect and induced employment as well as overall workforce needs and migration.

2.3 Indirect and Induced Employment

This assessment initially focused much attention on the overall changes in local employment that would accompany energy resource development because changes in employment would translate into effects on migration, population growth, housing needs, and demands on public infrastructure and services. Changes in the level and characteristics of energy resource development (e.g., field development versus production) would ripple through the local economies. Increases in development would support economic expansion, and reductions would result in economic contractions. The degree of expansion or contraction would be a function of the initial changes in direct activity, the structure of the local economy, and the economic interactions between the local, regional, national, and global economies.

Economic multipliers are a common metric used to express the relationship between the initial economic stimulus (e.g., exploration and development activities). Economic multipliers can be defined for employment, income, output, and taxes. Employment (jobs) multipliers are a common metric used for socioeconomic assessment because of the availability of information regarding project-related employment. For example, a total employment multiplier of 2.7 would indicate that each direct job in that industry would support, on average, a total of 2.7 jobs locally, or alternatively, each direct job would support the equivalent of 1.7 additional jobs in the local economy. The additional jobs would include both indirect and induced responses to the economic infusion. Indirect jobs would be those linked to service companies and vendors that support the direct activity. Induced effects would be those supported by employee purchases (e.g., lodging, food, and clothing as well as fuel, tires, and other motor vehicle operating supplies). A higher multiplier could be seen as favorable because it reflects greater support for the local economy; however, it also could be seen as triggering more immigration, growth and associated demand for housing and community services.

Multipliers vary between industries, regions, and over time depending on the structure of the local economy and availability of various goods and services. For example, the multiplier for oil and gas drilling services is higher in the Casper/Douglas/Gillette area than in many other areas of Wyoming due to the existence of diversified and established industry supported by past oil and gas and mining activity in central Wyoming. The estimated multipliers associated with oil and gas drilling in the CCPA from the IMPLAN model are provided in **Table 2-5**. These multipliers are based on 2013 economic data for Converse and Natrona counties from the U.S. Bureaus of Economic Analysis, Labor Statistics, and the Census.

Three categories of jobs related to the exploration, development, and production activities in the CCPA:

- **DIRECT:** Operator and contract construction, drilling, or oil and gas service employees working directly on the project (e.g., surveyors, water haulers, and completion services).
- **INDIRECT:** Employees of companies providing goods and services to the project (e.g. fuel refiners, drilling pipe manufacturers, and cellphone service providers).
- **INDUCED:** Employees of private and public establishments supported by spending by direct and indirect employees (e.g., motels, grocery stores, medical, local government, and schools).

The indirect and induced effects in the local area often increase as activity level increase and the oil and gas field matures.

For this assessment, the estimates of direct employment associated with the initial development, ancillary facility construction, truck hauling of produced water and oil, and future production employment were multiplied by the appropriate employment multipliers provided on **Table 2-5** to obtain the corresponding estimates of indirect and induced employment.

Table 2-5 Total Output, Employment, and Income Multipliers: Converse and Natrona Counties, 2013

IMPLAN Sector / Industry	Direct Effects	Indirect Effects	Induced Effects	Total Effects	Multiplier (=Total/Direct)
20 – Extraction of oil and natural gas					
Output	1.000	0.131	0.117	1.248	1.248
Employment	1.226	0.578	0.920	2.725	2.222
Labor Income	0.175	0.048	0.038	0.262	1.491
22 – Coal mining					
Output	1.00	0.187	0.084	1.271	1.271
Employment	1.039	0.758	0.659	2.456	2.364
Labor Income	0.103	0.055	0.028	0.186	1.801
37 – Drilling oil and gas wells					
Output	1.000	0.197	0.175	1.372	1.372
Employment	2.091	1.058	1.371	4.520	2.162
Labor Income	0.252	0.077	0.058	0.386	1.536
38 – Support activities for oil and gas operations					
Output	1.000	0.173	0.257	1.430	1.430
Employment	4.934	1.048	2.009	7.990	1.619
Labor Income	0.427	0.054	0.084	0.565	1.323
54 – Construction of other new power and communication structures					
Output	1.000	0.285	0.308	1.593	1.593
Employment	5.175	1.673	2.413	9.261	1.790
Labor Income	0.492	0.087	0.101	0.680	1.384
56 – Construction of new highways and streets					
Output	1.000	0.435	0.244	1.679	1.679
Employment	4.258	2.069	1.908	8.263	1.790
Labor Income	0.337	0.121	0.080	0.538	1.597
58 – Construction of other new non-residential structures					
Output	1.000	0.337	0.288	1.625	1.625
Employment	5.474	2.063	2.258	9.794	1.789
Labor Income	0.443	0.100	0.095	0.637	1.439
395 – Wholesale Trade					
Output	1.000	0.225	0.241	1.466	1.466
Employment	3.959	1.609	1.887	7.454	1.883
Labor Income	0.378	0.075	0.079	0.533	1.408
409 – Rail Transportation					
Output	1.000	0.248	0.111	1.359	1.359
Employment	1.363	1.017	0.866	3.246	2.382
Labor Income	0.150	0.058	0.036	0.244	1.627

Table 2-5 Total Output, Employment, and Income Multipliers: Converse and Natrona Counties, 2013

IMPLAN Sector / Industry	Direct Effects	Indirect Effects	Induced Effects	Total Effects	Multiplier (=Total/Direct)
411 – Transportation by truck					
Output	1.000	0.396	0.319	1.715	1.715
Employment	5.277	1.819	2.499	9.596	1.818
Labor Income	0.500	0.103	0.105	0.708	1.416
413 – Pipeline Transportation					
Output	1.000	0.208	0.290	1.498	1.498
Employment	2.097	1.113	2.278	5.488	2.617
Labor Income	0.482	0.069	0.095	0.646	1.342

Source: IMPLAN 2015.

2.4 Total Incremental Employment Related to Energy Resource Development

Combining the various categories of direct employment and the estimated indirect and induced employment derived using the IMPLAN multipliers yields the total estimated incremental employment due to Alternative A and Alternative B. Estimated employment associated with Alternative A would peak at 2,004 jobs in 2026 and would decline after completion of development as production levels decline. A summary of the total employment (i.e., direct jobs plus total indirect and induced jobs) for Alternative A that was derived using the IMPLAN job multipliers is provided in **Table 2-6**. Total employment for Alternative B is provided in **Table 2-7**. The total number of jobs was converted to the estimated number of workers using multiple-job hold adjustment factors.

Table 2-6 Estimated Total Employment Associated with Alternative A

Activity	Estimated Total Employment			
	2018	2026	2032	2035
Oil and gas extraction	84	148	171	147
Oil and gas drilling	299	306	327	15
Oil and gas support	192	201	113	10
Construction	303	222	191	-
Transportation	200	295	214	127
Professional services	17	17	9	-
Direct jobs	1,095	1,189	1,025	299
Indirect and induced jobs	940	1,025	1,105	299
Adjustment for multiple job-holders	-192	-208	-205	-60
Total Workers	**1,843**	**2,004**	**1,958**	**573**

Table 2-7 Estimated Total Employment Associated with Alternative B

Activity	Estimated Total Employment			
	2018	2026	2032	2035
Oil and gas extraction	291	515	280	280
Oil and gas drilling	1,270	1,270	-	-
Oil and gas support	321	321	-	-
Construction	691	354	-	-
Transportation	441	1,205	660	590
Professional services	25	25	-	-
Direct jobs	3,039	3,690	940	870
Additional new residential and commercial construction	400	0	0	0
Indirect and induced jobs	3,146	3,324	801	750
Adjustment for multiple job-holders	-206	-667	-163	-152
Total Workers	**5,979**	**6,347**	**1,578**	**1,468**

Absent constraints on development due to the unavailability of sufficient labor, nearly 6,000 jobs would be added in the first full year of development under Alternative B. Job gains would continue as the number of transportation workers would increase in response to increases in production and infrastructure construction. The peak incremental total employment attributable to Alternative B would be greater than 6,300 jobs.

Dramatic decreases in local employment would occur following the completion of well development and infrastructure construction. Combined declines of more than 8,200 jobs would occur as production levels would reduce the level of transportation and production employment.

3.0 Population and Residency Patterns

Incremental labor demand is the basis for estimating population growth in the region. Based on local labor market conditions, it was assumed that residents would fill up to 1,500 jobs associated with oil and gas development in the CCPA under Alternative A. These job-takers could be from among the ranks of the unemployed, underemployed, individuals currently employed in previously-permitted oil and gas development activities in the CCPA, or who previously worked in the area but are temporarily working elsewhere due to the slowdown in the local industry. There would be no incremental population changes associated with these workers. It was assumed that current residents would fill up to 600 additional jobs under Alternative A.

Remaining positions would be filled by workers who relocate on a permanent or a temporary basis, the latter including those who would commute from their permanent place of residence on a periodic basis. Estimates of the population influx associated with such immigration were based on the following assumptions:

Direct employment:

- 70 percent of the workers would be single or single status (i.e., unaccompanied by others).
- 30 percent of the workers would be accompanied by one or more other family members, some of which also would be in the labor force, with an overall average household size of 2.2 persons.

Indirect and induced employment:

- 40 percent of the workers would be single or single status.
- 60 percent of the workers would be accompanied by one or more family members, with an overall average household size of 2.2 persons.

Applying those factors to the estimated labor force demands yielded an estimated population impact that would peak at nearly 9,500.

The high percentage of single-status males in an oil and gas development workforces is well known, but poorly documented. Jeffrey Jaquet, who has written extensively about socioeconomic aspects of the natural gas boom in Sublette County, states that "demographic data on these transient populations is extremely hard to obtain. In the natural gas industry, the energy company (or operator) contracts out the vast majority of work to an array of contractors or subcontractors, and the energy companies have little direct ability, or more importantly desire, to obtain population or demographic information from the workforces. Anecdotal evidence suggests that these workers are primarily in their 20's and 30's and overwhelmingly male" (Jacquet 2009). Blevins et al. (2004) also discusses the large number of single status males in oil and gas development workforces.

A key factor underlying the assumptions for workforce, population, and housing distribution was the location of oil and gas service firms. The majority of oil and gas industry workers during the development phase would be employees of oil and gas service companies. Such workers typically report to their employer's offices and yards for work and travel to work assignments throughout the region with their employer's vehicles and equipment. Casper has been the regional oil and gas service center for central Wyoming since the 1920s.

As shown in **Table 3-1**, approximately 51 percent of the oil and gas extraction firms in the region are located in Natrona County, approximately 40 percent are in Campbell County, and approximately 9 percent are in Converse County. Similarly, of the firms classified as support for the mining sector, including oil and gas, approximately 41 percent are located in Natrona County, approximately 45 percent are in Campbell County (although many of those are associated exclusively with coal mining), and approximately 14 percent are in Converse County. Many oil and gas service companies provide services to operations throughout central Wyoming and even out-of-state, including into the Bakken region of North Dakota; therefore, an employee could work on a well in the CCPA and also be assigned to perform services on a well in Campbell County or elsewhere the next day or week. Some oil and gas service firms have established offices in Converse County and additional firms may establish offices, field offices, and yards in the county in the future. However, the majority of oil and gas service workers would be expected to live near their employers in those cities because many such firms are already located in Casper or Gillette.

Table 3-1 Employing Units of the Oil and Gas Industry in the Analysis Area: 3rd Quarter 2013

Employing Units	Converse County	Natrona County	Campbell County	Wyoming
Oil and gas extraction	7	40	31	242
Support activities for mining, including both coal mining and oil and gas[1]	48	138	151	768

[1] Excludes many construction contractors, trucking firms, and professional services firms that are classified in other industries but also provide some support for oil and gas development.

Source: Wyoming Department of Workforce Services 2014a.

The assumed distribution of new residents to the region related to development of the Project would be as provided in **Table 3-2**.These assumptions reflect the existing size of the communities in terms of population size; the locations of the established oil field services industries (i.e., more in the Casper area); the inventory of temporary accommodations; the size, extent, and diversity of the trade and service industry base (e.g., larger, more extensive, and more diverse base in Casper compared to Douglas), and the base of housing opportunities (e.g., more limited in Douglas). Additionally, spouses of relocating workers would be more likely to find employment in the larger population centers, increasing the possibility that some workers would choose to live in these communities. The availability of temporary housing and proximity to the CCPA supports assigning some temporary residents to Wright and increasing the share to Gillette. Additionally, it would be likely that other smaller communities also could experience increases in population, particularly as housing availability tightens in the larger communities.

Table 3-2 Distribution of New Residents to the Region

Community	Percent of Total	Community	Percent of Total
Casper/Evansville/Mills	50	Glendo	2
Douglas	17	Wheatland	2
Gillette	15	Rolling Hills	0.5
Glenrock	4	Elsewhere, including unincorporated	5.5
Wright	4	**TOTAL**	**100**

4.0 Housing

Incremental workforce and population growth serve as the basis for estimating housing needs in the region. Direct, indirect, and induced workers associated with Alternative B would require both temporary and longer-term housing resources. A portion of the drilling and field-development workforce, including ancillary facility construction workers likely would seek temporary housing resources while working in the CCPA. Temporary demand could be accommodated by motels and recreational vehicle pads, or by temporary workforce housing (sometimes known as mancamps) that could house one or multiple beds per unit.

Most production workers and a portion of drilling, completion, and gas field service workers as well as indirect and induced employees likely would seek conventional housing resources in communities near the CCPA. For this assessment, conventional housing included single-family and multi-family housing as well as mobile homes on lots and in mobile home parks.

Housing needs is expressed in terms of units; needs for temporary housing is expressed in terms of rooms/units. Overall need was based on room/unit per 1.2 single-status workers and one dwelling unit per accompanied-worker household. It was assumed that 500 beds in temporary workforce housing facilities would be provided or contracted for by the operators and/or contractors during the early years of development. Such temporary accommodations were not specifically included as part of the Proposed Action; however, the OG has indicated that development of temporary housing would be considered in the event of critical housing shortages. The need for such temporary housing capacity arose during recent oil and gas development experiences in southern and southwestern Wyoming as well as in the Bakken region of North Dakota. Given the near full absorption of housing that occurred in the three-county socioeconomic analysis area during 2013 and 2014, and an anticipated resumption of those conditions that would be anticipated upon implementation of Alternative B, it is likely that such temporary workforce facilities would be required to house the estimated employment levels for the early years of development.

The remaining housing need was derived based on assumptions regarding the type of housing that the direct, indirect, and induced workers living in each community would seek or be able to secure. Casper and Gillette have the largest share of existing conventional and temporary housing resources, and developers likely would be cautious about investing in new housing development based on the historic and recent volatility in oil and gas prices.

Distributions of housing were defined: one for the larger communities where many direct workers and most of the indirect and induced workers likely would reside, and the other for those smaller communities that primarily would host direct and some induced workers. The housing distribution assumptions used for this analysis are summarized in **Table 4-1**.

Table 4-1 Assumed Housing Distribution

Communities	Percent of Housing Market		
	Temporary Lodging	Rental Housing	Conventional Ownership
Larger communities (i.e., Casper, Douglas, and Gillette)	40	50	10
Smaller communities (i.e., Glenrock, Wright, Glendo, Wheatland, Rolling Hills, and others)	78	20	2

The resulting overall allocation of the housing need during the development phase would be:

- Temporary lodging, including recreational vehicle pads: 47 percent
- Conventional rental units: 45 percent, and
- Conventional long-term ownership: 9 percent.

It was not assumed that the housing market would be static. The rapid buildup of oil and gas development associated with Alternative B likely would exceed the housing sector response in Converse County, particularly in the early years of the development, which likely would result in more workers living in temporary housing in the Casper area, given the much larger lodging base in that community.

5.0 Production

Estimated oil, gas, and produced water production is another important element of the socioeconomic assessment. Annual oil and gas production volumes were key inputs to the revenue analysis, and estimated produced oil and water volumes were inputs into the estimated truck haul transportation employment. Assumptions used regarding annual production per well are presented in **Table 5-1**. These assumptions were drawn from information provided by the OG combined with consideration of the analysis for the geology and hydrology resources.

Table 5-1 Assumptions for Annual Production per Well

Production Year	Oil (barrels)	Natural Gas (MMcf)	Produced Water (barrels)
1	66,479	209	9,302
2	29,966	118	9,302
3	20,597	84	9,302
4	16,006	66	9,302

Table 5-1 Assumptions for Annual Production per Well

Production Year	Oil (barrels)	Natural Gas (MMcf)	Produced Water (barrels)
5	13,235	56	9,302
6	11,373	48	9,302
7	10,009	43	9,302
8	8,979	38	9,302
9	8,163	35	9,302
10	7,495	32	9,302
11	6,914	30	-
12	6,418	28	-
13	5,983	26	-
14	5,604	25	-
15	5,253	23	-
20	3,935	18	-
25	2,990	13	-
30	2,401	10	-
Total for Life of Well	**274,034**	**1,157**	**93,020**

Combining the assumed number of new wells drilled annually and the annual production assumptions, total estimated annual production would be as provided on **Table 5-2**.

Table 5-2 Estimated Annual Production

	Alternative A			Alternatives B and C		
Production Year	Number of New Wells	Oil (millions of barrels)	Natural Gas (MMcf)	Number of New Wells	Oil (millions of barrels)	Natural Gas (MMcf)
2018	110	3.66	11,495	500	16.62	52,250
2019	110	8.96	29,453	500	40.73	133,875
2020	110	11.74	40,513	500	53.37	184,150
2021	110	13.75	48,758	500	62.52	221,625
2022	110	15.36	55,457	500	69.83	252,075
2023	110	16.72	61,155	500	75.98	277,975
2024	110	17.89	66,143	500	81.33	300,650
2025	110	18.94	70,593	500	86.08	320,875
2026	110	19.88	74,624	500	90.36	339,200
2027	110	20.74	78,320	-	94.28	356,000
2028	110	21.53	81,736	-	81.26	319,275
2029	110	22.27	84,915	-	60.48	252,100

Table 5-2 Estimated Annual Production

Production Year	Alternative A			Alternatives B and C		
	Number of New Wells	Oil (millions of barrels)	Natural Gas (MMcf)	Number of New Wells	Oil (millions of barrels)	Natural Gas (MMcf)
2030	110	22.95	87,890	-	50.94	215,350
2031	110	23.59	90,684	-	44.69	190,575
2032	110	24.18	93,313	-	40.09	172,075
2033	13	21.52	85,657	-	36.49	157,450
2038	-	10.55	45,806	-	25.34	105,175
2043	-	7.46	32,887	-	18.89	79,175
Life of Project	**1,663**	**455.7**	**1,924,424**	**5,000**	**1,370.17**	**5,7860,000**

Annual production value was derived by combining the production volumes with assumptions regarding future commodity prices for oil and gas. Per guidance from the BLM, a range of commodity prices were used, including a low price scenario and a high price scenario. Estimated values of production under the low price scenario were $65 per barrel of crude and $4.00 per million cubic foot for natural gas. The corresponding assumptions under the high price scenario were $100 per barrel for crude and $6.00 per million cubic foot for natural gas. The commodity prices for natural gas were net of a processing allowance of $0.50 per million cubic foot of gas. The resulting estimates of the annual value of oil and gas output associated with the alternatives are shown in **Table 5-3**. No probability analysis of either of these price scenarios or of possible combinations of intermediate prices was completed for this assessment.

Table 5-3 Estimated Annual Value of Oil and Gas Output

Production Year	Alternative A (millions of nominal dollars)		Alternatives B and C (millions of nominal dollars)	
	Low Price	High Price	Low Price	High Price
2018	$222.08	$314.00	$1,020.00	$1,425.95
2019	$553.57	$774.00	$2,516.23	$3,518.08
2020	$730.80	$1,022.00	$3,321.81	$4,645.03
2021	$859.76	$1,202.00	$3,908.02	$5,465.18
2022	$963.11	$1,347.00	$4,377.77	$6,122.42
2023	$1,050.25	$1,469.00	$4,773.87	$6,676.65
2024	$1,126.08	$1,575.00	$5,118.54	$7,158.90
2025	$1,193.46	$1,669.00	$5,424.85	$7,587.51
2026	$1,254.34	$1,754.00	$5,701.58	$7,974.72
2027	$1,309.99	$1,832.00	$5,954.52	$8,328.66
2028	$1,361.24	$1,904.00	$5,167.47	$7,228.67
2029	$1,408.72	$1,970.00	$3,887.02	$5,438.48
2030	$1,452.93	$2,032.00	$3,282.40	$4,592.74
2031	$1,494.27	$2,090.00	$2,884.12	$4,035.58

Table 5-3 Estimated Annual Value of Oil and Gas Output

Production Year	Alternative A (millions of nominal dollars)		Alternatives B and C (millions of nominal dollars)	
	Low Price	High Price	Low Price	High Price
2032	$1,533.05	$2,181.00	$2,590.60	$3,624.96
2033	$1,371.60	$1,936.00	$2,360.15	$3,302.54
2038	$683.25-	$954.00	$1,547.38	$2,165.41
2043	$484.50	$677.00	$1,161.64	$1,625.62-

[1] Estimated value of production under the low scenario would be $65 per barrel of crude oil and $4.00 per million cubic foot for natural gas. The corresponding assumptions under the high price scenario were $100 per barrel for crude oil and $6.00 per million cubic foot for natural gas. The commodity prices for natural gas were net of a processing allowance of $0.50 per million cubic foot of gas.

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