4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This Chapter provides an analysis of the impacts or environmental consequences that would result from implementation of Alternative A – Proposed Action, Alternative B – No Action Alternative, Alternative C – Agency Preferred Alternative, or Alternative D – Minimum Development Alternative. The impact analysis describes the effects of implementing the alternatives on the physical, biological, and human environment as described in **Chapter 3**. The resource-specific effects of the alternatives are evaluated both quantitatively and qualitatively, depending on available data and the nature of the resource analyzed. Mitigation measures and residual impacts are discussed, where appropriate, to further minimize impacts.

An environmental consequence or impact is defined as a modification in the existing environment brought about by the Proposed Action or an alternative. Impacts can be a primary result of the action (direct) or a secondary result (indirect), and can be permanent or long-lasting (long-term) or temporary and of short duration (short-term). Impacts can vary in degree from only a slight discernible change to a total change in the environment.

Direct effects are caused by the action and generally occur at the time the action is implemented and within the Project Area (e.g., removal/loss of vegetation). Indirect effects are caused by the action and occur later in time or farther removed from the Project Area (e.g., sediment yield impacts downstream from the Project Area). Short-term impacts are effects on the environment that occur during and immediately after well pad construction, drilling, completion, testing, and/or production facility installation, and can last up to four years, or until completion of interim reclamation. Although short in duration, such impacts can be obvious and disruptive. For this project, short-term impacts are defined as lasting four years or less. Long-term impacts are changes made in the environment during construction and operation of the project that remain longer than four years and perhaps for the life of the project (approximately 20 years) and beyond.

Analysis of the development of wells on State and Tribal leases are included for each alternative; however, the BLM only approves the development of Tribal leases following authorization of the BIA during the APD process and does not have the authority to approve development on State leases. Despite this, analysis of these wells was included to further inform the BLM AO on the overall extent of project impacts.

4.2 AIR QUALITY

This Section on air quality environmental impacts is based on emission inventories for the Proposed Action and alternatives (Appendix F-1 through F-4); the *Near Field Air Quality Technical Support Document for the XTO Energy RBU Infill Development Project* (RBU Near-Field TSD), Kleinfelder/Buys and Associates 2010/updated 2012 (Appendix G); the *Ozone Impact Assessment for XTO Energy's River Bend Unit Natural Gas Development Project Environmental Assessment*, (RBU Ozone Assessment) Alpine/Buys and Associates, May 2010 (Appendix H-1), and the *Memorandum to Update the Ozone Impact Assessment for XTO Energy's River Bend Unit Natural Gas Development Project* (RBU Ozone Update Memo), Alpine 2011 (Appendix H-2). A visibility degradation analysis was also conducted and is discussed in the RBU Near-Field TSD.

Both development and production activities for the Proposed Action and alternatives may cause emissions of pollutants with the potential to affect ambient air quality. These emissions may be caused by the following sources:
Development Activities:

- Well pad, new central facility and road construction: equipment producing fugitive dust while moving and leveling earth and vehicles generating fugitive dust on access roads;
- Drilling: vehicles generating fugitive dust on access roads and drill rig engine exhaust;
- Completion: vehicles generating fugitive dust on access roads, frac pump engine and generator emissions and completion venting emissions;
- Vehicle tailpipe emissions associated with all development phases.
- Production Activities:
- Well production operations: three-phase separator emissions, well site glycol dehydration unit emissions, flashing and breathing emissions from condensate tanks, fugitive emissions from pneumatic devices, fugitive dust and tailpipe emissions from pumpers and trucks transporting produced condensate and water from storage tanks;
- Central production facility: compressor engines emissions, central glycol dehydration unit emissions, fugitive emissions from pneumatic devices, flare emissions from central dehydrators and central flashing and breathing emissions from condensate tanks; and
- Vehicle tailpipe emissions associated with all production phases.

The potential for adverse air quality effects of the Proposed Project is assessed by comparing the potential ambient air quality impact of the Proposed Project to the NAAQS. The potential impact of the Proposed Project is a combination of the existing (background) ambient air quality and the modeled impact of future activities caused by the Proposed Project.

Table 3-2 in **Chapter 3** presents the background ambient air quality and the associated NAAQS. For near-field impacts resulting from development activities, the pollutant of concern is PM_{10} and $PM_{2.5}$. For near-field impacts resulting from production activities, the pollutants of concern are NO_2 and CO. Ozone is the pollutant of concern for far-field impacts related to production. These potential impacts are discussed in the following sections.

Prior to early 2010, the NAAQS for NO_2 was promulgated only for an annual average. In early 2010 (after the RBU Near-Field TSD analyses had been completed), the USEPA promulgated a new 1-hour NO_2 standard. This standard is complex and is stated as the 3-year average of the 98th percentile of the annual distribution of daily maximum 1-hour concentrations within an area.

Although the potential impact of development activities was not quantitatively analyzed in the RBU Near-Field TSD, such activities are not expected to cause an exceedance of the 1-hour standard. This is because development activities at any one location would be temporary (less than 3 years) and would not otherwise contribute to NO_2 concentrations after these activities are completed.

For example, drill rig emissions analyzed for a similar development project (Greater Natural Buttes FEIS, March 2012) determined that if Tier 2 drill rig engines are used and there are no more than four drill rigs running on adjacent well pads simultaneously, maximum single hour modeled impacts could be higher than the concentration value for the 1-hour NO_2 NAAQS (highest reported value = 217.8 ug/m^3 compared to the NAAQS of 188 ug/m^3). However, compliance with the NAAQS for 1-hour NO_2 is based on the 98th percentile of the daily 1-hour maxima for each of 3 consecutive years. Because duration of drilling is limited, the drilling activity would not likely coincide with the eight worst case hours in a single year. Also, because drill rigs move to different locations during the course of development, the same level of

drilling would not occur for 3 consecutive years at the same location. Therefore, exceedances of the 3-year average 98th percentile would not likely occur, even if a single hour exceeds the numerical value of the NAAQS.

The Proposed Action drilling operations are consistent with GNB, and thus the 1-hour NO_2 standard will not be exceeded with the Proposed Action. Potential emissions from operational traffic are also not expected to adversely impact one-hour NO_2 concentrations due to the low traffic volume associated with the proposed alternatives.

In addition to the above BLM proposed 1-hour NO_2 mitigation measures, prior to beginning drilling operations they will be reviewed by the Utah Department of Air Quality and the USEPA under the Clean Air Act permitting program on state or tribal lands, including the new Tribal New Source Review regulations. Under this permitting program, operations may not commence until it is demonstrated that they will not cause an exceedance of the 1-hour NO_2 NAAQS.

Not only has the USEPA published a new 1-hour NO_2 NAAQS in a probabilistic form, on June 22, 2010 the USEPA published a new 1-hour SO_2 NAAQS and deleted the annual standard. The new 1-hour SO2 standard is expressed as the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour concentrations within an area. Based on analysis for a similar project (Greater Natural Buttes, FEIS, March 2012), and the relatively low amounts of production related SO_2 emissions, project related impacts are anticipated to remain well below the 1-hour SO_2 NAAQS.

4.2.1 Alternative A – Proposed Action

Pollutant emissions have the potential to affect air quality on both a local and a regional scale. Emission inventories for the criteria pollutants [nitrogen oxides (NO_x), CO, SO_2, particulates (PM_{10} and $PM_{2.5}$)] and HAPs were developed for the Proposed Action development and production-related activities. Near-field pollutant dispersion modeling was performed to assess the potential air quality impacts from the Proposed Action for comparison to existing ambient air quality standards. Far-field (ozone) modeling was also conducted and is discussed further in the following paragraphs.

In addition to the modeling conducted specifically for the Proposed Action, the air quality analyses performed for the Anadarko Greater Natural Buttes FEIS (March 2012), and the Gasco Uinta Basin Natural Gas Development Project (March 2012) both incorporated the Proposed Action emissions. These analyses showed that air quality in the project area is not expected to be adversely impacted from the Proposed Action.

4.2.1.1 Emissions

During the development phase, vehicle and fugitive dust emissions would increase within the RBU Project Area. Vehicle emissions would result from work crews commuting to and from the work site and from the transportation and operation of equipment to construct well pads, roads, and pipelines. Vehicle tailpipes would emit small quantities of NO_2, SO_2, and CO. Fugitive dust concentrations (PM_{10} and $PM_{2.5}$) would increase with additional vehicle traffic on roads and from wind erosion in areas of soil disturbance. Drill rig operations would result mainly in an increase of NO_2 and CO emissions. These emissions would produce elevated pollutant levels but would be short-term and localized for the duration of the activities. **Table 4.2-1** summarizes emissions expected from the development phase.

Table 4.2-1. Annual Emissions for Various Phases of the Proposed Action*

Pollutant	Development Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
NO_X	0.23	192	26.0	0.03	0.00	218
CO	1.20	154	22.4	0.27	0.00	178
VOC	0.14	45.6	17	0.02	0.00	63
SO_2	0.01	0.70	0.30	0.002	0.00	1.0
PM_{10}	8.88	496	210	1.59	0.03	716
$PM_{2.5}$	0.95	54.6	21.2	0.16	3.84E-03	77
Benzene	0.00	0.10	0.07	0.00	0.00	0.2
Toluene	0.00	0.04	0.06	0.00	0.00	0.1
Ethylbenzene	0.00	0.00	0.00	0.00	0.00	0.002
Xylene	0.00	0.02	0.02	0.00	0.00	0.0
n-Hexane	0.00	0.00	0.31	0.00	0.00	0.3
Formaldehyde	0.00	9.97E-03	5.73E-04	0.00	0.00	0.011
Acrolein	0.00	9.96E-04	5.49E-05	0.00	0.00	1.1E-03
CO_2	0.00	19,541	932	0.00	0.00	20,472
CH_4	8.65E-03	12.4	89	1.55E-03	0.00	101
N_2O	0.00	0.00	0.00	0.00	0.00	0

[a] Assumes maximum development scenario (93 wells developed in one year)

* Emissions Inventory as presented for the Proposed Action based on revisions to data and assumptions from the Emission Inventory as analyzed in the Near-Field AQTSD. Revisions made to account for refinements in production data and related equipment requirements

During the production phase, NO_2, CO, VOC, PM, and HAP emissions would result from the long-term operation of several compressor engines, separator heaters, dehydrators, and pump unit engines. Vehicle tailpipes would emit small quantities of NO_2, SO_2, and CO. Fugitive dust concentrations (PM_{10} and $PM_{2.5}$) would increase with additional vehicle traffic on roads.

Emissions for the Proposed Action from the operation of compressor engines were calculated based on the additional 8,520 of horsepower distributed over eight existing compressor stations and one new compressor station. Emissions were estimated based on typical emissions and control rates for a 4-stroke lean-burn engine with an oxidation catalyst. These controls were applied to the CO and formaldehyde emissions because of requirements of the MACT Federal rules found under Title 40, Section 63, Subpart ZZZZ of the Code of Federal Regulations. **Table 4.2-2** summarizes the annual emissions associated the production phase.

Table 4.2-2. Total Annual Production Emissions from the Proposed Action*

Pollutant	Total Project Production Related Emissions (tons/year) [a]							
	Pumping Unit Engines	Production Heaters	Stock Tanks	TEG Dehydrators	Operations Vehicle	Pneumatics	Compressor Engines	Total (tons/year)
NO_X	30	218	0.00	0.00	15.8	0.0	82	346
CO	60	183	0.00	0.00	44.0	0.0	16	302
VOC	15	2.68	1,326	1,535	9.01	2196.5	38	5,122
SO_2	0.00	0.00	0.00	0.00	0.65	0.0	0.00	0.65
PM_{10}	1.5	16.6	0.00	0.00	1.36	0.0	3.0	22
$PM_{2.5}$	1.5	16.6	0.00	0.00	0.14	0.0	3.0	21
Benzene	0.12	0.00	8.5	161	0.00	0.0	0.03	170
Toluene	0.04	0.01	7.1	363	0.00	0.0	0.03	370
Ethylbenzene	0.00	0.00	0.1	21.7	0.00	0.0	0.00	21.8
Xylene	0.01	0.00	1.3	321	0.00	0.0	0.01	323
n-Hexane	0.00	3.92	26.5	13.1	0.00	0.0	0.08	44
Formaldehyde	1.5	0.16	0.00	0.00	0.00	0.0	4.9	6.6
Acetaldehyde	0.21	0.00	0.00	0.00	0.00	0.0	0.6	0.8
Acrolein	0.20	0.00	0.00	0.00	0.00	0.0	0.37	0.57
CO_2	38,217	261,486	11.0	0.00	0.00	0.0	32,839	332,553
CH_4	17	5.01	446	163	0.48	8634.1	373	9,639
N_2O	0.00	4.79	0.00	0.00	0.00	0.0	0.00	4.79

[a] Assumes maximum development scenario(484 producing wells). Emission estimates for additional HAPs are included in the inventory. Emission for HAPs less than 0.5 tons per year are not shown.

* Emissions Inventory as presented for the Proposed Action based on revisions to data and assumptions from the Emission Inventory as analyzed in the Near-Field AQTSD. Revisions made to account for refinements in production data and related equipment requirements

The emission estimates presented in **Tables 4.2-1 and 4.2-2** are significantly less (on the order of one-half) than the emissions presented in the May 2010 Draft EA for the Proposed Action. The May 2010 emission estimates were based on an initial estimate prepared by Dominion Energy. After the May 2010 Draft EA was prepared, the Project Proponent (i.e., XTO), conducted an extensive internal review of the methodology and assumptions used in the Dominion Energy estimates. The review determined that the Dominion emission estimates contained a number of assumptions and methods that over-estimated emissions. **Table 4.2-3** shows the main refinements made to yield the emission assumptions shown in **Tables 4.2-1 and 4.2-2**. The refinements in **Table 4.2-3** reduced total NOx emissions (development plus production) from 905 tons per year to 564 tons per year and VOC emissions from 11,848 tons per year to 5,185 tons per year. Nevertheless, the RBU Near-Field impact analysis is based on the original May 2010 Dominion Energy emission over-estimates.

Table 4.2-3. Basis for Refined Emission Estimates from the Proposed Action*

Item	Dominion Energy Estimate	Refined Estimate
Well Production	Constant for 15+ years	Production decline that is actually experienced
Well Gas Production Rate	1.2 MMscf gas per day per well	0.2 MMscf per day per well
Well Condensate Production Rate	3 bbl per day per well	1 bbl per day per well
Gas analysis for VOC content	Single value from a compressor station	Values from well sites
Number of wells requiring pumping units	454 wells and 35 hp engines	73 wells and 22 hp engines
Glycol dehydrator reboilers	500 MMBtu/hour	250 MMBTU/hour

4.2.1.2 Criteria Pollutant Impacts

Criteria pollutants modeled for potential impacts and compared to ambient air quality standards include PM_{10}, $PM_{2.5}$, NO_2 (annual) and CO. The highest possibility of emissions for PM_{10} and $PM_{2.5}$ takes place during the construction and development phase of the proposed action. The highest possibility of emissions for NO_x and CO takes place during the drilling, completion, and production phases of the proposed action. Each pollutant was modeled under the maximum development scenarios of the proposed action. **Tables 4.2-4 and 4.2-5** presents the maximum predicted impacts from the dispersion modeling added to the existing background concentration and compared to the applicable ambient air quality standard for each modeled criteria pollutant. Modeling assumptions can be found in the RBU Near-Field TSD. Maximum impacts are a combination of worst-case meteorology (i.e., poorest dispersion conditions), worst-case (i.e., maximum) emissions, and maximum background.

Table 4.2-4. Proposed Action Potential Construction and Development Impacts

Pollutant	Averaging Period	Ambient Air Concentration (µg/m^3)				
		Year of Maximum Impact	Predicted	Background [b]	Total	NAAQS
PM_{10}	24-Hour	1999	41.9	18.0	59.9	150
$PM_{2.5}$	24-Hour	1995	18.4	21.6	40.0[b]	35
	Annual	1995	0.73	12.3	13.0	15

[a] Based on data collected at the Ouray or Redwash Monitoring Stations (see AQIA, Greater Natural Buttes FEIS, AQTSD, March 2012).

[b] Although the modeled total impact appears to exceed the NAAQS, this is not case. The NAAQS is the 3-year average of the 98th percentile. The modeled impact presented herein is the maximum modeled concentration, not the 98th percentile. Accordingly, due to the conservative nature of the model assumptions, use of a background data value based on less than 3-years of data, and use of the maximum impact instead of the 98th percentile, actual impacts are expected to be less than the NAAQS.

Table 4.2-5. RBU Proposed Action Development and Operations Impacts

Pollutant	Averaging Period	Ambient Air Concentration (µg/m^3)					
		Year of Maximum Impact	Predicted	Background [a]	Total	PSD Class II Increment	NAAQS
NO_2	Annual	1999	19.2[b]	9.0	28.2	25	100
CO	8-hour	1999	338	3,910	4,248	-	10,000
	1-hour	1996	658	6,325	6,983	-	40,000

[a] Based on data collected at the Ouray or Redwash Monitoring Stations (see AQIA, Greater Natural Buttes FEIS, AQTSD, March 2012).
[b] NO_2 impacts are converted from modeled NOx to NO_2 using a 75% conversion rate.

4.2.1.3 Hazardous Air Pollutant Impacts

Modeled results were compared to the Utah screening levels, and the acute, chronic, and carcinogenic thresholds for potential adverse health impacts. Impacts from HAPs with the highest four predicted emissions, plus acrolein due to the dangers in small levels of exposure, were compared to all criteria. Short-term impacts from HAP exposure were assessed by comparing one-hour average impacts to the HAP-specific acute REL (reference exposure level) and annual average impacts to the HAP-specific RfC (reference concentration for continuous inhalation exposure). The REL is the acute concentration at or below which no adverse health effects are expected. The RfC is the average concentration, i.e., an annual average, at or below which no long-term adverse health effects are expected. Both of these guideline values are for non-cancer effects. **Table 4.2-6** presents the predicted results of emission impacts under the proposed action in comparison to the State of Utah TSLs for averaging periods of 1-hour (short-term) and 24-hour (chronic). None of the HAPs exceed Utah TSLs.

Table 4.2-6. RBU Proposed Action Predicted HAP Comparison to State of Utah TSLs

Pollutant and Averaging Time	Predicted Maximum Impact (µg/m^3)	Maximum Impact Year	Toxic Screening Levels [b] (µg/m^3)	Percent of TSL
Formaldehyde (1-hour)	12.8	1996	36.8	34.8%
Acrolein (1-hour)	1.63	1996	22.9	7.12%
Benzene [a] (Annual)	26.9	1999	53.2	50.6%
Toluene (24-hour)	10.5	1996	2,512	0.40%
Xylenes (24-hour)	103	1999	14,473	0.70%

[a] Although there exists an acute TLV for benzene, the State of Utah does not apply a comparison to an acute TSL since the chronic TSL is more stringent. Thus, the annual Benzene impact is compared to the Benzene chronic TSL.
[b] Source: Utah Department of Environmental Quality – Division of Air Quality (2008).

Table 4.2-7 presents the acute RELs and RfCs for non-cancer effects for the Proposed Action. The predicted maximum concentrations of all HAPs are compared against the REL and RfC for each pollutant. Predicted concentrations of acrolein for the Proposed Action exceed both the acute REL and the RfC.

Table 4.2-7. Proposed Action Non-Carcinogenic Acute REL and RfC Impacts

HAP	REL [a] (µg/m^3)	Predicted Maximum 1-Hour Impact (µg/m^3)	Percent of REL	RfC [c] (µg/m^3)	Predicted Maximum Annual Impact (µg/m^3)	Percent of RfC
Acrolein	0.19	1.63	858%	0.02	0.13	650%
Acrolein [d]	2.5	1.63	65%	0.35	0.13	37%
Formaldehyde	94	12.8	13.6%	9.8	1.04	10.6%
Benzene [b]	1,300	187	13.0%	30	26.9	89.6%
Toluene	37,000	521	1.41%	5,000	43.3	0.87%
Xylenes	22,000	321	1.46%	100	26.2	26.2%

[a] USEPA Reference Exposure Level (REL) for no adverse effects EPA Air Toxics Database, Table 2 (EPA 2007), unless otherwise noted.
[b] REL for benzene is based on a 6-hr exposure (OEHHA 1999), predicted concentration is a 6-hr average.
[c] EPA Air Toxics Database, Table 1 (EPA 2007)
[d] California OEHHA acute and chronic REL, June 2008.

The modeling based on the May 2010 Draft EA for the Proposed Action shows an apparent exceedance of the acrolein USEPA REL and RfC. However, the modeling does not show an exceedance of the California RELs and RfC. However, the May 2010 Draft EA modeling was for emissions of acrolein much greater than for the current Proposed Action (shown in **Tables 4.2-1 and 4.2-2**). Furthermore, the maximum modeled acrolein concentrations are at locations where there are no persons exposed (i.e., the modeling was done for the maximum impact point, just as the NAAQS modeling). Therefore, no adverse health effects from acrolein emissions are expected.

Table 4.2-8 presents the unit risk factor, exposure adjustment factor, and the estimated cancer risk for the MLE and MEI exposure scenarios for the Proposed Action known, probable, and possible carcinogenic HAPs. The unit risk factor is a slope factor that when multiplied by the ambient air concentration provides an estimate of the probability of one additional person contracting cancer based on continuous exposure over a 70-year lifetime. A range of unit risk factors is available for benzene. All estimated risks are within the acceptable range.

There is uncertainty associated with adding cancer risk values together although it is commonly done for carcinogens having similar modes of action or target organs. However formaldehyde, a suspected human carcinogen is suspected to cause leukemia which is also the type of cancer possibly caused by benzene. Therefore it is reasonable to add benzene and formaldehyde risk numbers together.

As is the case for acrolein and the other acute and chronic HAPs, the modeled cancer risk shown in **Table 4.2-8** is from the May 2010 Draft EA, with emissions much larger than the current Proposed Action. Furthermore, the exposures are for hypothetical locations (maximum impact), even when there are no persons actually exposed. Therefore, the actual cancer risk is expected to be less than one in one million.

Table 4.2-8. Proposed Action Carcinogenic HAP Risk

Exposure Scenario	HAP	Unit Risk Factor ($1/\mu g/m^3$)	Exposure Adjustment Factor	Modeled Annual Impact ($\mu g/m^3$)	Cancer Risk
MLE	Benzene	2.2×10^{-06} to 7.8×10^{-06}	0.095	26.9	5.6×10^{-06} to 2.0×10^{-05}
	Formaldehyde	1.3×10^{-05}	0.095	1.04	1.3×10^{-06}
	TOTAL MLE RISK				**1.3×10^{-05}**
MEI	Benzene	2.2×10^{-06} to 7.8×10^{-06}	0.40	26.9	2.4×10^{-05} to 8.4×10^{-05}
	Formaldehyde	1.3×10^{-05}	0.643	1.04	8.7×10^{-06}
	TOTAL MEI RISK				**9.3×10^{-05}**

Example Benzene MLE Calculation: 0.0000022 unit risk factor * 0.095 adjustment factor * 26.9 impact = 0.0000056 cancer risk
MEI = maximally exposed individual
MLE = most likely exposure

4.2.1.4 Visibility Impacts

A screening analysis to determine the impacts on visibility caused by the RBU Project Area at 50 km distances was performed. The VISCREEN model approved by the USEPA was used to determine the visual effect parameters (color difference parameter and plume contrast against a background) from the RBU project area emissions plumes from a given vantage point (i.e., a scenic vista). VISCREEN is recommended for use up to a maximum distance of 50 km from the source. Due to the distance from RBU to the nearest Class I area (greater than 150 km), analyzing the visibility impact (degradation) that RBU could have on a given location at 50 km is considered to be a conservative (over-estimate.

Potential visibility degradation can be evaluated in terms of the change in deciview (Δdv), change in contrast, and/or change in visual range. All three criteria are related to the extinction coefficient (B_{ext}) but are numerically different.

Changes in deciviews are calculated by sophisticated long range transport models. A 1.0 dv "Just Noticeable Change" is equivalent to a 10% change in B_{ext}. There are no applicable federal, state, tribal, or local visibility standards. However, predicted visibility impacts are often compared to Levels of Acceptable Change (LAC) developed by Federal Land Managers (FLAG 2000). This threshold is based on the original development of the deciview scale (Pitchford and Malm 1994), and is supported by EPA's Final Regional Haze Regulation (EPA 1999) decision to use 1.0 Δdv as the significance level when preparing periodic reasonable progress reports. Therefore, a "Just Noticeable Change" threshold of a 10% change in extinction or 1.0 Δdv can be used as a significance criterion.

The VISCREEN model used for the visibility impact screening analysis calculates the contrast of a potential plume of pollutants emitted by the proposed project. The model uses 5 percent contrast as the significance criterion. Contrast is directly related to visual range, and most visual range calculations use a 2 percent contrast difference as being "barely noticeable". That is, if there is a 2 percent difference in contrast between the object being viewed and the background, the object would be barely noticeable and the distance at which the contrast decreases to 2 percent is the visual range. Accordingly, to be

comparable to the deciview "Just Noticeable Change" criterion, a 2 plume percent contrast value was used as the significance criterion instead of the default VISCREEN criterion of 5 percent.

Results from execution of the VISCREEN model with the inputs specified above are reported in the RBU Near-Field TSD. The modeled potential plume contrast for the Proposed Action was 1 percent or less 50 km from the RBU. This contrast value is less than the "Just Noticeable Change" criterion and is not considered objectionable or adverse.

The 50 km distance was used as the VISCREEN model is designed to yield conservative (i.e., over predict) estimates of potential visibility impacts near a source. The model uses hypothetical worst case meteorology (e.g., 1 meter per second wind speed) and assumes straight line transport indefinitely. At a 1 meter per second wind speed, it will take nearly 14 hours to transport emissions 50 km. Therefore, using VISCREEN quantitatively for distances beyond 50 km is not reasonable. However, at distances beyond 50 km, the plume contrast will be much less than at 50 km due to plume dispersion and entrainment of background ambient air.

4.2.1.5 Greenhouse Gases

The Proposed Project greenhouse gas (GHG) emissions were shown in **Tables 4.2-1 and 4.2-2**. The USEPA has recently promulgated two regulatory programs that could potentially affect the Proposed Project: 40 CFR 98 Subpart W Mandatory Reporting and the GHG Tailoring Rule.

Subpart W of the Greenhouse Gas Mandatory Reporting Rule is applicable to Petroleum and Natural Gas Systems (i.e. the project as described in the Alternatives). Subpart W does not require any controls or establish any emissions limits related to GHG emissions or impacts. Therefore, there is no requirement under the mandatory reporting rule at this time that would affect any of the Alternatives of the proposed project, other than the possibility of monitoring, recordkeeping, and reporting of GHG emissions.

The Tailoring Rule applies to large single sources of GHG emissions under the PSD program. If emissions for a single source exceed 100,000 tons per year global warming potential, then Best Available Control Technology, among other requirements, apply. However, the Proposed Action is not subject to the Tailoring Rule because the emissions are not at a single source.

4.2.1.6 Eolian Dust

According to Climate Science (2008), eolian dust is generated from a wide range of sources including industrial emissions and the wind erosion of soils. Dust may affect ocean productivity, control terrestrial nutrient cycling and alter regional and global climate. Dust deposition onto snow cover in the western United States has recently been shown to accelerate melt and reduce snow-cover duration by approximately one month, a finding that has broad implications for water resources in mountainous regions of the United States. Regional sources of dust produce significant quantities of mineral aerosols with effects on soil fertility, air quality and human health. Like many arid environments, the drylands of the western United States have experienced widespread land-use change over the past two centuries, with rapid acceleration of agricultural and grazing activities following the westward expansion of the United States in the 1800s. Despite growing evidence of the impacts of land use on wind erosion of soils around the world, the history of human influences on atmospheric dust remains poorly documented. Records showing increased dust accumulation in Antarctic ice cores between the nineteenth and twentieth centuries, and evidence for changing chemistry of glacial dust during the twentieth century, suggest higher contemporary atmospheric mineral aerosol loads than during the pre-industrial period. However, without more documentation of contemporary and paleo-deposition rates, we are largely limited to

speculation about how humans have altered regional and global dust emissions, and in particular to this project, how it could contribute to eolian dust deposition.

4.2.1.7 Project-Specific Ozone Assessment

In May 2010, a preliminary analysis of potential ozone impacts from the Proposed Action project emissions and cumulative emissions was performed using the Models-3 Community Multiscale Air Quality (CMAQ) modeling system, version 4.6 publicly released October 2006. The results of this project-specific analysis were presented in the RBU Ozone Assessment (**Appendix H-1**). For this analysis, the modeled emissions were based on emissions for 2018, the year of maximum project emissions and with the original over-estimated Dominion Energy methodology. In order to simulate atmospheric ozone levels, it is necessary to develop emissions estimates for all other emission sources (i.e., industrial, electric generation, motor vehicle, biogenic) in addition to the emissions from the RBU project. The foundation datasets for the emissions development were based on the emissions data developed by the Western Regional Air Partnership (WRAP).

With the original over-estimated emissions, the results of the model indicated that no areas in the vicinity of the XTO RBU project area would experience an exceedance of the 75 parts per billion (ppb) ozone NAAQS with either the 2005 or 2006 meteorological data with or without the project emissions. The maximum predicted impact from the Proposed Action case in 2018 was shown to be less than 0.7 ppb when the USEPA-recommended "relative non-monitored area" methodology was used. The project-specific ozone impact analysis was updated in 2011 with the refined emission estimates for the Proposed Action shown in **Tables 4.2-1 and 4.2-2**. This update was reported in the RBU Ozone Update Memo **(Appendix H-2)**. Again, no area was shown to exceed the 75 ppb NAAQS, and the maximum "relative non-monitored area" impact of the Proposed Action was zero for one of the two meteorological years modeled (2005) and less than 0.4 ppb for the second meteorological year (2006).

During the winters of 2009-2010 and 2010-2011, monitored ozone concentrations in the Uinta Basin exceeded the 8-hour NAAQS of 75 ppb. However, none of the summer days exceeded the NAAQS. Winter-time exceedance of the ozone standard is a new phenomenon and is not well understood nor modeled. Nevertheless, the BLM has established an Ozone Action Plan, and is conducting a updated ozone modeling effort and other efforts as part of an Adaptive Management Strategy/Air Resource Management Strategy (ARMS). Based on the data review and criteria set forth in the ozone action plan, the BLM, in consultation with the appropriate Federal, Tribal and State stakeholders, will determine when to trigger implementation of the Ozone Action Plan. The specifics of the Ozone Action Plan, Adaptive Management Strategy, and ARMS are discussed in **Section 4.2.5**, Potential Mitigation Measures.

4.2.2 Alternative B – No Action Alternative

Under this alternative, XTO would continue to develop the necessary infrastructure in order to drill and operate 16 wells previously approved under EA No. 1997-49. The number of new well pads and roads under this alternative would be substantially less than the number of new well pads and roads under the Proposed Action. **Table 4.2-9** and **4.2-10** summarize the annual emissions associated with various phases of the RBU Infill No Action Alternative.

Table 4.2-9. Annual Emissions for Various Phases of the RBU Infill No Action Alternative B

Pollutant	Development Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
NO_X	0.04	36	4.5	0.00	0.00	40
CO	0.23	28	3.8	0.02	0.00	32
VOC	0.03	8.4	3	0.00	0.00	11
SO_2	0.00	0.12	0.05	0.000	0.00	0.2
PM_{10}	1.80	85	36	0.11	0.03	123
$PM_{2.5}$	0.20	9.5	3.7	0.01	3.84E-03	13
Benzene	0.00	0.02	0.01	0.00	0.00	0.0
Toluene	0.00	0.01	0.01	0.00	0.00	0.0
Ethylbenzene	0.00	0.00	0.00	0.00	0.00	0.000
Xylene	0.00	0.00	0.00	0.00	0.00	0.0
n-Hexane	0.00	0.00	0.05	0.00	0.00	0.1
Formaldehyde	0.00	1.87E-03	9.85E-05	0.00	0.00	0.002
Acrolein	0.00	1.87E-04	9.45E-06	0.00	0.00	2.0E-04
CO_2	0.00	3,664	160	0.00	0.00	3,824
CH_4	1.67E-03	2.3	15	1.09E-04	0.00	18
N_2O	0.00	0.00	0.00	0.00	0.00	0

[a] Assumes maximum development scenario (16 wells in a single year)

Table 4.2-10. Total Annual Production Emissions from the No Action Alternative

Pollutant	Tons/Year							Total (tons/year)
	Pump Unit Engines	Production Heaters	Condensate Tanks	TEG Dehydrators	Operations Vehicle	Pneumatics	Compressor Engines	
NO_X	7	7	0.00	0.00	0.4	0.0	3	17
CO	13	6	0.00	0.00	1.5	0.0	1	21
VOC	3	0.09	32	51	0.25	25.0	1	113
SO_2	0.00	0.00	0.00	0.00	0.02	0.0	0.00	0.02
PM_{10}	0.3	0.5	0.00	0.00	0.04	0.0	0.1	1

Pollutant	Tons/Year							Total (tons/year)
	Pump Unit Engines	Production Heaters	Condensate Tanks	TEG Dehydrators	Operations Vehicle	Pneumatics	Compressor Engines	
$PM_{2.5}$	0.3	0.5	0.00	0.00	0.00	0.0	0.1	1
Benzene	0.03	0.00	0.2	5	0.00	0.0	0.00	6
Toluene	0.01	0.00	0.2	12	0.00	0.0	0.00	12
Ethylbenzene	0.00	0.00	0.0	0.7	0.00	0.0	0.00	0.7
Xylene	0.00	0.00	0.0	11	0.00	0.0	0.00	11
n-Hexane	0.00	0.13	0.7	0.4	0.00	0.0	0.00	1
Formaldehyde	0.3	0.01	0.00	0.00	0.00	0.0	0.2	0.5
Acrolein	0.05	0.00	0.00	0.00	0.00	0.0	0.0	0.1
CO_2	8,376	8,410	0.3	0.00	0.00	0.0	1,195	17,981
CH_4	4	0.16	12	5	0.01	119.2	14	155
N_2O	0.00	0.15	0.00	0.00	0.00	0.0	0.00	0.15

[a] Assumes maximum development scenario 16 producing wells

The near-field and ozone impact analyses discussed in **Section 4.2.1.7** was conducted and analyzed using the specifications of the Proposed Action, which includes the maximum development scenario throughout the life of the project (i.e. 484 wells). Due to the fact that the No Action Alternative would consist of significantly less development than the Proposed Action, this alternative would yield equal or lesser impacts than the Proposed Action.

4.2.3 Alternative C – Agency Preferred Alternative

Under this alternative, XTO would develop the necessary infrastructure in order to drill and operate 250 wells. The number of new well pads and roads under this alternative would be less than the number of new well pads and roads under the Proposed Action. **Table 4.2-11** and **4.2-12** summarize the annual emissions associated with the various phases of Alternative C.

Table 4.2-11. Annual Emissions for Various Phases of the RBU Infill Alternative C

Pollutant	Development Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
NO_X	0.28	125	16.8	0.04	0.00	142
CO	1.48	100	14.4	0.32	0.00	116
VOC	0.18	29.7	11	0.03	0.00	41

Pollutant	Development Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
SO_2	0.01	0.45	0.20	0.002	0.00	0.7
PM_{10}	10.90	320	135	1.88	0.03	468
$PM_{2.5}$	1.16	35.3	13.7	0.19	3.84E-03	50
Benzene	0.00	0.06	0.04	0.00	0.00	0.1
Toluene	0.00	0.02	0.04	0.00	0.00	0.1
Ethylbenzene	0.00	0.00	0.00	0.00	0.00	0.001
Xylene	0.00	0.02	0.01	0.00	0.00	0.0
n-Hexane	0.00	0.00	0.20	0.00	0.00	0.2
Formaldehyde	0.00	6.49E-03	3.69E-04	0.00	0.00	0.007
Acrolein	0.00	6.48E-04	3.54E-05	0.00	0.00	6.8E-04
CO_2	0.00	12,722	601	0.00	0.00	13,323
CH_4	1.06E-02	8.0	57	1.83E-03	0.00	65
N_2O	0.00	0.00	0.00	0.00	0.00	0

[a] Assumes maximum development scenario (60 wells developed in one year)

Table 4.2-12. Total Annual Production Emissions from Alternative C

Pollutant	Tons/Year							Total (tons/year)
	Pump Unit Engines	Production Heaters	Condensate Tanks	TEG Dehydrators	Operations Vehicle	Pneumatics	Compressor Engines	
NO_X	16	113	0.00	0.00	8.1	0.0	47	183
CO	31	95	0.00	0.00	22.8	0.0	9	157
VOC	8	1.39	502	795	4.63	390.7	22	1,724
SO_2	0.00	0.00	0.00	0.00	1.34	0.0	0.00	0.34
PM_{10}	0.8	8.6	0.00	0.00	1.70	0.0	1.7	12
$PM_{2.5}$	0.8	8.6	0.00	0.00	0.07	0.0	1.7	11
Benzene	0.06	0.00	3.8	83	0.00	0.0	0.02	87
Toluene	0.02	0.00	3.0	188	0.00	0.0	0.02	191
Ethylbenzene	0.00	0.00	0.0	11.3	0.00	0.0	0.00	11.3
Xylene	0.01	0.00	0.5	167	0.00	0.0	0.01	167

Pollutant	Tons/Year							Total (tons/year)
	Pump Unit Engines	Production Heaters	Condensate Tanks	TEG Dehydrators	Operations Vehicle	Pneumatics	Compressor Engines	
n-Hexane	0.00	2.03	11.4	6.8	0.00	0.0	0.05	20
Formaldehyde	0.8	0.08	0.00	0.00	0.00	0.0	2.8	3.7
Acrolein	0.11	0.00	0.00	0.00	0.00	0.0	0.3	0.4
CO_2	19,894	135,342	5.8	0.00	0.00	0.0	18,659	173,901
CH_4	9	2.59	195	85	0.25	1,862.9	212	2,367
N_2O	0.00	2.48	0.00	0.00	0.00	0.0	0.00	2.48

[a] Assumes maximum development of 250 producing wells

The near-field and ozone impact analyses discussed in **Section 4.2.1.7** was conducted and analyzed using the specifications of the proposed action, which includes the maximum development scenario throughout the life of the project (i.e. 484 wells). Due to the fact that Alternative C would consist of approximately 48 percent less development than the Proposed Action, this alternative would yield equal or lesser impacts than the Proposed Action.

4.2.4 Alternative D – Minimum Development Alternative

Under this alternative, XTO would develop the necessary infrastructure in order to drill and operate 150 wells. The number of new well pads and roads under this alternative would be significantly less than the number of new well pads and roads under the Proposed Action. **Table 4.2-13** and **4.2-14** summarize the annual emissions associated with the various phases of Alternative D.

Table 4.2-13. Annual Emissions for Various Phases of the RBU Infill Alternative D

Pollutant	Development Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
NO_X	0.28	125	16.8	0.04	0.00	142
CO	1.48	100	14.4	0.32	0.00	116
VOC	0.18	29.7	11	0.03	0.00	41
SO_2	0.01	0.45	0.20	0.002	0.00	0.7
PM_{10}	10.90	320	135	1.88	0.03	468
$PM_{2.5}$	1.16	35.3	13.7	0.19	3.84E-03	50
Benzene	0.00	0.06	0.04	0.00	0.00	0.1
Toluene	0.00	0.02	0.04	0.00	0.00	0.1
Ethylbenzene	0.00	0.00	0.00	0.00	0.00	0.001

Pollutant	Development Emissions (tons/year) [a]					Total (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
Xylene	0.00	0.02	0.01	0.00	0.00	0.0
n-Hexane	0.00	0.00	0.20	0.00	0.00	0.2
Formaldehyde	0.00	6.49E-03	3.69E-04	0.00	0.00	0.007
Acrolein	0.00	6.48E-04	3.54E-05	0.00	0.00	6.8E-04
CO_2	0.00	12,722	601	0.00	0.00	13,323
CH_4	1.06E-02	8.0	57	1.83E-03	0.00	65
N_2O	0.00	0.00	0.00	0.00	0.00	0

[a] Assumes maximum development scenario (60 wells developed in one year)

Table 4.2-14. Total Annual Production Emissions from Alternative D

Pollutant	Tons/Year							Total (tons/year)
	Pump Unit Engines	Production Heaters	Condensate Tanks	TEG Dehydrators	Operations Vehicle	Pneumatics	Compressor Engines	
NO_X	9	68	0.00	0.00	5.1	0.0	28	110
CO	19	57	0.00	0.00	14.0	0.0	5	95
VOC	5	0.83	304	477	2.92	234.4	13	1,037
SO_2	0.00	0.00	0.00	0.00	0.21	0.0	0.00	0.21
PM_{10}	0.5	5.1	0.00	0.00	0.42	0.0	1.0	7
$PM_{2.5}$	0.5	5.1	0.00	0.00	0.04	0.0	1.0	7
Benzene	0.04	0.00	2.3	50	0.00	0.0	0.01	52
Toluene	0.01	0.00	1.8	113	0.00	0.0	0.01	115
Ethylbenzene	0.00	0.00	0.0	6.7	0.00	0.0	0.00	6.7
Xylene	0.01	0.00	0.3	100	0.00	0.0	0.01	100
n-Hexane	0.00	1.22	6.8	4.1	0.00	0.0	0.03	12
Formaldehyde	0.5	0.05	0.00	0.00	0.00	0.0	1.7	2.2
Acrolein	0.07	0.00	0.00	0.00	0.00	0.0	0.2	0.3
CO_2	12,041	81,205	3.5	0.00	0.00	0.0	11,197	104,447
CH_4	5	1.56	117	51	0.15	1,117.7	127	1,420
N_2O	0.00	1.49	0.00	0.00	0.00	0.0	0.00	1.49

The near-field and ozone impact analyses discussed in **Section 4.2.1.7** was conducted and analyzed using the specifications of the proposed action, which includes the maximum development scenario throughout the life of the project (i.e. 484 wells). Due to the fact that Alternative D would consist of approximately 69 percent less development than the Proposed Action, this alternative would yield equal or lesser impacts than the Proposed Action.

4.2.5 Recommended Mitigation Measures

Monitored ozone exceedances in the Uinta Basin could result in a nonattainment designation for the region. In view of this, and unless otherwise specified, the applicant has committed to employ the following measures at the outset of the proposed project to mitigate possible additional adverse ozone impacts:

- Control of emissions from glycol dehydrators at all existing and new compressor stations and production wells based on emissions values.
- Electric compression, if and where feasible
- Emission controls having a control efficiency of 95 percent on existing condensate tanks with a potential to emit of greater 20 tpy, and on new condensate tanks with a potential to emit of 6 tpy VOCs.
- Low-bleed pneumatic devices would be installed at all new compressor stations and production facilities. Within 6 months after of the Record of Decision (ROD), all existing high-bleed pneumatic devices would be replaced with low bleed pneumatic devices. High-bleed devices may be allowed to remain in service for critical safety and/or process reasons.
- Green completions for all well completion activities.
- Tier 2 drill rig engines
- Lean burn natural gas-fired stationary compressor engines or equipment with equivalent emission rates.
- Catalyst on all natural gas-fired compressor engines to reduce the emissions of CO and VOCs.
- Dry seals on new centrifugal compressors.
- An annual inspection and maintenance program to reduce VOC emissions, including:
    - Performing inspections of thief hatch seals and Enardo pressure relief valves to ensure proper operations.
    - Reviewing gathering system pressures to evaluate any areas where gathering pressure may be reduced, resulting in lower flash losses from the condensate storage tanks.

Additionally, the applicant commits to developing a project-specific adaptive management strategy, to be informed by periodic emission inventory updates. Implementation of this strategy and associated application of “enhanced” ozone mitigation measures would be required once the proposed project is initiated if:

1) USEPA designates the area “nonattainment” for ozone;
2) There is a monitored ozone standard exceedance;
3) The ARMS modeling shows that additional mitigation is needed to prevent future ozone exceedances; or
4) The ARMS group establishes industry-wide mitigation requirements through ongoing modeling.

If implementation of this adaptive management strategy is triggered, the applicant commits to working with the BLM to analyze project-specific “enhanced” mitigation measures and employ them within 1 year. The measures to be considered could include, but would not be limited to, the following:

- Reducing the total number of drill rigs.
- Installing Tier 4 or better drill rig engines.
- Seasonally reducing or ceasing drilling during specified periods.
- Using only lower-emitting drill and completion rig engines during specified time periods.
- Using natural gas-fired drill and completion rig engines.
- Replacing internal combustion engines with gas turbines for natural gas compression.
- Using electric drill rig or compression engines.
- Centralizing gathering facilities.
- Limiting blowdowns or restricting them during specified periods.
- Installing plunger lift systems with smart automation.
- Employing a monthly Forward Looking Infrared, or FLIR, monitoring program to reduce VOCs.
- Enhancing a direct inspection and maintenance program.
- Employing tank load out vapor recovery.
- Employing enhanced VOC emission controls with 95 percent control efficiency on additional production equipment having a potential to emit of greater than 5 tons per year.

In addition to the commitments discussed above, the applicant commits to complying with applicable air pollution control rules and regulations.

Air quality issues are being addressed on a Utah-wide basis through the Utah Air Resource Technical Advisory Group (UTAG) and the BLM's ARMS. The actions outlined below have been designed to address ozone levels possibly associated with oil and gas operations in the Uinta Basin. The actions consist of the following elements:

- Refine air quality modeling predictions;
- Develop a Uinta Basin ozone action plan; and
- Implement a regional ozone action plan.

The first two elements of this strategy are being implemented by the BLM and other agency stakeholders, independent of the decision to be made regarding further development in the Uinta Basin. Regional operators may participate in these initial planning steps, thereby having the opportunity to contribute to the outcome of the process. The third element would require specific action by the applicant and other oil and gas operators in the Uinta Basin following the approval of the ROD. All three elements are described in more detail in the following paragraphs.

4.2.5.1 Refine Air Quality Modeling Predictions

The ARMS adaptive management strategy involves conducting a regional photochemical modeling analysis to compare and evaluate the effect of different mitigation activities on the ozone levels in the Uinta Basin. This modeling would be conducted in consultation with appropriate federal, Tribal, and state stakeholders as well as with regional oil and gas operators. The aim of the modeling effort would be to compare the effect of changes in VOC and NOX emissions, under various control strategies, to model-predicted change in ozone levels. Separate comparisons may be made for winter and summer periods. An updated emissions inventory, observed ozone levels within the basin, and corresponding meteorological data would be used.

Modeling results would provide an estimate of ozone region-wide and depict spatially the effectiveness of different emission controls on ozone formation in the Uinta Basin. The BLM would isolate the project-

specific incremental ozone increases from the ARMS modeling immediately following completion of the region-wide modeling effort.

The updated air quality modeling analysis utilizing the new inventory and monitored data would be performed within 2 years of signing the ROD for the Gasco Uinta Basin Natural Gas Development Project (signed June18, 2012). This would be accomplished by isolating project-specific impacts from the ARMS regional scale air quality modeling study, if available. The modeling would consider the current emission inventory data, to be updated periodically, current operating practices, applicant committed mitigation, and any applicable Best Available Control Technology (BACT) requirements in place at the time the modeling is conducted. The BLM, in consultation with appropriate federal, state, and Tribal stakeholders, would evaluate the modeling results and identify any needed additional reductions in ozone precursor emissions.

As soon as possible following evaluation of the modeling results, the BLM and appropriate stakeholders would use their respective authorities to implement any needed emission control mitigation measures and/or operating limitations necessary to ensure continued compliance with applicable ambient air quality standards for ozone. Absent an effective technology to implement, reductions in the pace of development may be utilized to ensure ambient air quality standards are met.

4.2.5.2 Develop a Uinta Basin Ozone Action Plan

Based on the results of the photochemical modeling study, the BLM would develop an ozone action plan that would describe mitigation to be enacted to address observed ozone levels above the NAAQS. The plan would be developed in consultation with appropriate federal, Tribal, and state stakeholders. Regional oil and gas operators also may participate in the development of the plan. Specific criteria would be identified within the plan for determining when additional mitigation would be initiated and which measures would be recommended. Criteria also would be specified for when the use of additional mitigation could be suspended based on observed ozone concentrations. Potential mitigation strategies are included in the list of “enhanced mitigation measures” presented above.

4.2.5.3 Implement a Regional Ozone Action Plan

The BLM would evaluate monitored ozone ambient air quality data at sites in the Uinta Basin to determine when to implement the ozone action plan. Monitoring data would be obtained, summarized, and reviewed on an ongoing basis following quality assurance review of each data set. Based on the data review and the criteria set forth in the ozone action plan, the BLM, in consultation with the appropriate federal, Tribal, and state stakeholders, would determine when to trigger implementation of the plan. Following issuance of the ROD for this project, the applicant and other operators in the Uinta Basin would be required to participate in the implementation of the BLM-approved ozone action plan within the Uinta Basin.

The applicant, in consultation with the BLM and appropriate federal, Tribal, and state stakeholders would employ “enhanced mitigation measures” as warranted through the Ozone Action Plan within 1 year of a nonattainment designation or monitored ozone standard exceedance.

The BLM would ensure that appropriate ambient air monitoring is occurring in the Uinta Basin. The BLM and/or the operator, in consultation with the UTAG, would establish monitoring sites in the event that additional monitored data is necessary. These monitors would conform to USEPA monitoring protocols (40 CFR Parts 50 and 58), with emphasis on obtaining measurements that contribute to the formation of secondarily formed pollutants such as $PM_{2.5}$ and ozone, to ensure that monitoring data are valid and useful in calibrating the model, and determining control strategies.

4.3 SOIL RESOURCES

Soils in the RBU Project Area, as described in **Section 3.2.2**, are generally rated poor in reclamation potential. Impacts to soils are typically described in terms of short-term (or initial) and long-term (or residual) impacts. In disturbed areas where interim reclamation is implemented, ground cover by herbaceous species could potentially re-establish within 5 to 7 years following seeding of native plant species and diligent weed control efforts, consequently reducing soil erosion. These reclaimed areas have often been referred to as short-term disturbances. However, it is important to note that all surface disturbances could remain as long-term (or even permanent) impacts on the landscape if reclamation efforts are not successful.

4.3.1 Alternative A – Proposed Action

Construction and operation of the proposed Project under the Proposed Action would result in short- and long-term impacts to soils within the Project Area. Impacts would result from the clearing of vegetation, excavation, salvage, stockpiling, and redistribution of soils during construction and reclamation activities associated with well pad sites, access roads, and proposed pipelines.

Implementation of the Proposed Action would result in the direct disturbance of approximately 1,075 acres of soils in within the Project Area**.** Following construction, approximately 412 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance associated with implementation of the Proposed Action to approximately 663 acres. **Table 4.3-1** provides a summary of short-term and long-term surface disturbances associated with each soil mapping unit on Federal, State, and private lands in the Project Area that would be disturbed under the Proposed Action.

Blading or excavation to achieve desired grades could result in slope steepening of exposed soils in cut and fill areas, mixing of topsoil and subsoil materials, and the breakdown of soil aggregates into loose particles. Soil structural aggregates would also be broken down by compaction from vehicular traffic. Removal and stockpiling of topsoil for revegetation purposes could reduce the natural fertility of the soil, and cause a loss of soil profiles by mixing soil horizons and subsequent breakdown in soil structure.

Table 4.3-1. Soil Disturbance by Major Soil Map Units under the Proposed Action

Map Unit Name and Number	Short Term Surface Disturbance (acres)	Long Term Surface Disturbance (acres)
Badland-Rock outcrop complex, 1 to 100 percent slopes (12)	0.0	0.0
Motto-Casmos complex, 2 to 25 percent slopes (152)	349.4	215.5
Motto-Rock outcrop complex, 2 to 25 percent slopes (154)	248.5	153.2
Turzo loam, 0 to 4 percent slopes (242)	0.0	0.0
Cadrina extremely stony loam-Rock outcrop complex, 25 to 50 percent slopes (36)	72.7	44.8
Cadrina-Badland-Rock outcrop complex, 25 to 50 percent slopes (37)	28.3	17.5
Casmos-Cadrina-Badland complex, 4 to 25 percent slopes (42)	23.2	14.3
Crustown-Motto complex, 2 to 25 percent slopes (62)	0.6	0.4
Total	**722.7**[1]	**445.7**

[1] Does not include Tribal land.

4.3.1.1 Erosion and Sedimentation

Soils would also be susceptible to increased erosion in newly disturbed areas. The removal of vegetative cover, steepening of slopes, and the breakdown of aggregates would increase the potential for channelized runoff and accelerated soil erosion. Wind erosion could also increase with removal of vegetation and exposure of soils. Erosion would result in the formation of more rills and gullies and increase sedimentation of surface water. Erosion would be particularly evident if project related activities are conducted during periods of high precipitation. The increased erosion of soils could potentially lead to increased loss of vegetative cover and increased sedimentation in ephemeral drainages, Willow Creek, the Green River and/or other unnamed drainages. The actual amount of additional sedimentation that would reach the drainages with the RBU Project Area would depend on the effectiveness of reclamation and erosion control measures as well as natural factors including the water available for overland flow; the texture of the eroded material, the amount and kind of ground cover; the shape, gradient, and length of the slope; and surface roughness (Barfield et al. 1981).

The water erosion potentials for all of the soils that would be disturbed under the Proposed Action are below 0.15, indicating a low potential for erosion. In addition, the reclamation source material rating for these soils is low, indicating the presence of soil factors that would inhibit the growth of vegetation. It is expected that following construction activities, re-vegetation, and 5 to 7 growing seasons, erosion rates would decrease to near baseline conditions for the reclaimed portions of the well pads, unused portions of the road corridors, and buried pipeline ROWs. Erosion rates would be expected to remain at slightly elevated levels for the new access roads even in the absence of high traffic volumes.

4.3.1.2 Soil Contamination

Sources of potential soil contamination include leaks or spills of natural gas condensate liquids from wellheads, gas and water lines, produced water sumps, and condensate storage tanks. To reduce the potential for hydrocarbon contamination of soils, gas lines and water lines would be designed to minimize the potential for spills and leaks. Storage tanks would be surrounded by berms capable of holding at least 110 percent of the largest single tank volume. Leaks or spills of saline water, hydrofracturing chemicals, fuels, and lubricants could also result in soil contamination. Depending on the size and type of spill, the effect on soils would primarily consist of the potential loss of soil productivity. Implementation of the project SPCC plan would minimize the risk of such spills by providing safeguards against spills and detailing reporting and cleanup measures to be taken in the event of a spill. Thus, the potential for impacts to soils from spills is considered to be minor.

4.3.1.3 Destruction of Biological Soil Crusts

Mapping of biological soil crusts has not been performed in the RBU Project Area. However, based upon the physical and biological characteristics of the existing soils, biological soil crusts could occur. Biological soil crusts are vulnerable to vehicle traffic, livestock grazing, and pedestrian traffic. The fibers that compose the tensile strength of biological soil crusts are weak in comparison to the compressional strength placed on the crusts by machinery, human footprints, big game, and livestock. The impact of a given surface disturbance on biological soil crusts depends upon its severity, frequency, timing, and type, as well as the weather conditions during and after the disturbance (Belnap et al. 2001). Biological soil crusts occurring in the RBU Project Area have been largely disturbed by previous natural gas development as well as livestock grazing. Surface disturbances associated with the Proposed Action could add to these disturbances by breaking, overturning, and burying soil crusts to various degrees (Belnap et al. 2001).

The recommended mitigation measures for erosion control described in **Section 4.3.5** would be implemented during construction to avoid or minimize soil erosion and off-site deposition. Based on these measures and implementation of ACEPMs, there should be no adverse impact on soil resources as a result of implementation of the Proposed Action.

4.3.2 Alternative B – No Action Alternative

Impacts to soil resources under Alternative B would be similar in nature to those described under the Proposed Action. However, potential impacts would be considerably less under the No Action Alternative, as only 16 new oil and gas wells would be developed on State and Tribal lands in the RBU Project Area. The overall surface disturbance would be approximately 12.7 acres, which is nearly 99 percent less than the Proposed Action. Correspondingly, impacts to soils, including biological soil crusts, related to potential increase in erosion, sediment yield, and spills of hazardous material in the RBU Project Area would be proportionately less under Alternative B.

4.3.3 Alternative C – Agency Preferred Alternative

Impacts to soil resources under Alternative C would be similar in nature to those described under the Proposed Action. Under the Moderate Recovery Alternative, 234 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative C would result in a total surface disturbance of 923 acres, which is 152 acres less and 910 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. Following construction, approximately 363 acres of initial disturbance (39 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance associated with implementation of the Alternative C to approximately 560 acres. As such, the potential for ground disturbing activities to impact soil resources in the RBU Project Area would be lower.

As with the Proposed Action, the water erosion potential for all of the soils that would be disturbed under the Alternative C is below 0.15, indicating a low potential for erosion. In addition, the reclamation source material rating for these soils is low, indicating the presence of soil factors that would inhibit the growth of vegetation. The recommended mitigation measures described in **Section 4.3.5** would help to improve reclamation success.

4.3.4 Alternative D – Minimum Development Alternative

Impacts to soil resources under Alternative D would be similar in nature to those described under the Proposed Action. Under Alternative D, 334 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative D would result in a total surface disturbance of 592 acres which is 483 acres less and 579 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. Following construction, approximately 225 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance associated with implementation of the Alternative D to approximately 367 acres. As such, the potential for ground disturbing activities to impact soil resources in the RBU Project Area would be lower than that of any other action alternative.
As with the Proposed Action, the water erosion potential for all of the soils that would be disturbed under the Alternative D is below 0.15, indicating a low potential for erosion. In addition, the reclamation source material rating for these soils is low, indicating the presence of soil factors that would inhibit the growth of vegetation. The recommended mitigation measures described in **Section 4.3.5** would help to improve reclamation success.

4.3.5 Recommended Mitigation Measures

The following recommended mitigation measures would be applied to reduce impacts to soil resources:

1) Erosion and sedimentation would be reduced through the use of BMPs including, but not limited to; mulching, hydroseeding, erosion control blankets, silt fence installation, jute matting, revegetation, interim reclamation, and/or mychorrizal bacteria supplements.
2) In areas with unstable soils where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes. Erosion control efforts would be monitored by XTO and, if necessary, modifications would be made to control erosion.
3) All disturbed areas of access roads, other than the driving surface, would be revegetated as directed by the AO. These include, but are not limited to, the shoulders, ditches, and cut and fill slopes of the access roads.
4) Well pads would be bermed to prevent runoff from entering nearby drainages.

4.4 WATER RESOURCES

4.4.1 Alternative A – Proposed Action

Construction and operation of the proposed RBU project under the Proposed Action would result in direct and indirect impacts to water resources. The principal impacts to water resources likely to be associated with the Proposed Action include: (1) increased sedimentation and turbidity of surface water as a result of surface disturbance and increased sediment delivery into streams via runoff; (2) depletion of stream flows in the Green River from the removal of water for drilling and operational activities; (3) increased runoff; (4) effects to water quantity and quality (i.e., potential contamination of surface water resources with drilling fluids or other wastes generated by natural gas drilling and production activities; and (5) direct and indirect impacts to floodplains.

4.4.1.1 Surface Water

The magnitude of potential project-related impacts to surface water resources would depend on a number of factors, including the proximity of surface disturbances to ephemeral tributaries of Willow Creek and the Green River, slope aspect and gradient, soil type, the duration and timing of the construction activity, and the success or failure of reclamation and erosion control measures. The potential for adverse impacts to surface water resources would be greatest during project construction activities and would likely decrease in time due to natural stabilization, interim and final reclamation, and successful revegetation efforts.

<u>Increased Sedimentation</u>

Increased erosion and subsequent increased sedimentation of Willow Creek and other ephemeral drainages within the RBU Project Area is possible. The increased erosion could also potentially lead to an increase in turbidity and salinity in the Green River. Both of these effects could have negative impacts on aquatic habitat within affected drainages.

The actual amount of sediment that would be transported to the ephemeral drainages within the RBU Project Area and on to Willow Creek and the Green River would depend on natural factors and the effectiveness of the erosion control devices employed, but is expected to be minimal based the generally flat nature of the RBU Project Area. Natural factors which attenuate the transport of sediment into creeks include water available for overland flow, the texture of the eroded material, the amount and kind of ground cover, the slope shape, gradient, and length, and surface roughness (Barfield et al. 1981).

Potential increases in construction-related erosion and sedimentation would be minimized by implementing BMPs (e.g., silt fencing, straw bales). During construction, erosion control measures would be implemented to avoid or minimize soil erosion and sedimentation. The erosion control methods used would be specified on a site-specific basis during the APD process for each well pad.

Water Use and Stream Flow Regimes

As described in **Chapter 2**, water would be required in most aspects of project construction and operations. Water would be obtained from a number of the existing sources including springs, groundwater wells, and surface water diversion points listed in **Table 2.1-4**. Approximately 2.7 acre-feet of water would be needed to drill and complete each well. Thus, the total water use for the drilling of all 484 wells under the Proposed Action would be approximately 1,307 acre-feet over the 8-year development period (between 100 and 251 acre-feet per year). In addition, approximately 0.1 acre-feet of water per well pad could be utilized for dust abatement each year during the drilling phase of the project. As such, water utilized for dust abatement for a maximum of 484 well pads and associated roads would be approximately 48.4 acre-feet over the 8-year drilling phase of the project. Another 6.3 acre-feet of water per year would be used for dust abatement during project operations, or a total of 126 to 189 acre-feet of water for dust suppression during operations over the 20 to 30 year construction and operational period. Based upon these water use estimates, the average annual amount of water depleted from the Green River would be approximately 169.4 acre-feet during the 8-year drilling phase of the project, which would then decrease to an average of approximately 6.3 acre-feet per year thereafter for the remaining 20 to 30 year LOP. In comparison, the average annual flow in the Green River at Ouray is about 4,064,290 acre-feet (based on flow data from the USGS gauging station at Ouray).

Increased Runoff

Soils compacted on well pads and roads contribute slightly greater runoff than undisturbed sites. The increased runoff could lead to slightly higher peak flows in the ephemeral streams in the RBU Project Area and Willow Creek, potentially increasing erosion of the channel banks. The increased erosion could lead to slightly increased turbidity in these streams during storm events.

Water Quality

The Proposed Action could result in accidental spills of fuel, lubricants, hydraulic fluids, drilling fluids, assorted chemicals required for standard well field operations, and produced water. XTO would prudently manage their facilities to minimize the potential for spills and would employ practices described in *Onshore Oil and Gas Order No. 1*, which identifies strategies to reduce and/or eliminate accidental spills and leaks.

4.4.1.2 Groundwater

With respect to groundwater resources, implementation of the Proposed Action is unlikely to impair water quality of shallow freshwater aquifers. The depth at which steel surface casing is set; along with cementing the casing entirely from total depth to surface would provide protection to shallow freshwater aquifers. In addition, the thick impermeable layers of rock encountered between the freshwater aquifers and the hydrocarbon producing zones make it virtually impossible for hydrocarbons, produced water, and stimulation fluids from drilling operations to either contaminate potable water zones or deplete the near surface potable water aquifers.

4.4.1.3 Floodplains

Floodplains are protected by Executive Order 11988 which requires that all Federal agencies take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Potential impacts to floodplains from the Proposed Action include increased sedimentation, pollution of surface water due to accidental spills or loss of containment of petroleum products, fuels and other chemicals, and damage to or loss of riparian vegetation. However, under the Proposed Action, no new surface disturbance would occur within the Willow Creek floodplain. Therefore there would be no direct impacts to floodplains under the Proposed Action.

4.4.2 Alternative B – No Action Alternative

Potential impacts to water resources, including erosion, sedimentation, stream flow regimes, runoff, and water quality under the No Action Alternative would be similar in nature as those described under the Proposed Action. However, potential impacts would be considerably less under the No Action Alternative, as only 16 new oil and gas wells would be developed on State and Tribal lands in the RBU Project Area. The overall surface disturbance would be approximately 12.7 acres, which is nearly 99 percent less than the Proposed Action.

4.4.3 Alternative C – Agency Preferred Alternative

Potential impacts to water resources, including erosion, sedimentation, stream flow regimes, runoff, and water quality under Alternative C would be similar in nature as those described under the Proposed Action. Under the Moderate Recovery Alternative, 234 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative C would result in a total surface disturbance of 923 acres which is 152 acres less and 910 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. Following construction, approximately 363 acres of initial disturbance (39 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance associated with implementation of the Alternative C to approximately 560 acres. As such, the rates for erosion, sedimentation, runoff, and other impacts to water resources in the RBU Project Area would be lower than that of the Proposed Action.

No new surface disturbing activity would occur within the 100-year floodplain. Therefore there would be no impacts to floodplains under Alternative C.

The volume of water needed for drilling and completion of wells proposed under Alternative C would be approximately 675 acre-feet (250 wells x 2.7 acre-feet per well), which is approximately 632 acre-feet (48 percent) less than that of the Proposed Action. An additional 25.6 acre-feet of water would be needed for dust suppression under Alternative C, which is approximately 22.8 acre-feet (53 percent) less than that required under the Proposed Action.

4.4.4 Alternative D – Minimum Development Alternative

Potential impacts to water resources, including erosion, sedimentation, stream flow regimes, runoff, and water quality under Alternative D would be similar in nature as those described under the Proposed Action. Under Alternative D, 334 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative D would result in a total surface disturbance of 592 acres which is 483 acres less and 579 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. Following construction,

approximately 225 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance associated with implementation of the Alternative D to approximately 367 acres. As such, the rates for erosion, sedimentation, runoff, and other impacts to water resources in the RBU Project Area would be lower than that of any other action alternative.

No new surface disturbing activity would occur within the 100-year floodplain. Therefore there would be no impacts to floodplains under Alternative D.

The volume of water needed for drilling and completion of wells proposed under Alternative D would be approximately 405 acre-feet (150 wells x 2.7 acre-feet per well), which is approximately 902 acre-feet (69 percent) less than that of the Proposed Action. An additional 14.9 acre-feet of water would be needed for dust suppression under Alternative C, which is approximately 33.5 acre-feet (69 percent) less than that required under the Proposed Action.

4.4.5 Recommended Mitigation Measures

No additional mitigation measures are recommended under Alternatives A, B, C, or D.

4.5 PALEONTOLOGICAL RESOURCES

4.5.1 Alternative A – Proposed Action

The Uinta and Green River Formations are categorized as Class 4a (high) paleontological formations. Class 4 formations are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. Surface-disturbing activities, such as site and road construction, and secondary surface activities, such as vehicular and pedestrian traffic, can irreversibly damage or destroy sensitive paleontological resources and result in the loss of scientifically important fossils. Alternatively, construction of well pads, access roads, and pipeline corridors may have a positive effect by uncovering or revealing scientifically important fossils.

Where surface-disturbing activities occur on previously disturbed areas, fossil resources would not be affected. However, where surface disturbance is proposed on undisturbed areas, paleontological resources could be at risk. Where fossils occur on the surface within these areas, they may potentially be broken or destroyed during surface-disturbing activities. Disturbance of bedrock for the construction of reserve pits and access roads also results in the potential for exposing, breaking, and destroying fossils. However, as surveys for paleontological resources would be conducted prior to any surface disturbance and appropriate measures would be taken if fossils are discovered (during surveys or excavation), potential impacts to fossil resources in the Uinta Formation would be reduced or eliminated.

4.5.2 Alternative B – No Action Alternative

Potential impacts to paleontological resources under Alternative B would be similar in nature to those described under the Proposed Action. However, the overall potential for exposure of, or damage to, fossils during excavation or construction activities would be considerably less under the No Action Alternative, as only 16 new oil and gas wells would be developed on State and Tribal lands in the RBU Project Area. The overall surface disturbance would be approximately 12.7 acres, which is nearly 99 percent less than the Proposed Action. Further, as surveys for paleontological resources would be conducted prior to any surface disturbance and appropriate measures would be taken if fossils are

discovered (during surveys or excavation), potential impacts to fossil resources in the Uinta Formation would be reduced or eliminated.

4.5.3 Alternative C – Agency Preferred Alternative

Potential impacts to paleontological resources under Alternative C would be similar in nature to those described under the Proposed Action. Under the Alternative C, 234 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative C would result in a total surface disturbance of 923 acres which is 152 acres less and 910 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. As such, the potential for ground disturbing activities to impact paleontological resources in the RBU Project Area would be lower. Further, as surveys for paleontological resources would be conducted prior to any surface disturbance and appropriate measures would be taken if fossils are discovered (during surveys or excavation), potential impacts to fossil resources in the Uinta Formation would be reduced or eliminated.

4.5.4 Alternative D – Minimum Development Alternative

Potential impacts to paleontological resources under Alternative D would be similar in nature to those described under the Proposed Action. Under Alternative D, 334 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative D would result in a total surface disturbance of 592 acres which is 483 acres less and 579 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. As such, the potential for ground disturbing activities to impact paleontological resources in the RBU Project Area would be lower than that of any other action alternative. As with the Proposed Action, surveys for paleontological resources would be conducted prior to any surface disturbance and appropriate measures would be taken if fossils are discovered (during surveys or excavation), and therefore, potential impacts to fossil resources in the Uinta Formation would be reduced or eliminated.

4.5.5 Recommended Mitigation Measures

No additional mitigation measures are recommended under Alternatives A, B, C, or D.

4.6 CULTURAL RESOURCES

4.6.1 Alternative A – Proposed Action

Direct impacts to cultural resources related to the RBU APE include surface disturbance associated with construction of new well pads and expansion of existing well pads, construction of new roads, installation of co-located gas lines and produced water lines, and construction of new central facilities, which would result in an initial surface disturbance of 1,075 acres. Indirect impacts to cultural resources in the Project Area as a result of the Proposed Action could result from atmospheric, visual, and auditory intrusions; increased visitation and traffic during construction and operation; vandalism; off-highway vehicle (OHV) and other motorized vehicle use; erosion; and unknown impacts to unidentified cultural landscapes, all of which may contribute to an alteration of the overall setting and feeling of the Project Area. Such changes in the Project Area could lead to the damage, destruction, or removal of scientific information, the loss of research potential, the loss of interpretation possibilities, and the destruction of the character or setting of a site.

While the locations of proposed new well pads, access roads, pipelines, and other surface facilities illustrated on Figure 2.1-1 have not been individually inspected, they have been conceptually identified considering topography, land features, vegetation, and operational constraints. Onsite inspections, including an intensive cultural resource inventory of individual well pads, access roads, pipelines, and other surface facility locations by the BLM and operator personnel would occur during the permitting process for individual wells or ROWs, and site-specific adjustments to location and orientation would be made at that time.

As is discussed in **Section 3.2.5** much of the RBU Project Area is developed and has received varying degrees and intensities of archaeological inventories and analysis. Previous natural gas exploration and production and associated projects have driven much of the archaeological inventories conducted on the RBU Project Area. This has resulted in a patchwork of areas that have been intensively surveyed, interspersed with other areas that have not been inventoried for cultural resources. However, it should be noted that under the Proposed Action, the majority of the proposed development would occur in areas that have received considerable scrutiny from cultural resource inventories. Cultural resource surveys have been conducted for past ROW authorizations and individual well pads. In addition, most roads in the RBU APE have also been surveyed. Taken collectively, these surveys have resulted in a fairly systematic examination of the RBU APE resulting in sufficient data for identifying culturally sensitive areas.

Prior to the initiation of construction activities, a Class III inventory would be conducted in all areas proposed for surface disturbance. Whenever feasible, any prehistoric and historic sites documented during the Class III inventory as eligible for listing on the National Register of Historic Places (NRHP), as well as areas identified as having a high probability of significant subsurface materials, would be avoided by development. If avoidance is not feasible or does not provide the required protection, data recovery will be conducted through excavation. Based on these measures and the implementation of recommended mitigation measures as outlined in **Section 4.6.5**, adverse impacts to cultural resources are unlikely to occur.

4.6.2 Alternative B – No Action Alternative

Impacts to cultural resources under the No Action Alternative would be similar in nature to those described under the Proposed Action. However, potential impacts would be considerably less under the No Action Alternative, as only 16 new oil and gas wells would be developed on State and Tribal lands in the RBU Project Area. The overall surface disturbance would be approximately 12.7 acres, which is nearly 99 percent less than the Proposed Action. As with the Proposed Action, an intensive cultural resource inventory of individual well pads, access roads, pipeline ROWs, and other surface facility locations would occur during the APD process, and site-specific adjustments to the location and orientation of project facilities would be made as appropriate.

4.6.3 Alternative C – Agency Preferred Alternative

Impacts to cultural resources under Alternative C would be similar in nature to those described under the Proposed Action. Under Alternative C, 250 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative C would result in a total surface disturbance of 923 acres which is 152 acres less and 910 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. As with the Proposed Action, an intensive cultural resource inventory of individual well pads, access roads, pipeline ROWs, and other surface facility locations would occur during the APD process, and site-specific adjustments to the location and orientation of project facilities would be made as appropriate.

4.6.4 Alternative D – Minimum Development Alternative

As with Alternative C, direct effects under Alternative D due to surface disturbance would be of the same nature as those described under the Proposed Action. Under Alternative D, 300 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative D would result in a total surface disturbance of 592 acres which is 483 acres less and 579 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. As with the Proposed Action, an intensive cultural resource inventory of individual well pads, access roads, pipeline ROWs, and other surface facility locations would occur during the APD process, and site-specific adjustments to the location and orientation of project facilities would be made as appropriate.

4.6.5 Recommended Mitigation Measures

In addition to the ACPEMS for cultural resources, potential mitigation under all alternatives could also include the following:

- As directed by the AO, protective fencing would be placed around the boundaries of historic properties during activities that occur within 150 feet.

- If deemed appropriate by the AO, construction activities within areas having a high site potential would be monitored by a qualified archaeologist for the presence of subsurface cultural material.

4.7 LIVESTOCK GRAZING

4.7.1 Alternative A – Proposed Action

Implementation of the Proposed Action would cause direct and indirect effects on grazing livestock as a result of construction and operational activities. Principle impacts to livestock grazing would include: (1) the direct removal of forage and subsequent reduction in livestock AUMs; (2) increased potential for disrupting livestock operations; (3) increased gas development-related traffic in allotments; and (4) decreased quality and quantity of forage due to potential noxious weed infestations.

The Proposed Action would result in the removal of approximately 580 usable acres (defined as BLM-administered lands on slopes less than 40 percent) of vegetation (involving 261 livestock AUMs) in grazing allotments in the RBU Project Area. Of the 580 useable acres, approximately 470 acres (or 81 percent) would occur as a result of expansion of existing surface disturbance, while approximately 110 acres (or 19 percent) would occur as a result of new surface disturbance. **Table 4.7-1** provides a breakdown of the estimated loss of livestock AUMs by grazing allotment.

The Proposed Action could directly affect range improvements, stock watering, and facilities related to the control of livestock movement. The number of gates to control livestock would increase with the increased level of project-related facilities and access roads. This increase, in tandem with increased traffic levels, would increase the potential for gates to be left open and livestock to get out of the allotment. Fowler and Witte (1985) found that ranches had increased labor requirements from activities, such as gathering cattle, fixing fences, closing gates, removing litter, and repairing vandalism damages that occurred during the occurrence of oil and gas development.

Table 4.7-1. Estimated Allotment Acres and AUMs Affected by the Proposed Action

Allotment Name	Usable[1] Allotment Acres w/in RBU Project Area	Loss of Usable Acres w/in RBU Project Area	Permitted AUMs w/in RBU Project Area	Loss of AUMs w/in RBU Project Area
Green River AMP	157	< 1	6	< 1
Sand Wash	2,592	149	160	13
Wild Horse Bench	9,886	431	3,997	247
TOTAL	12,635	580	4,163	261

Source: BLM 2010
[1] Usable land is defined as BLM land that has a slope lower than 40 percent.

Additionally, the increase in the number of roads constructed to access wells within allotments and the associated use of these roads would increase the level of vehicular traffic within allotments. Although these roads would be constructed for use by XTO employees and their contractors, these roads would also be used by the general public for recreation and other purposes. This increase in use would increase the potential for collisions with and harassment of livestock.

Implementation of the Proposed Action could also increase the potential for noxious weeds which could impact grazing resources within the Project Area. Noxious weeds are generally unpalatable to livestock, and thus their establishment would result in the reduction of available forage.

Under the Proposed Action, design features would be implemented that would reduce impacts to disturbed grazing habitats. These include re-vegetation of disturbed areas and implementation of noxious weed control and monitoring. Where impacts cannot be avoided, any livestock facilities (e.g. fences, cattle guards, gates, drift fences and natural barriers) that are damaged by the Proposed Action would be repaired or replaced. Additional cattle guards or gates would also be installed as needed and maintained for the life of the well.

4.7.2 Alternative B – No Action Alternative

Impacts to livestock grazing under the No Action Alternative would be similar in nature to those described below under the Proposed Action. However, potential impacts would be considerably less under the No Action Alternative, as only 16 new oil and gas wells would be developed on State and Tribal lands in the RBU Project Area. Implementation of the No Action Alternative would not result in any new disturbance to any useable acres within the RBU Project Area.

4.7.3 Alternative C – Agency Preferred Alternative

Impacts to livestock grazing under Alternative C would be similar in nature to those described under the Proposed Action. Alternative C would result in the removal of approximately 499 useable acres (or approximately 3.9 percent) of vegetation in grazing allotments in the RBU Project Area. Of the 499 useable acres impacted, approximately 404 acres (or 81 percent) would occur as a result of expansion of existing surface disturbance, while 95 acres (or 19 percent) would occur as a result of new surface disturbance.

4.7.4 Alternative D – Minimum Development Alternative

Impacts to livestock grazing under Alternative D would be similar in nature to those described under the Proposed Action. Alternative D would result in the removal of approximately 317 useable acres (or approximately 2.5 percent) of vegetation in grazing allotments in the RBU Project Area. Of the 317 useable acres impacted, approximately 250 acres (or 79 percent) would occur as a result of expansion of existing surface disturbance, while 67 acres (or 21 percent) would occur as a result of new surface disturbance.

4.7.5 Recommended Mitigation Measures

No additional mitigation measures are recommended under Alternatives A, B, C, or D.

4.8 VEGETATION INCLUDING SPECIAL STATUS PLANT SPECIES AND INVASIVE OR NOXIOUS WEEDS

4.8.1 Alternative A – Proposed Action

4.8.1.1 General Vegetation

Construction and operation of the proposed RBU Project under the Proposed Action would result in direct and indirect impacts to vegetation communities within the Project Area. Direct effects to vegetation (i.e., modification of structure, species composition, and extent of cover types) would occur from disturbance or removal of vegetation associated with construction and expansion well pad sites, access roads, pipeline corridors, and compressor stations. Indirect effects may include the short-term and long-term increased potential for noxious weed invasion, exposure of soils to accelerated erosion, soil compaction, and shifts in species composition and/or changes in plant density.

Implementation of the Proposed Action would result in the direct disturbance of 1,075 acres of vegetation **(Table 4.8-1).** This includes approximately 831 acres of scrub/shrub, 169 acres of grasslands/herbaceous, 40 acres of woody wetland, and 35 acres of barren land vegetation cover types. Following construction, approximately 412 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance associated with implementation of the Proposed Action to approximately 663 acres.

The duration of impacts to vegetation would depend, in part, on the success of mitigation and revegetation efforts and the time needed for natural succession to return revegetated areas to pre-disturbance conditions. Following interim reclamation, ground cover would likely begin to re-establish within 2 to 3 years following seeding using native plant species. An estimated 7 to 10 years would be needed for shrub species to successfully re-vegetate the disturbed portions of the Project Area. Long-term disturbance would remain for the estimated 33 to 43 year LOP, until such time as the abandoned well pads and roads would be restored to near existing conditions.

Interim reclamation for portions of the well pads and access roads not needed for production facilities/operations would be completed within six months following completion of the last well planned for the pad. Pipeline ROWs would be reclaimed within six months of pipeline installation. Seeding of temporarily disturbed areas along roads and pipelines, would be completed within 30 days following completion of construction.

Table 4.8-1. Vegetation Communities Affected by the Proposed Action

Land Cover Type	Vegetation Community	Initial (short-term) Surface Disturbance (acres)	Residual (long-term) Surface Disturbance (acres)
Scrub/Shrub	Colorado Plateau Mixed Low Sagebrush Shrubland	25.7	15.9
	Intermountain Basins Big Sagebrush Shrubland	29.4	18.1
	Inter-Mountain Basins Mat Saltbush Shrubland	6.6	4.1
	Inter-Mountain Basins Mixed Salt Desert Scrub	754.1	465.1
	Colorado Plateau Pinyon-Juniper Shrubland	15.3	9.4
Total		**831.1**	**512.6**
Grasslands/ Herbaceous	Inter-Mountain Basins Semi-Desert Grassland	0.4	0.2
	Inter-Mountain Basins Semi-Desert Shrub Steppe	168.9	104.2
Total		**169.3**	**104.4**
Woody Wetland	Inter-Mountain Basins Greasewood Flat	37.7	23.2
	Rocky Mountain Lower Montane Riparian Woodland and Shrubland	2.2	1.4
Total		**39.9**	**24.6**
Barren Lands	Inter-Mountain Basins Shale Badland	16.5	10.2
	Colorado Plateau Mixed Bedrock Canyon and Tableland	18.0	11.1
Total		**34.5**	**21.3**
Disturbed	Invasive Annual Grassland	0.5	0.3
	Invasive Southwest Riparian Woodland and Shrubland	--	--
	Existing Development (i.e., roads, well pads, other surface facilities)	--	--
Total		**0.5**	**0.3**
Grand Total		**1,075.3**	**663.2**

Implementation of the Proposed Action also would increase the potential for the occurrence of indirect effects. Additional construction related impacts could include soil compaction, an increased potential for wind and water erosion of disturbed surfaces prior to reclamation, and the potential for shifts in species composition and/or changes in plant density.

4.8.1.2 Invasive and Noxious Weeds

Disturbances from construction would increase the potential for the establishment and spread of noxious weeds. Noxious weeds tend to be aggressive colonizers of disturbed areas where the native vegetation has been removed. Therefore, disturbances associated with construction and expansion of well pad sites, access roads, pipelines, and other project facilities would provide opportunities for invasive and noxious weeds to become established. Once established, weeds could increase fuel levels and the potential for increased intensity and numbers of wildfires; contribute to a reduction in the overall visual character of the area; and contribute to the reduction or elimination of native plant species, wildlife habitat, and/or habitat for special status plant species.

In order to minimize the potential for adverse effects from invasive and noxious weed establishment, monitoring for invasive and noxious weeds would be necessary and if found, control and eradication measures would be implemented as outlined in the COAs for the APD for the project. The implementation of these measures along with other ACEPMs would minimize the potential for adverse impacts from noxious weeds.

4.8.1.3 Special-status Plant Species

In general, impacts of the Proposed Action on special-status plant species and their habitats would be similar to those discussed in the preceding section for vegetation communities. However, these impacts can be more severe for special status plant species, if present, since the distribution and abundance of these species are limited in the Project Area and surrounding region.

If present within the development areas, direct effects on the Uinta Basin hookless cactus, clay reed-mustard, and Spanish bayonet would occur from construction activities associated with the Proposed Action, which could directly kill or damage individual plants or populations through right-of-way clearing earth-moving activities, and vehicle traffic. Areas of permanent disturbance would remove portions of the seed bank, and areas of temporary disturbance also can alter the seed bank.

<u>Uinta Basin Hookless Cactus</u>

Implementation of the Proposed Action would result in the direct disturbance of approximately 980 acres of potential habitat for the Uinta Basin hookless cactus within the Project Area. Following construction, approximately 363 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance associated with implementation of the Proposed Action on Uinta Basin hookless cactus habitat to approximately 617 acres.

Under the Proposed Action, approximately 3 proposed wells would be drilled within Level 1 core conservation areas for the Uinta Basin hookless cactus. Approximately 11 proposed wells would be drilled within Level 2 core conservation areas for the Uinta Basin hookless cactus. The development of these wells along with associated road and pipeline installation would initially result in direct short-term loss of approximately 14 acres of Level 1 core habitat and 58 acres of Level 2 core habitat within the Project Area. Following construction, approximately 38 percent of the disturbance associated with construction of proposed well pads, portions of access roads, and pipeline ROWs not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance to Level 1 and 2 core conservation areas associated with implementation of the Proposed Action to approximately 8.7 and 36.0 acres, respectively.

The majority (77 percent) of this surface disturbance under the Proposed Action would only occur as an expansion of existing infrastructure and in Level 2 core conservation areas that are already fragmented by past oil and gas activity. In fact, the RBU Project Area already contains some 324 well pads, 108 miles of road, and 137 miles of pipelines and associated central facilities.

Implementation of the Proposed Action also would increase the potential for occurrence of indirect and dispersed direct effects to this species, if present. Disturbances from construction could increase the potential for the limited invasion and establishment of noxious weed species. Invasion by non-native species is particularly problematic as they are capable of effective competition with native species for space, water, light, nutrients, and subsequent survival. Over time, the successful establishment of non-native species can choke out native vegetation and eventually dominate large areas. An increase in weedy annual grasses also increases the potential for fire by increasing the density and flammability of available

fuels. Grasses are more flammable, and establish in denser populations, than woody and non-woody native vegetation.

Additional indirect construction-related impacts could include an increased potential for wind erosion of disturbed areas creating airborne dust that could be transported into suitable habitat for this species. Airborne dust generated by vehicles could inhibit photosynthesis and transpiration in this species. Inhibited and reduced rates of photosynthesis could affect the rate of growth, the reproductive capacity of individual plants, and ultimately the ability of these individuals to persist in adjacent areas. Thompson et al. (1984) and Farmer (1992) have indicated that varying amounts of dust settling on vegetation can block stomata, increase leaf temperature, and reduce photosynthesis.

Clay Reed-mustard

Since clay reed-mustard generally grows on steep, nearly inaccessible slopes and canyon walls, direct disturbance to potential habitat for this species is unlikely. Implementation of the Proposed Action could however, increase the potential for occurrence of indirect and dispersed direct effects to this species, if present. Disturbances from construction could increase the potential for the limited invasion and establishment of noxious weed species, and increased potential for wind erosion of disturbed areas creating airborne dust that could be transported into suitable habitat for this species, as described previously for the Uinta Basin hookless cactus.

Spanish Bayonet

Implementation of the Proposed Action could result in the direct disturbance of potential habitat for the spanish bayonet, if present within the Project Area. Under the Proposed Action, approximately 831 acres of scrub/shrub vegetation, which serves as potential habitat for the Spanish bayonet, would be impacted. Following construction, approximately 316 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance of scrub/shrub vegetation associated with implementation of the Proposed Action to approximately 515 acres.

As with the Uinta Basin hookless cactus and clay-reed mustard, implementation of the Proposed Action could also increase the potential for indirect and dispersed direct effects to this species, if present. Disturbances from construction could increase the potential for the limited invasion and establishment of noxious weed species, and increased potential for wind erosion of disturbed areas creating airborne dust that could be transported into suitable habitat for this species, as described previously for the Uinta Basin hookless cactus.

Design features set out under the Proposed Action would reduce impacts to special status plant species. These actions include: noxious and invasive species control and monitoring, use of existing roads when possible, minimizing new surface disturbance, dust abatement, pre-construction surveys in potential habitat, and adherence to species-specific conservation measures on BLM-administered lands (**Appendix B**). The species-specific conservation measures for the Uinta Basin hookless cactus, clay reed-mustard, and Spanish bayonet include provisions to avoid occupied habitat, employ the use of spatial buffers between surface activities and known populations of plants, limit off-road travel, and monitor the effectiveness of these measures.

Based on adherence to the above-mentioned actions, the Proposed Action ***"may affect, is not likely to adversely affect"*** the clay reed-mustard. Because additional surface disturbance is proposed in Level 1 core conservation areas under the Proposed Action, the Proposed Action ***"may affect, is likely to adversely affect"*** the Uinta Basin hookless cactus.

4.8.2 Alternative B – No Action Alternative

Impacts to vegetation resources, noxious weeds, and special status plant species under the No Action Alternative would be similar in nature as those described below under the Proposed Action. However, potential impacts would be considerably less under the No Action Alternative, as only 16 new oil and gas wells would be developed on State and Tribal lands in the RBU Project Area. The overall disturbance to vegetation would be approximately 12.7 acres, which is nearly 99 percent less than the Proposed Action. Correspondingly, impacts from noxious weeds and to special status plant species in the RBU Project Area would be proportionately less under Alternative B.

4.8.3 Alternative C – Agency Preferred Alternative

Impacts to vegetation resources including special status plant species under Alternative C would be similar in nature to those described under the Proposed Action. Under the Moderate Recovery Alternative, 234 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative C would result in the direct disturbance of 923 acres of vegetation which is 152 acres less and 910 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. This includes approximately 714 acres of scrub/shrub, 144 acres of grasslands/herbaceous, 37 acres of woody wetland, and 28 acres of barren land vegetation cover types. Following construction, approximately 363 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance to vegetation associated with implementation of the Alternative C to approximately 560 acres. As such, the potential for impacts from noxious weeds and to special status plant species in the RBU Project Area would be proportionately less than that of the Proposed Action.

Under Alternative C, no new surface disturbance would occur with USFWS proposed Level 1 or 2 core conservation areas for Uinta Basin hookless cactus. In addition, a minimum 300-foot buffer would be maintained between the edge of new surface disturbance and identified populations of Uinta Basin hookless cactus.

As with the Proposed Action, interim and final reclamation of disturbed areas, control and eradication measures for noxious and invasive species, pre-construction surveys for Uinta Basin hookless cactus, clay reed-mustard, and Spanish bayonet, and adherence to species-specific conservation measures on BLM-administered lands including provisions to avoid occupied habitat and employ the use of spatial buffers between surface activities and known populations of special status plant species would reduce impacts to vegetation and special status plant species.

Based on adherence to the above-mentioned actions, and the fact that no newly proposed surface disturbance would occur within Level 1 and 2 core conservations areas for the Uinta Basin hookless cactus, Alternative C ***"may affect, is not likely to adversely affect"*** the clay reed-mustard or Uinta Basin hookless cactus.

4.8.4 Alternative D – Minimum Development Alternative

Impacts to vegetation resources including special status plant species under Alternative D would be similar in nature to those described under the Proposed Action and would be the least of all action alternatives considered. Under Alternative D, 334 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative D would result in a total surface disturbance of 592 acres which is 483 acres less and 579 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. This includes

approximately 455 acres of scrub/shrub, 102 acres of grasslands/herbaceous, 19 acres of woody wetland, and 16 acres of barren land vegetation cover types. Following construction, approximately 225 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance associated with implementation of Alternative D to approximately 367 acres. As such, the potential for impacts from noxious weeds and to special status plant species in the RBU Project Area would be proportionately less than that of the Proposed Action.

Under Alternative D, no new surface disturbance would occur with USFWS proposed Level 1 or 2 core conservation areas for Uinta Basin hookless cactus. In addition, a minimum 300-foot buffer would be maintained between the edge of new surface disturbance and identified populations of Uinta Basin hookless cactus.

As with the Proposed Action, interim and final reclamation of disturbed areas, control and eradication measures for noxious and invasive species, pre-construction surveys for Uinta Basin hookless cactus, clay reed-mustard, and Spanish bayonet, and adherence to species-specific conservation measures on BLM-administered lands including provisions to avoid occupied habitat and employ the use of spatial buffers between surface activities and known populations of special status plant species would reduce impacts to vegetation and special status plant species.

Based on adherence to the above-mentioned actions, and the fact that no proposed surface disturbance will occur within Level 1 core conservations areas for the Uinta Basin hookless cactus, Alternative D ***"may affect, is not likely to adversely affect"*** the clay reed-mustard or Uinta Basin hookless cactus.

4.8.5 Recommended Mitigation Measures

No additional mitigation beyond what is proposed under the ACEPMs is recommended for vegetation and special-status plant species under the Proposed Action or other alternatives.

4.9 FISH AND WILDLIFE INCLUDING SPECIAL STATUS SPECIES

4.9.1 Alternative A – Proposed Action

4.9.1.1 General Wildlife and Wildlife Habitats

Construction and operation of the proposed RBU Project under the Proposed Action would result in direct and indirect impacts to wildlife and wildlife habitats. The principal impacts to terrestrial wildlife likely to be associated with the Proposed Action include: (1) the loss of certain wildlife habitats due to construction activities such as earth-moving associated with proposed well pads, access roads, and pipeline corridors; (2) habitat fragmentation; (3) vehicle-related mortality, (4) displacement of some wildlife species; and (5) an increase in the potential for illegal kill and harassment of wildlife. The magnitude of impacts to wildlife and wildlife habitats would depend on a number of factors including the type and duration of disturbance, the species of wildlife present, time of year, and implementation of recommended and required mitigation measures.

Implementation of the Proposed Action would result in the direct disturbance of 1,075 acres of wildlife habitat **(see Table 4.8-1).** This includes approximately 831 acres of scrub/shrub, 169 acres of grasslands/herbaceous, 40 acres of woody wetland, and 35 acres of barren land vegetation cover types. Direct disturbance to wildlife habitat includes activities such as ground surface grading and excavation, tree and shrub removal, and/or scraping of road surfaces that disturbs surface and subsurface soils. Each

of these activities could effectively remove and/or degrade existing habitat, thereby reducing its availability to local wildlife populations.

Following construction, approximately 412 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. These areas would be revegetated with seed mixes approved by the BLM, some of which are specifically oriented to enhance wildlife use. The duration of impacts to vegetation would depend, in part, on the success of mitigation and reclamation efforts and the time needed for natural succession to return revegetated areas to pre-disturbance conditions. Grasses and forbs are expected to become established within the first several years following reclamation; however, an estimated 7 to 10 years would be required for shrub establishment and production of useable forage. Thus, under the Proposed Action, total habitat disturbance would be reduced from approximately 1,075 acres to 663 acres.

Permanent and temporary loss of habitat as a result of construction activities could affect some small mammal, reptile, and/or amphibian species with very limited home ranges and mobility. Although there is no way to accurately quantify these effects, the impact is likely to be moderate in the short term and be reduced over time as reclaimed areas produce suitable habitats. Most of these wildlife species would be common and widely distributed throughout the Project Area and the loss of some individuals as a result of habitat removal would have a negligible impact on populations of these species throughout the region.

Indirect effects due to displacement of wildlife also would occur as a result of construction activities associated with the proposed project. In response to the increase in human activity (e.g., equipment operation, vehicular traffic, and noise) wildlife may avoid or move away from the sources of disturbance to other habitats. This avoidance or displacement could result in underutilization of the physically unaltered habitats adjoining the disturbances. The net result would be that the value of habitats near the disturbances would be decreased and previous distributional patterns would be altered. The habitats would not support the same level of use by wildlife as before the onset of the disturbance. Additionally, some wildlife would be displaced to other habitats leading to some degree of overuse and degradation to those habitats.

Public vehicle use of roads reconstructed to access the Project Area can have an additive, or possibly a synergistic influence on reducing wildlife use of adjacent habitats, as well as causing additional impacts. Public access to reconstructed roads in the Project Area would increase the potential for mortality and general harassment of wildlife. Seasonal closures of some existing roads to public use following construction would be one of the most effective measures that could be implemented to offset this impact.

4.9.1.2 Big Game

<u>Pronghorn Antelope</u>

The greatest direct impact to pronghorn under the Proposed Action would be due to direct habitat loss and fragmentation. Under the Proposed Action, 457 of the 484 proposed wells would be drilled within crucial value, year-long fawning pronghorn habitat. The development of these wells along with associated road and pipeline installation would initially result in direct short-term loss of approximately 1,001 acres of year-long scrub/shrub, grasslands/herbaceous, and barren land habitats within the Project Area (**Table 4.9-1**). Following construction, approximately 380 acres of initial disturbance (38 percent) associated with construction of proposed well pads, portions of access roads, and pipeline ROWs not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance to pronghorn crucial value, year-long fawning habitat associated with implementation of the Proposed Action to approximately 621 acres.

The majority (77 percent) of this surface disturbance under the Proposed Action would only occur as an expansion of existing infrastructure and in habitats that are already fragmented by past oil and gas activity. In fact, the RBU Project Area already contains some 324 well pads, 108 miles of road, and 137 miles of pipelines and associated central facilities.

Table 4.9-1. Surface Disturbances to UDWR-designated Big Game Ranges Under the Proposed Action

Habitat	Total Range in RBU Project Area (Acres)	Disturbance Associated with the Proposed Action in RBU Project Area		
		Number of Proposed Wells	Initial (short-term) Surface Disturbance (acres)	Residual (long-term) Surface Disturbance (acres)
Mule Deer – Crucial Value Year-Long Fawning Habitat	149	2	8	5
Pronghorn – Crucial Value Year-Long Fawning Habitat	16,478	457	1,001	621
Rocky Mtn. Bighorn Sheep – Crucial Value Year-Long Habitat	6,806	192	384	237

The proposed 74 new well pads located in previously undisturbed habitat would require the construction of new access roads that would increase habitat fragmentation in an already disturbed landscape. Surface-disturbing activities that remove vegetation in crucial value, year-long fawning habitat for pronghorn could affect pronghorn fawn activities in the RBU Project Area. The direct removal of vegetation could displace fawns into areas that do not provide adequate density or height of vegetation, or adequate forb and grass production. The removal of vegetation could also reduce relative habitat values for pronghorn fawning sites, if fawning habitat no longer offers concealment and exposes fawns to predators.

Additional impacts to pronghorn would result from increases in noise levels and human presence during construction and development activities. Activities associated with the construction phase of the project are likely to temporarily displace pronghorn from adjacent habitats, lowering the overall habitat effectiveness of these areas. These zones are not likely to be completely abandoned by these species, but the effective use of these areas could be reduced depending on a number of factors such as time of year, social structure of individual herds, and whether populations are resident or migratory. However, once construction is completed and facilities are put into operation and subsequent human activities reduced, pronghorn are likely to return to pre-disturbance activity patterns, because most resident animals would have already been acclimated to the relatively high level of human activity associated with past oil and gas operations in the Project Area.

The potential for vehicle collisions with pronghorn during the spring, summer, and fall months would be increased by a commensurate increase in vehicle traffic during construction and would continue (although at a much reduced rate) throughout all phases of the well operations. In addition, the short-term influx of temporary construction workers and the long-term use of the area by gas field employees would increase the potential for poaching and general harassment of pronghorn and other big game.

To avoid direct impacts to pronghorn during the critical fawning period, XTO would limit any construction or development activity within crucial value, year-long fawning habitat for pronghorn from May 15 to June 20. Based on this ACEPM, impacts to pronghorn would be minimal, limited primarily to displacement from areas of human activity and habitat alteration.

Successful interim reclamation of areas not utilized for production activities as well as final reclamation efforts could re-establish some pronghorn seasonal ranges over time. In addition, ACEPMs that include measures to reduce speeding on area roads and to prevent harassment and/or poaching of pronghorn and other big game species would further reduce potential impacts associated with the Proposed Action.

Mule Deer

Under the Proposed Action, only 2 of the 484 proposed wells would be drilled within habitats designated as crucial for mule deer. None of the other 482 proposed wells and associated access roads and pipelines would be located within designated mule deer range. The development of these wells along with associated road and pipeline installation would initially result in direct short-term loss of approximately 8 acres of crucial value year-long fawning habitat within the Project Area (**see Table 4.9-1**). Following construction, approximately 3 acres of initial disturbance (38 percent) associated with construction of proposed well pads, portions of access roads, and pipeline ROWs not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance to mule deer crucial value, year-long fawning habitat associated with implementation of the Proposed Action to approximately 5 acres. No adverse impacts to mule deer are expected as a result of direct habitat disturbance under the Proposed Action because only a small percentage of designated crucial habitats will be affected.

Rocky Mountain Bighorn Sheep

Bighorn sheep generally prefer areas with rugged topography surrounded by cliffs and tall bluffs and many of these areas are sheltered from the effects of noise and human presence associated with construction and development activities. The Project Area supports a year-round resident population of Rocky Mountain bighorn sheep. However, only 41 percent (6,806 acres) of the Project Area is classified as bighorn range. Under this alternative, an estimated 192 of the 484 proposed wells (40 percent) would be drilled within year-long, crucial bighorn sheep range. The development of these wells along with associated road and pipeline installation would initially result in direct short-term loss of approximately 384 acres of habitat within the Project Area (**see Table 4.9-1**). The majority (77 percent) of this surface disturbance under the Proposed Action would only occur as an expansion of existing infrastructure and in habitats that are already fragmented by past oil and gas activity. Following construction, approximately 146 acres of initial disturbance (38 percent) associated with construction of proposed well pads, portions of access roads, and pipeline ROWs not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance to bighorn sheep year-long, crucial habitat associated with implementation of the Proposed Action to approximately 237 acres.

Surface-disturbing activities that remove vegetation in year-long, crucial habitat for bighorn sheep would reduce the amount of forage availability in higher elevation areas. Of particular concern for bighorn sheep would be the loss/fragmentation of winter concentration areas, lambing grounds, and migration corridors. Disturbance of migration corridors could preclude some individuals from accessing habitats specific to their winter and summer life cycles, which could lead to a decrease in overall production or fitness.

Similar to pronghorn, additional impacts to bighorn sheep would result from increases in noise levels and human presence during construction and development activities. Activities associated with the construction phase of the project are likely to temporarily displace bighorn sheep from adjacent habitats,

lowering the overall habitat effectiveness of these areas. However, once construction is completed and facilities are put into operation and subsequent human activities reduced, bighorn sheep are likely to return to pre-disturbance activity patterns, albeit at slightly lower local densities.

4.9.1.3 Migratory Birds

The intensity of impacts from the Proposed Action on migratory birds that utilize the RBU Project Area and surrounding region would be dependent upon the seasons of construction and the drilling of each well. If construction and drilling of the proposed well pad and wells were completed in the late summer months (i.e., August – September), many of the migratory species would have left the immediate Project Area for southern wintering grounds, or at least will have fledged and left their nests. Disturbance during this time would be temporary, and project-related impacts would not likely have an appreciable impact on migratory bird populations as a whole or individual species in general. If the proposed well construction and drilling were to occur during the peak nesting months in spring/summer, the Proposed Action could result in at least some degree of nest abandonment, direct mortality, reproductive failure, displacement of birds, and destruction of nests. This would have a greater impact on High-Priority migratory bird species that may be nesting in the Project Area due to the smaller population size and limited distribution found in these species.

Construction, drilling, and completion activities, as well as production and maintenance activities, would result in the fragmentation of habitat and associated edge avoidance by migratory birds, which has been documented as leading to lower levels in productivity (Renfrew et al. 2005). Associated noise and increased human presence would cause displacement from foraging and nesting habitats. If displaced, birds could move to less suitable habitats which could cause an increase in competition and deteriorated physical condition. Increased roads and vehicle traffic levels could also lead to the increased potential for collisions between migratory birds and vehicles. However as mentioned previously, much of the surface disturbance under the Proposed Action would only occur as an expansion of existing infrastructure and in locations where birds either already encounter visual and noise disruptions or have previously abandoned these areas altogether.
Successful interim and final reclamation efforts would re-establish some migratory bird habitat over time. Provisions to remove visible accumulation of oil from reserve pits would prevent exposure of migratory birds and other wildlife to petroleum products.

4.9.1.4 Raptors

The principal impacts of the Proposed Action on raptors are: (1) nest desertions and/or reproductive failure caused by project-related disturbances, (2) increased public access and subsequent human disturbance resulting from new road construction, and (3) temporary reductions in prey populations. Based on aerial and ground inventories conducted by a number of organizations prior to 2008, 7 raptor nests were identified within the Project Area.

Direct impacts to raptors could result from surface-disturbing activities or areas with concentrated human activity, in close proximity to an active raptor nest. This could lead to temporary displacement from nesting sites, avoidance of affected areas, and deterrence from establishing other nesting sites. Steidl and Anthony (2000) suggest that the greatest energetic costs from disturbance occur in nestlings, potentially decreasing overall reproductive success. Displacement could also lead to increased use of adjacent habitats, which could lead to increased inter- and intra-specific competition for resources.

It is important to note that the RBU Project Area already contains 324 well pads, 108 miles of roads, 137 miles of pipelines, and seven compressor stations. Much of the surface disturbance under the Proposed Action would only occur as an expansion of existing infrastructure and in locations where raptors already

encounter at least some degree of visual and noise disruptions. In addition, as increased noise levels and visual disturbances associated with construction and drilling activities would be localized and short-term, displacement to adjacent habitats would likely be temporary in nature and would not likely alter the productivity of current raptor populations within the RBU Project Area. In addition, the cliffs on which the 7 raptor nests were found provide a moderate to high degree of topographic screening which provide increased insulation from facilities, human activity, and altered habitat.

The creation of new roads outlined in the Proposed Action would increase public access to areas within the Project Area. As use of the Project Area by both workers and recreationists increases, the potential for encounters between raptors and humans would also increase and could result in increased disturbance to nests and foraging areas, vehicle collisions, and shooting incidences. Closures of some new and existing roads to public vehicle use following construction would be one of the most effective measures that could be implemented to offset this potential impact.

The development of proposed well pads and associated roads and pipelines would initially disturb an estimated 1,075 acres of potential habitat for several species of small mammals that serve as prey items for raptors. This short-term moderate impact would affect approximately 6.4 percent of the Project Area and is not likely to be the determining factor in the level of use the Project Area receives by raptors because the small amount of short-term change in prey base populations created by the construction associated with the Proposed Action is minimal in comparison to the overall status of the rodent and lagomorph cycles which is controlled over the region and state by natural forces. While prey populations on the Project Area would likely sustain some stress during the initial phase of the project, prey numbers would be expected to soon rebound to pre-disturbance levels following reclamation of approximately 38 percent of the total initial disturbance area involving pipelines, unused portions of well pads and roads, and wells that are no longer productive. Once reclaimed, these areas will likely promote an increased density and biomass of small mammals that is comparable to those of undisturbed areas (Hingten and Clark 1984). For these reasons, implementation of the Proposed Action is not expected to produce any appreciable long-term negative changes to the raptor prey base within the Project Area.

Prior to any new surface disturbance, formal raptor surveys would be conducted to search for possible undocumented nests and provide needed information on the current activity status of nests on and adjacent to the Project Area. The surveys would be conducted by a BLM-approved biologist in all areas scheduled for construction. If an occupied nest is found, construction would be postponed until after the young have fledged and left the nest, generally accepted to be August 31 (refer to ACEPM in **Section 2.1.12.3**).

Consideration of topography and vegetative screening when locating well pads and project-related facilities could further reduce or minimize indirect impacts to raptor species within the RBU Project Area. Successful interim reclamation of areas not utilized for production activities, as well as final reclamation efforts, could reestablish some raptor and prey habitat over time. Measures to reduce speeding and remove carrion on area roads could reduce direct impacts associated with the Proposed Action.

4.9.1.5 Special-status Fish and Wildlife Species

In general, construction and operational impacts of the Proposed Action on special-status fish and wildlife species and their habitats would be similar to those discussed in the preceding sections for vegetation communities and wildlife. However, these impacts can be more severe for special-status fish and wildlife species, if present, since the distribution and abundance of many of these species are limited in the Project Area and surrounding region. An adverse impact to special-status fish and wildlife species would be considered to occur if construction and/or operation of any component of the proposed Project would

cause substantial changes to the existing abundance, distribution, or habitat value for a special-status fish and wildlife species.

White-tailed Prairie Dog

While there are no documented white-tailed prairie dog colonies within the RBU Project Area, it is likely that at least some smaller, more sparsely populated colonies exist within the Project Area boundary. Impacts to the white-tailed prairie dog may result in direct mortalities of individuals, as a result of crushing from construction activities, vehicles, and equipment. Additional impacts may result from increased habitat fragmentation, human presence, and noise. Based on the small amount of white-tailed prairie dog colonies potentially present and impacted by the proposed Project, impacts to the white-tailed prairie dog are anticipated to be low. Habitat disturbance in surrounding areas may encourage future colonization in the short-term, based on the availability of disturbed soils that would occur within the Project Area subsequent to the Project-related construction.

Specific measures under the Proposed Action, including the ACEPMs, would reduce impacts to the white-tailed prairie dog. Successful interim and final reclamation efforts could re-establish some the white-tailed prairie dog habitat over time. ACEPMs to reduce speeding on area roads would reduce the potential for collisions between prairie dogs and vehicles. Weed control would reduce habitat degradation. In addition, implementation of recommended mitigation measure that includes provisions to avoid active white-tailed prairie dog colonies during construction could further reduce impacts related to habitat loss and fragmentation in the RBU Project Area. Overall, the Proposed Action may indirectly impact the white-tailed prairie dog, but would not likely result in a trend towards Federal-listing of this species.

Greater Sage Grouse

No sage grouse leks are known to occur in the Project Area, nor is any part of the Project Area known to be within a 2-mile buffer zone of a lek. The nearest document lek is located approximately 6.8 miles southeast of the Project Area. In addition, no surface disturbance to Preliminary Priority Habitat, or habitats designated as occupied, brood rearing, or winter habitats for sage grouse would occur under the Proposed Action. Although most of the habitat within the Project Area is marginal for sage grouse breeding and nesting, it is possible that a few individual sage grouse occasionally use portions of the Project Area.

No adverse impacts to sage grouse are expected as a result of direct habitat disturbance under the Proposed Action because no leks or designated habitats will be affected and the relatively small number of sage grouse that are likely to occur within the Project Area. For the same reasons, disturbance from project-related activities, vehicle collisions, and poaching/harassment impacts to sage grouse are expected to be minimal.

Yellow-billed Cuckoo

Riparian habitat that could be utilized by the yellow-billed cuckoo occurs west, but outside, of the RBU Project Area along the Green River. Therefore the Proposed Action would not have direct impacts to this species or its habitat. However, indirect impacts to potential yellow-billed cuckoo habitat could result under the Proposed Action from increased soil erosion and potential for spills and leaks. These impacts would be reduced with interim reclamation, recommended mitigation measures for erosion control to avoid or minimize soil erosion and off-site deposition, and spill containment measures.

Bald Eagle

Although no bald eagle nesting has been reported to occur within or near the RBU Project Area, bald eagles have been documented to roost in cottonwood trees along the Green River within 0.5 mile of the RBU Project Area. Impacts to roosting bald eagles from implementation of the Proposed Action would be similar to those identified and assessed in **Section 4.9.1.4** for raptors including increased public access and subsequent human disturbance resulting from new road construction and temporary reductions in prey populations.

It is important to note that the RBU Project Area already contains 324 well pads, 108 miles of roads, 137 miles of pipelines, and seven compressor stations. Much of the surface disturbance under the Proposed Action would only occur as an expansion of existing infrastructure and in locations where eagles already encounter at least some degree of visual and noise disruptions. In addition, as increased noise levels and visual disturbances associated with construction and drilling activities would be localized and short-term, they would not be likely alter the current use of cottonwood trees along the Green River as roost sites for bald eagles. In addition, the cliffs and trees which occur along the Green River which would provide a moderate level of topographic screening, which would provide increased insulation from facilities, human activity, and altered habitat near the westernmost portion of the RBU Project Area.

In addition to fish taken along the Green River, bald eagles would be expected to feed on carrion during the winter, including deer and pronghorn using winter range within portions of the Project Area. The potential for vehicle collisions with big game could increase as a result of increased vehicular traffic associated with the presence of construction crews and activities in the Project Area. Measures to control speed limits and adherence to the removal of big game carcasses from roadsides would be implemented to reduce the potential for vehicle-related collisions with bald eagles.

As with raptors in general, XTO would conduct current year raptor surveys within the species specific buffer from the proposed surface disturbance (per Appendix A of the Vernal RMP ROD) (refer to ACEPM in **Section 2.1.12.3**). The surveys would be conducted by a BLM-approved biologist on all areas scheduled for construction. If an occupied nest is found, construction would be postponed until after the young have fledged and left the nest. Implementation of this ACEPM, as well as other measures including interim and final reclamation, adherence to speed limits, and measures to contact the County for carrion removal. Based on adherence to these measures, the Proposed Action would not likely result in a trend toward re-listing of this species, nor would it result in an appreciable loss of bald eagle populations or density within the RBU Project Area.

Golden Eagle

All of the raptor nests identified in the Project Area were those of golden eagles. Impacts to golden eagles from implementation of the Proposed Action would be very similar to those identified and assessed in **Section 4.9.1.4** for raptors including nest desertions and/or reproductive failure caused by project-related disturbances, increased public access and subsequent human disturbance resulting from new road construction, and temporary reductions in prey populations. As with the raptors in general, XTO would conduct current year raptor surveys within the species specific buffer from the proposed surface disturbance (per Appendix A of the Vernal RMP ROD) (refer to ACEPM in **Section 2.1.12.3**). The surveys would be conducted by a BLM-approved biologist on all areas scheduled for construction. If an occupied nest is found, construction would be postponed until after the young have fledged and left the nest. Implementation of this ACEPM, as well as other measures including interim and final reclamation, adherence to speed limits, and measures to contact the County for carrion removal. Based on adherence to these measures, the Proposed Action would not likely result in a trend toward Federal listing of this species, nor would it result in an appreciable loss of golden eagle populations or density within the RBU Project Area.

Burrowing Owl

The primary impact to burrowing owls under the Proposed Action would be the loss and increased fragmentation of potential nesting and foraging habitat within the RBU Project Area. Surface-disturbing activities or areas with concentrated human activity in proximity of an active burrowing owl nest could lead to nest abandonment, thereby affecting the breeding pair and their annual productivity. Since burrowing owls alternate between nest sites within a breeding territory, any surface facilities where ongoing traffic or human presence occurs in or near active prairie dog colonies could prevent burrows from being used as nest sites in the future.

Construction, drilling, and completion activities would also result in visual disturbance on the landscape, increased noise from equipment use, and increased vehicle traffic, all of which could cause burrowing owls to avoid disturbed areas. Such displacement and avoidance could lead to an increased use of adjacent habitat, which could then lead to increased inter-specific and intra-specific competition for resources in these areas.

Under the Proposed Action, ACEPMs that include provisions for site-specific field surveys for raptors prior to surface-disturbing activities, spatial/temporal buffers around active nests, and adherence to speed limits, could reduce or minimize displacement or nest abandonment of burrowing owls. In addition, implementation of recommended mitigation measures that include provisions to avoid active white-tailed prairie dog colonies during construction could further reduce impacts related to the loss of potential nesting habitat in the RBU Project Area.

Colorado River Fish Species

As discussed in **Chapter 3**, habitat for four Federally-listed fish species (the humpback chub, bonytail chub, razorback sucker, and Colorado pikeminnow) and three conservation agreement fish species (flannelmouth sucker, bluehead sucker, and roundtail chub) is located in the Green River west of the RBU Project Area. Although no ground-disturbing activities would occur in aquatic habitat for these species as a result of the Proposed Action, these fish could be impacted by water depletion activities, increased siltation due to soil erosion, and hazardous substances in the case of an accidental spill or leak.

Water Depletions

The proposed project would utilize water from the Upper Colorado River system (i.e., Green River, Willow Creek, and underground wells that potentially draw water from the system) for drilling and completion activities, as well as dust abatement. The drilling of all 484 proposed wells under the Proposed Action would consume about 1,307 acre-feet of water over a period of 8 years (between 100 and 251 acre-feet per year). In addition, approximately 0.1 acre-feet of water per well pad would be utilized for dust abatement each year. As such, water utilized for dust abatement for a maximum of 484 well pads and associated roads would be approximately 48 acre-feet over a 8-year development period. Based upon these water-use estimates, between 104 and 260 acre-feet of water per year could be used for drilling, completion, and dust abatement over the first 8 years of the project. Following drilling and completion activities, water usage would then be limited to approximately 6.3 acre-feet per year for dust abatement for the remainder of the project life. Depletions can reduce the ability of the Green River to create and maintain the physical habitat (areas inhabited or potentially habitable to special status fish for use of spawning, development of fish larvae, feeding, or serving as corridors between these areas) and the biological environment required by the fish. Water depletions can also contribute to alterations in flow regimes that favor non-native fish.

In order to address depletion (and other) impacts to the endangered Colorado River fish, a Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) was initiated on January 22, 1988. Under the 1988 Recovery Program, any water depletions from tributary waters within the Colorado River drainage are considered to *"jeopardize the continued existence"* of these fish. In order to further define and clarify the recovery processes in the Recovery Program, a Section 7 agreement was implemented on October 15, 1993, by Recovery Program participants. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan (RIPRAP). The RIPRAP identifies actions currently required to recover the endangered fish species in the most expeditious manner. Included in the RIPRAP was the requirement that a one-time depletion fee would be paid to help support the Recovery Program for all non-historic water depletions (i.e., occurring after January 1988) from the Upper Colorado River Basin. The depletion fees as amended were intended to be the reasonable and prudent alternative to avoid jeopardy to the endangered fishes by depletion of the Upper Colorado River Basin (USFWS 2009).

Similar to the Colorado River fish, the above-mentioned water depletion impacts could also affect the flannelmouth sucker, bluehead sucker, and roundtail chub, but would not likely result in a loss of viability, nor cause a trend towards Federal listing of these species. It should be noted that some depletion-related impacts to these species would be reduced as XTO and/or their contractors have voluntarily committed to avoid pumping water from low flow environments and would use a maximum of 0.25-inch mesh screening on the pump intake while pumping water. If impinged fish are observed on the intake, XTO would immediately stop work and contact the USFWS and UDWR. Furthermore, if implemented, ACEPMs described in **Section 2.1.12.3** to limit pumping and avoid entrainment would also reduce the potential for impacts to fish species in the Green River.

Other Project Activities

Implementation of the Proposed Action could also degrade USFWS-designated critical habitat for the Colorado River fish in the Green River by increasing erosion, sediment yield, and the potential for exposure to hazardous substances in the case of an accidental spill. Turbidity and salinity would be expected to increase as well. However, these impacts would be minimized by implementation of ACEPMs under the Proposed Action which include provisions to minimize surface disturbance, implement interim and final reclamation, implement a SPCC plan, utilize appropriate erosion control measures, and utilize closed-loop drilling systems for all proposed wells located in the 100-year floodplain of Willow Creek and in all named drainages within 5 river miles of the Green River.

Conclusion

The estimated 1,356 acre-feet of water needed for the proposed drilling, completion and fugitive dust control actions would result in a depletion of surface and groundwater within the Green River Watershed, thus directly affecting the Colorado River endangered fish and the Conservation Agreement fish species and their habitats. Therefore, the Proposed Action ***"may affect, is likely to adversely affect"*** the humpback chub, bonytail chub, razorback sucker, and Colorado pikeminnow and their USFWS-designated critical habitat.

4.9.2 Alternative B – No Action Alternative

Impacts to fish and wildlife resources under the No Action Alternative would be similar in nature to those described for the Proposed Action. However, potential impacts would be considerably less under the No Action Alternative, as only 16 new oil and gas wells would be developed on State and Tribal lands in the RBU Project Area. The overall surface disturbance would be approximately 12.7 acres, which is nearly 99 percent less than the Proposed Action. Correspondingly, impacts to general wildlife, wildlife habitat,

big game, migratory birds, raptors, and special-status wildlife species in the RBU Project Area would be proportionately less under Alternative B.

4.9.3 Alternative C – Agency Preferred Alternative

Impacts to fish and wildlife resources under Alternative C would be similar in nature, but less in extent, than those described under the Proposed Action. Under Alternative C, 234 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative C would result in the direct disturbance of 923 acres of general wildlife habitat which is 152 acres less and 910 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. This includes approximately 714 acres of scrub/shrub, 144 acres of grasslands/herbaceous, 37 acres of woody wetland, and 28 acres of barren land vegetation cover types. Following construction, approximately 363 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance to vegetation associated with implementation of the Alternative C to approximately 560 acres.

Alternative C would result in the direct disturbance of 882 acres of critical year-long fawning habitat for antelope and 322 acres of critical year-long fawning habitat for bighorn sheep, which is 119 acres and 62 acres less than that of the Proposed Action, respectively. Additionally, impacts to general migratory birds, raptors, and special-status wildlife species in the RBU Project Area would be proportionately less under Alternative C.

An estimated 701 acre-feet of water would be needed for the proposed drilling, completion and fugitive dust control actions under Alternative C, **which is approximately 655 acre-feet (48 percent) less than that of the Proposed Action.** Implementation of Alternative C would result in a depletion of surface and groundwater within the Green River Watershed, which can reduce the ability of the Green River to create and maintain the physical habitat (areas inhabited or potentially habitable to special status fish for use of spawning, development of fish larvae, feeding, or serving as corridors between these areas) and the biological environment required by the fish. Water depletions can also contribute to alterations in flow regimes that favor non-native fish.

As with the Proposed Action, interim and final reclamation of disturbed areas, pre-construction surveys for special status wildlife, and adherence to species-specific conservation measures on BLM-administered lands including provisions to avoid occupied habitat and employ the use of spatial buffers between surface activities and known populations of special status wildlife species would reduce impacts to wildlife including special status species.

Conclusions

Since any appreciable amount of surface and groundwater depletions within the Green River Watershed can affect habitat for listed Colorado River fish species, Alternative C ***"may affect, is likely to adversely affect"*** the humpback chub, bonytail chub, razorback sucker, and Colorado pikeminnow and their USFWS-designated critical habitat.

4.9.4 Alternative D – Minimum Development Alternative

Impacts to fish and wildlife resources under Alternative D would be similar in nature to those described under the Proposed Action and would be the least of all action alternatives considered. Under Alternative D, 334 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative D would result in a total surface disturbance of 592 acres of general wildlife habitat which is 483 acres less and 579 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively. This includes approximately 455 acres of scrub/shrub, 102 acres of grasslands/herbaceous, 19 acres of woody wetland, and 16 acres of barren land vegetation cover types. Following construction, approximately 225 acres of initial disturbance (38 percent) associated with construction of proposed well pad, portions of the access road, and pipeline ROW not needed for operational purposes would be reclaimed. This would reduce the long-term disturbance associated with implementation of Alternative D to approximately 367 acres.

Alternative D would result in the direct disturbance of 558 acres of critical year-long fawning habitat for antelope and 165 acres of critical year-long fawning habitat for bighorn sheep, which is 443 acres and 219 acres less than that of the Proposed Action, respectively. No crucial year-long fawning habitat would be affected under Alternative D. Additionally, impacts to general migratory birds, raptors, and special-status wildlife species in the RBU Project Area would be proportionately less under Alternative D.

The volume of water needed for drilling and completion of wells proposed under Alternative D would be approximately 405 acre-feet (150 wells x 2.7 acre-feet per well), which is approximately 902 acre-feet (69 percent) less than that of the Proposed Action. An additional 14.9 acre-feet of water would be needed for dust suppression under Alternative C, which is approximately 33.5 acre-feet (69 percent) less than that required under the Proposed Action.

An estimated 420 acre-feet of water would be needed for the proposed drilling, completion and fugitive dust control actions under Alternative D, **which is approximately 936 acre-feet (69 percent) less than that of the Proposed Action and 281 acre-feet (40 percent) less than that required under Alternative C.** Implementation of Alternative D would result in a depletion of surface and groundwater within the Green River Watershed, (albeit at a substantially lower level than that under the Proposed Action or Alternative C).

As with the Proposed Action, interim and final reclamation of disturbed areas, pre-construction surveys for special status wildlife, and adherence to species-specific conservation measures on BLM-administered lands including provisions to avoid occupied habitat and employ the use of spatial buffers between surface activities and known populations of special status wildlife species would reduce impacts to wildlife including special status species.

Conclusions

Since any appreciable amount of surface and groundwater depletions within the Green River Watershed can affect habitat for listed Colorado River fish species, Alternative D ***"may affect, is likely to adversely affect"*** the humpback chub, bonytail chub, razorback sucker, and Colorado pikeminnow and their USFWS-designated critical habitat.

4.9.5 Recommended Mitigation Measures

No additional mitigation beyond what is proposed under the ACEPMs is recommended for wildlife or special-status terrestrial species under the Proposed Action or other alternatives. The following recommended mitigation measures would be applied to reduce impacts to listed Colorado River fish species.

1) To address the depletion associated with this project, XTO would be responsible for paying a one-time payment, which will be calculated by multiplying the project's average annual depletion by the depletion charge that is in effect at the time payment is made. Ten percent of the total payment will be provided to the USFWS's designated agent, the National Fish and Wildlife Foundation at the time of issuance of the Federal Approvals. The balance will be due at the time construction commences.

4.10 VISUAL RESOURCES

4.10.1 Alternative A – Proposed Action

The potential direct adverse impacts to visual resources would include the visual contrasts created by construction equipment, pipelines, well pads, temporary and permanent access roads, and other forms of infrastructure associated with gas exploration and development. In general, drilling rigs and equipment, construction and maintenance vehicles, development infrastructure, and surface disturbance, including roads, would impact an area's scenic quality and appearance of naturalness with human-made form, color, and linear contrasts. The visual impacts from producing wells (including permanent access roads, permanent well pads, pipelines, maintenance vehicles, and related infrastructure such as electrical generators, and dehydrators) would have similar visual contrasts with the natural landscape, and would persist throughout the production lifetime of the wells and during the life of the project.

Long-term fugitive dust generation by production-well maintenance vehicles and well-drilling activities could adversely impact long-distance scenic quality because these fugitive dust–producing activities would continue throughout the life of the project. However, air-quality modeling indicates that these impacts would not exceed PSD visibility standards (primarily affected by PM_{10} and $PM_{2.5}$) under the Proposed Action. Also, ACEPMs for dust abatement along access roads (see **Section 2.2.12.1**) would limit the potentially adverse effects of long-term, dust-related haze to long-distance scenic quality.

Additional impacts would include artificial light and associated sky glow from night lighting required for night-time drilling. This would be of greater concern in the high-recreation-use areas of the Green River corridor. Night lighting would degrade scenic quality in some relatively undeveloped area by introducing intrusive, artificial lighting into an otherwise unlit natural landscape. Short-term visual impacts from both gas flaring and horizontal and vertical lighting at the well-pad locations would occur during the drilling period of 30 to 40 days. The locations of these temporary impacts would shift across the project area as each individual well is completed. Short-term impacts would also include drilling rig visibility at site-specific drilling locations during the day and night, as the rigs would be moved weekly or monthly depending on site-specific drilling depths. Long-term impacts (for the lifetime of the project) would include pipeline, infrastructure, and well-pad visibility; surface disturbances from well-pad construction; and access road construction.

Table 4.10-1 shows the acres of potential direct surface-disturbing impacts within each VRM class under the Proposed Action. Implementation of the Proposed Action would result in the direct disturbance of 184 and 491 acres within designated VRM Class III and Class IV areas, respectively. The proposed development within designated VRM Class III and Class IV areas would be consistent with management objectives because the VRM objectives for these visual classes would permit moderate to major changes to the characteristic landscape that would accommodate the level of surface disturbances and visual contrasts created by proposed project activities.

The same proposed development activities would take place in designated VRM Class II areas. Under the Proposed Action, approximately 10 acres of surface disturbance would occur within designated VRM Class II areas. Class II management objectives would allow only minor changes to the characteristic

landscape, and any long-term, development-related surface disturbances and visually intrusive structures would be required to comply with those objectives. Under the Proposed Action, at least some of the proposed wells would be in the vicinity of the Green River. Drilling rigs would likely be visible in the short-term within portions of the VRM Class II areas, and project-related infrastructure would potentially be visible in the long-term. Site-specific mitigation (e.g., topographic screening, camouflage coloring) measures as described below would likely reduce the impacts to comply with VRM Class II objectives on BLM-administered lands in Class II areas.

Table 4.10-1. Acreage of VRM Classes Affected Under the Proposed Action

VRM Class	Acres Affected	Percent of Total Proposed Disturbance
Class I	0	0
Class II	10	2.8
Class III	184	7.2
Class IV	491	5.4

4.10.2 Alternative B – No Action Alternative

Impacts to visual resources under the No Action Alternative would be similar in nature to those described for the Proposed Action. However, potential impacts VRM class areas would not occur under the No Action Alternative, as no new wells would be developed on BLM administered lands and only 16 new oil and gas wells would be developed on State and Tribal lands in the RBU Project Area. The overall surface disturbance would be approximately 12.7 acres, which is nearly 99 percent less than the Proposed Action.

4.10.3 Alternative C – Agency Preferred Alternative

Impacts to visual resources under Alternative C would be similar in nature, but less in extent, than those described under the Proposed Action. Under Alternative C, 234 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative C would result in approximately 923 acres of surface disturbance which is 152 acres less and 910 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively.

Alternative C would result in the direct disturbance of approximately 171 acres of VRM Class III areas and 414 acres of VRM Class IV areas. No Class II areas would be affected under Alternative C, as no new surface disturbance would occur in these areas.

4.10.4 Alternative D – Minimum Development Alternative

Impacts to visual resources under Alternative D would be similar in nature to those described under the Proposed Action and would be the least of all action alternatives considered. Under Alternative D, 334 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action. Alternative D would result in approximately 592 acres of surface disturbance which is 483 acres less and 579 acres more than would be impacted under the Proposed Action and No Action alternatives, respectively.

Alternative D would result in the direct disturbance of approximately 122 acres of VRM Class III areas and 242 acres of VRM Class IV areas. No Class II areas would be affected under Alternative D, as no new surface disturbance would occur in these areas.

4.10.5 Recommended Mitigation Measures

The following mitigation measures would reduce potential impacts to Class II areas under the Proposed Action. On-site visual reviews during the APD process would determine if sufficient mitigation could be applied to meet VRM II class objectives. No additional mitigation beyond what is proposed under the ACEPMs is recommended for visual resources under the other alternatives

- Camouflage coloring, facility design, low-profile structures, proper placement, edge feathering along access roads and vegetation/road boundaries, and/or topographic screening would be used to reduce or eliminate the observable effects of well pads, roads, and infrastructure. Topographic screening and proper placement could include hiding the facilities behind ridge lines, in natural depressions, behind vegetation, or behind rock outcrops.
- Interim site and access road reclamation would occur to reduce the visual size of surface disturbance.
- Surface disturbances would be minimized by sharing ROWs, off-site directional drilling, and off-site placement of storage tanks.
- When feasible, pipelines would be buried in the road.
- The proposed well-pad size would be reduced to the minimum necessary.
- Night-lighting and light pollution skyglow impacts would be reduced as feasible by using only the minimal lighting required for safety and security, installing lights at the minimal heights required, and installing hoods on lights to reduce light diffusion.
- To preserve the integrity of viewsheds, during the APD processing, and as feasible, the Operator and AO would: jointly determine the use of topographic features to serve as visual screens; place facilities away from highly visible points such as ridgelines; use low-profile tanks to reduce visibility where taller tanks would be more visible; and avoid excessive side-casting of earth materials from ridgelines and steep slopes.
- As feasible and in order to reduce visual impacts, the Operator would use centralized tank locations for water and condensate tanks. The feasibility of centralizing tank facilities would be determined on a site-specific basis.

4.11 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

This section considers the socioeconomic impacts of implementing the Proposed Action and alternatives in terms of Tribal, State, and local government revenue as well as Tribal employment and employment within the regional economy.

Oil and gas development within the RBU Project Area has been occurring since the 1950s. During the past 10 years, approximately 173 wells have been developed in the RBU Project Area, which is an average of slightly more than 17 wells per year. If given approval, XTO could increase activity from its current level to the level described under the Proposed Action (an average of approximately 62 wells per year). Because drilling and production activity is ongoing within the RBU Project Area, some of the economic effects described in this section would be a continuation of effects rather than an addition of effects. For example, implementation of the Proposed Action could result in a sustained level of employment and reinforced support for the oil and gas field services sectors, which is well established in both Uintah and Duchesne Counties.

4.11.1 Alternative A - Proposed Action

For the Proposed Action, it is assumed that XTO would construct approximately 484 natural gas wells over an 8 year period. Average daily and annual production estimates for an individual well within the RBU Project Area were provided by XTO and are used as the basis for this economic analysis. As shown in **Figure 4.11-1**, production rates are greatest within the first three years of well development.

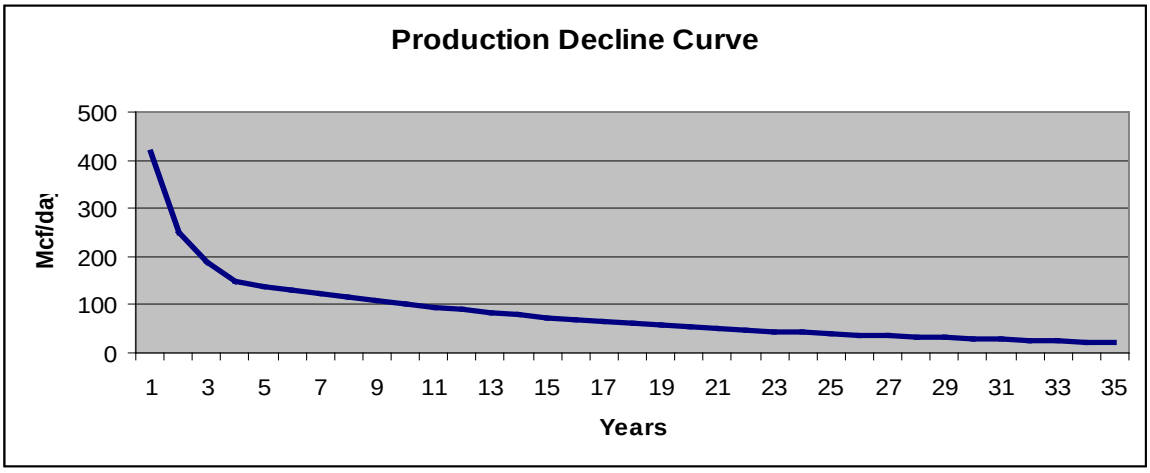

Figure 4.11-1. Production Decline for an Individual Well within the RBU Project Area

For the purposes of analysis, estimated annual average field production and estimated total field production were calculated by taking the production of an individual well (see **Figure 4.11-1**) and multiplying by the number of wells projected to be drilled during each year of the development phase (see **Table 2.1-3**). **Table 4.11-1** shows estimated annual field production and total field production over the life of the project.

Table 4.11-1. Estimated Annual and Total Field Production under the Proposed Action

Year	2010 (Mcf)	2011 (Mcf)	2012 (Mcf)	2013 (Mcf)	2014 (Mcf)	2015 (Mcf)	2016 (Mcf)	2017 (Mcf)	Total (Mcf)
1	7,003,713								7,003,713
2	4,212,537	9,135,277							13,347,814
3	3,159,402	5,494,613	14,159,680						22,813,695
4	2,488,994	4,120,960	8,516,651	8,678,513					23,805,117
5	2,311,373	3,246,514	6,387,487	5,219,883	10,048,805				27,214,061
6	2,172,691	3,014,834	5,032,096	3,914,912	6,044,075	9,744,296			29,922,903
7	2,042,330	2,833,945	4,672,992	3,084,188	4,533,056	5,860,921	9,287,532		32,314,963
8	1,919,790	2,663,908	4,392,615	2,864,092	3,571,165	4,395,690	5,586,190	6,394,694	31,788,145
9	1,804,602	2,504,074	4,129,058	2,692,248	3,316,317	3,462,948	4,189,642	3,846,229	25,945,119
10	1,696,326	2,353,829	3,881,315	2,530,713	3,117,340	3,215,823	3,300,622	2,884,672	22,980,639

Year	2010 (Mcf)	2011 (Mcf)	2012 (Mcf)	2013 (Mcf)	2014 (Mcf)	2015 (Mcf)	2016 (Mcf)	2017 (Mcf)	Total (Mcf)
11	1,594,547	2,212,600	3,648,435	2,378,870	2,930,299	3,022,875	3,065,081	2,272,560	21,125,266
12	1,498,874	2,079,844	3,429,529	2,236,137	2,754,482	2,841,502	2,881,178	2,110,384	19,831,930
13	1,408,941	1,955,053	3,223,759	2,101,970	2,589,212	2,671,012	2,708,307	1,983,762	18,642,015
14	1,324,405	1,837,750	3,030,332	1,975,852	2,433,860	2,510,751	2,545,809	1,864,736	17,523,493
15	1,244,942	1,727,485	2,848,512	1,857,300	2,287,829	2,360,106	2,393,059	1,752,852	16,472,085
16	1,170,244	1,623,837	2,677,602	1,745,862	2,150,558	2,218,500	2,249,476	1,647,680	15,483,760
17	1,100,030	1,526,405	2,516,947	1,641,111	2,021,525	2,085,389	2,114,508	1,548,820	14,554,735
18	1,034,027	1,434,821	2,365,927	1,542,645	1,900,234	1,960,266	1,987,637	1,455,891	13,681,449
19	971,987	1,348,731	2,223,973	1,450,085	1,786,221	1,842,651	1,868,379	1,368,537	12,860,563
20	913,667	1,267,809	2,090,533	1,363,080	1,679,045	1,732,093	1,756,277	1,286,425	12,088,929
21	858,847	1,191,739	1,965,104	1,281,294	1,578,304	1,628,165	1,650,901	1,209,240	11,363,594
22	807,316	1,120,235	1,847,196	1,204,419	1,483,604	1,530,476	1,551,845	1,136,686	10,681,776
23	758,877	1,053,020	1,736,364	1,132,152	1,394,590	1,438,646	1,458,735	1,068,483	10,040,869
24	713,345	989,840	1,632,182	1,064,223	1,310,913	1,352,330	1,371,210	1,004,375	9,438,417
25	670,544	930,450	1,534,252	1,000,369	1,232,258	1,271,188	1,288,939	944,112	8,872,113
26	630,311	874,622	1,442,198	940,348	1,158,322	1,194,917	1,211,602	887,466	8,339,786
27	592,493	822,145	1,355,665	883,928	1,088,824	1,123,222	1,138,905	834,217	7,839,398
28	556,943	772,817	1,274,324	830,891	1,023,495	1,055,829	1,070,571	784,164	7,369,035
29	523,527	726,448	1,197,866	781,037	962,085	992,480	1,006,337	737,114	6,926,894
30	492,115	682,861	1,125,994	734,176	904,359	932,931	945,958	692,888	6,511,281
31	462,588	641,889	1,058,435	690,125	850,098	876,954	889,199	651,315	6,120,604
32	434,832	603,375	994,928	648,718	799,092	824,338	835,847	612,236	5,753,367
33	408,743	567,173	935,231	609,795	751,147	774,877	785,697	575,501	5,408,165
34	384,219	533,143	879,118	573,206	706,078	728,385	738,555	540,972	5,083,676
35	361,165	501,155	826,372	538,814	663,713	684,682	694,242	508,513	4,778,656
36		471,085	776,790	506,486	623,890	643,600	652,587	478,003	4,152,441
37			730,182	476,097	586,458	604,984	613,431	449,322	3,460,475
38				447,531	551,270	568,686	576,626	422,363	2,566,475
39					518,194	534,565	542,029	397,021	1,991,809
40						502,491	509,507	373,200	1,385,199
41							478,937	350,808	829,745
42								329,760	329,760
Total									**528,643,924**

Estimated annual production values presented in **Table 4.11-1** were used to calculate the estimated value of production in the RBU Project Area. The estimated value of natural gas was derived by multiplying the annual gas field production by forecasted wellhead prices in the lower 48 states. This was considered to be the average wellhead price of natural gas between 2008 and 2011, based on information from the Energy Information Administration (EIA). The average wellhead price during this time period was $5.02 per million cubic feet. All values are expressed in 2011 U.S. dollars. The estimated value of production under the Proposed Action would be an annual average of about $63.2 million and about $2.65 billion cumulatively (undiscounted).

4.11.1.1 Tribal and Public Revenues

Taxes, royalties, and other revenues generated by natural gas development in the RBU Project Area are directly tied to the value of gas produced, which varies with both the amount of production and price. As discussed in **Section 3.2.10**, revenues generated by natural gas development are important revenue sources for the Ute Tribe, Uintah County, and the State of Utah. **Table 4.11-2** includes a detailed summary of the estimated revenues that would be generated if the Proposed Action were selected. An explanation of each of these revenues is included after the table.

As discussed in **Section 3.2.10.3**, the RBU Project Area contains some split-estate. For confidentiality reasons, mineral right ownership beneath Tribal lands has not been disclosed. Based on sub-surface mineral ownership patterns, and for the purposes of analysis in this EA, it is assumed that of the wells proposed on Tribal land; approximately four percent would be on Tribal minerals, five percent on State minerals, and 91 percent on Federal minerals.

4.11.1.2 Public Revenues

Mineral Lease Royalties

Federal mineral lease royalties are collected from oil and gas extraction operations located on Federally-held minerals at a rate of 12.5 percent. Federal mineral leasing regulations require that 50 percent of royalties collected from mineral lease royalties are returned to the state of origin. Within the State of Utah, close to 80 percent of State revenue is returned to impacted counties through the Permanent Community Impact Fund (PCIF) or through county special service districts. As shown in Table 4.11.3, annual average mineral lease royalties on Federal lands would be approximately $9.1 million. Cumulative mineral lease royalties on Federal lands would be approximately $380.4 million.

Mineral lease royalties on State lands are also collected at a rate of approximately 12.5 percent. According to Table 4.10.3, annual average mineral lease royalties on State lands would be approximately $379,113 and cumulative mineral lease royalties on State lands would be approximately $15.9 million.

State Severance Tax

Utah Severance Tax (Utah Code 59-05) is paid to the Utah Tax Commission and promptly remitted to the State Treasurer. With the exception of taxes collected on certain Indian lands, severance monies collected are credited to the General Fund, where it is subject to appropriation by the legislative process.

As discussed in **Section 3.2.10.1**, within Utah, natural gas severance tax rates are administered on a sliding scale basis. The rate is three percent of the value up to, and including, the first $1.50 per mcf and five percent of the value in excess of the first $1.50. There are several exemptions and stipulations for taxable

Table 4.11-2. Estimated Annual, Average, and Total Public and Tribal Revenues from the Proposed Action

Production Estimates and Values			Public and Tribal Revenues									
			Federal Mineral Royalty and State of Utah Appropriations (Dollars)					State Royalties and Revenues (Dollars)			Tribal Royalties and Revenues (Dollars)	
Year	Annual Field Production (mcf)	Total Production Value (Dollars)[1]	Total Federal Mineral Royalty	State of Utah (50% of Federal Mineral Royalty)	UDOT for Special Service Districts (40% of State Allocation)	PCIF (32.5% of State Allocation)	Department of Community and Cultural for Special Service Districts (5% of State Allocation)	SITLA Mineral Royalties	State Severance Tax	State Conservation Tax	Tribal Mineral Royalty	Tribal Severance Tax
1	7,003,713	35,158,637	3,839,323	1,919,662	767,865	623,890	31,195	210,952	1,406,345	70,317	253,142	84,381
2	13,347,814	67,006,027	7,317,058	3,658,529	1,463,412	1,189,022	59,451	402,036	2,680,241	134,012	482,443	160,814
3	22,813,695	114,524,751	12,506,103	6,253,051	2,501,221	2,032,242	101,612	687,149	4,580,990	229,050	824,578	274,859
4	23,805,117	119,501,690	13,049,585	6,524,792	2,609,917	2,120,557	106,028	717,010	4,780,068	239,003	860,412	286,804
5	27,214,061	136,614,587	14,918,313	7,459,156	2,983,663	2,424,226	121,211	819,688	5,464,583	273,229	983,625	327,875
6	29,922,903	150,212,974	16,403,257	8,201,628	3,280,651	2,665,529	133,276	901,278	6,008,519	300,426	1,081,533	360,511
7	32,314,963	162,221,117	17,714,546	8,857,273	3,542,909	2,878,614	143,931	973,327	6,488,845	324,442	1,167,992	389,331
8	31,788,145	159,576,489	17,425,753	8,712,876	3,485,151	2,831,685	141,584	957,459	6,383,060	319,153	1,148,951	382,984
9	25,945,119	130,244,495	14,222,699	7,111,349	2,844,540	2,311,189	115,559	781,467	5,209,780	260,489	937,760	312,587
10	22,980,639	115,362,809	12,597,619	6,298,809	2,519,524	2,047,113	102,356	692,177	4,614,512	230,726	830,612	276,871
11	21,125,266	106,048,837	11,580,533	5,790,267	2,316,107	1,881,837	94,092	636,293	4,241,953	212,098	763,552	254,517
12	19,831,930	99,556,286	10,871,546	5,435,773	2,174,309	1,766,626	88,331	597,338	3,982,251	199,113	716,805	238,935
13	18,642,015	93,582,913	10,219,254	5,109,627	2,043,851	1,660,629	83,031	561,497	3,743,317	187,166	673,797	224,599

Table 4.11-2. Estimated Annual, Average, and Total Public and Tribal Revenues from the Proposed Action

Production Estimates and Values			Public and Tribal Revenues									
			Federal Mineral Royalty and State of Utah Appropriations (Dollars)					State Royalties and Revenues (Dollars)			Tribal Royalties and Revenues (Dollars)	
Year	Annual Field Production (mcf)	Total Production Value (Dollars)[1]	Total Federal Mineral Royalty	State of Utah (50% of Federal Mineral Royalty)	UDOT for Special Service Districts (40% of State Allocation)	PCIF (32.5% of State Allocation)	Department of Community and Cultural for Special Service Districts (5% of State Allocation)	SITLA Mineral Royalties	State Severance Tax	State Conservation Tax	Tribal Mineral Royalty	Tribal Severance Tax
14	17,523,493	87,967,936	9,606,099	4,803,049	1,921,220	1,560,991	78,050	527,808	3,518,717	175,936	633,369	211,123
15	16,472,085	82,689,866	9,029,733	4,514,867	1,805,947	1,467,332	73,367	496,139	3,307,595	165,380	595,367	198,456
16	15,483,760	77,728,473	8,487,949	4,243,975	1,697,590	1,379,292	68,965	466,371	3,109,139	155,457	559,645	186,548
17	14,554,735	73,064,769	7,978,673	3,989,336	1,595,735	1,296,534	64,827	438,389	2,922,591	146,130	526,066	175,355
18	13,681,449	68,680,873	7,499,951	3,749,976	1,499,990	1,218,742	60,937	412,085	2,747,235	137,362	494,502	164,834
19	12,860,563	64,560,025	7,049,955	3,524,977	1,409,991	1,145,618	57,281	387,360	2,582,401	129,120	464,832	154,944
20	12,088,929	60,686,421	6,626,957	3,313,479	1,325,391	1,076,881	53,844	364,119	2,427,457	121,373	436,942	145,647
21	11,363,594	57,045,240	6,229,340	3,114,670	1,245,868	1,012,268	50,613	342,271	2,281,810	114,090	410,726	136,909
22	10,681,776	53,622,514	5,855,579	2,927,789	1,171,116	951,532	47,577	321,735	2,144,901	107,245	386,082	128,694
23	10,040,869	50,405,160	5,504,243	2,752,122	1,100,849	894,440	44,722	302,431	2,016,206	100,810	362,917	120,972
24	9,438,417	47,380,853	5,173,989	2,586,995	1,034,798	840,773	42,039	284,285	1,895,234	94,762	341,142	113,714
25	8,872,113	44,538,005	4,863,550	2,431,775	972,710	790,327	39,516	267,228	1,781,520	89,076	320,674	106,891
26	8,339,786	41,865,725	4,571,737	2,285,869	914,347	742,907	37,145	251,194	1,674,629	83,731	301,433	100,478

Table 4.11-2. Estimated Annual, Average, and Total Public and Tribal Revenues from the Proposed Action

Production Estimates and Values			Public and Tribal Revenues									
			Federal Mineral Royalty and State of Utah Appropriations (Dollars)					State Royalties and Revenues (Dollars)			Tribal Royalties and Revenues (Dollars)	
Year	Annual Field Production (mcf)	Total Production Value (Dollars)[1]	Total Federal Mineral Royalty	State of Utah (50% of Federal Mineral Royalty)	UDOT for Special Service Districts (40% of State Allocation)	PCIF (32.5% of State Allocation)	Department of Community and Cultural for Special Service Districts (5% of State Allocation)	SITLA Mineral Royalties	State Severance Tax	State Conservation Tax	Tribal Mineral Royalty	Tribal Severance Tax
27	7,839,398	39,353,778	4,297,433	2,148,716	859,487	698,333	34,917	236,123	1,574,151	78,708	283,347	94,449
28	7,369,035	36,992,554	4,039,587	2,019,793	807,917	656,433	32,822	221,955	1,479,702	73,985	266,346	88,782
29	6,926,894	34,773,008	3,797,212	1,898,606	759,442	617,047	30,852	208,638	1,390,920	69,546	250,366	83,455
30	6,511,281	32,686,630	3,569,380	1,784,690	713,876	580,024	29,001	196,120	1,307,465	65,373	235,344	78,448
31	6,120,604	30,725,431	3,355,217	1,677,609	671,043	545,223	27,261	184,353	1,229,017	61,451	221,223	73,741
32	5,753,367	28,881,900	3,153,903	1,576,952	630,781	512,509	25,625	173,291	1,155,276	57,764	207,950	69,317
33	5,408,165	27,148,987	2,964,669	1,482,335	592,934	481,759	24,088	162,894	1,085,959	54,298	195,473	65,158
34	5,083,676	25,520,053	2,786,790	1,393,395	557,358	452,853	22,643	153,120	1,020,802	51,040	183,744	61,248
35	4,778,656	23,988,853	2,619,583	1,309,791	523,917	425,682	21,284	143,933	959,554	47,978	172,720	57,573
36	4,152,441	20,845,255	2,276,302	1,138,151	455,260	369,899	18,495	125,072	833,810	41,691	150,086	50,029
37	3,460,475	17,371,582	1,896,977	948,488	379,395	308,259	15,413	104,229	694,863	34,743	125,075	41,692
38	2,566,475	12,883,707	1,406,901	703,450	281,380	228,621	11,431	77,302	515,348	25,767	92,763	30,921
39	1,991,809	9,998,880	1,091,878	545,939	218,376	177,430	8,872	59,993	399,955	19,998	71,992	23,997

Table 4.11-2. Estimated Annual, Average, and Total Public and Tribal Revenues from the Proposed Action

Production Estimates and Values			Public and Tribal Revenues									
			Federal Mineral Royalty and State of Utah Appropriations (Dollars)					State Royalties and Revenues (Dollars)			Tribal Royalties and Revenues (Dollars)	
Year	**Annual Field Production (mcf)**	**Total Production Value (Dollars)[1]**	**Total Federal Mineral Royalty**	**State of Utah (50% of Federal Mineral Royalty)**	**UDOT for Special Service Districts (40% of State Allocation)**	**PCIF (32.5% of State Allocation)**	**Department of Community and Cultural for Special Service Districts (5% of State Allocation)**	**SITLA Mineral Royalties**	**State Severance Tax**	**State Conservation Tax**	**Tribal Mineral Royalty**	**Tribal Severance Tax**
40	1,385,199	6,953,696	759,344	379,672	151,869	123,393	6,170	41,722	278,148	13,907	50,067	16,689
41	829,745	4,165,320	454,853	227,426	90,971	73,914	3,696	24,992	166,613	8,331	29,990	9,997
42	329,760	1,655,393	180,769	90,384	36,154	29,375	1,469	9,932	66,216	3,311	11,919	3,973
Total	**528,643,924**	**##########**	**289,794,141**	**144,897,071**	**57,958,828**	**47,091,548**	**2,354,577**	**15,922,755**	**106,151,700**	**5,307,585**	**19,107,306**	**6,369,102**
Average Annual	**12,586,760**	**63,185,536**	**6,899,861**	**3,449,930**	**1,379,972**	**1,121,227**	**56,061**	**379,113**	**2,527,421**	**126,371**	**454,936**	**151,645**

[1]Total production value is based on annual field production multiplied by the average wellhead price of natural gas from the Energy Information Administration (EIA) between 2008 and 2011. Source: EIA 2012.

value per the State Tax Commission's regulations. For example, the first $50,000 of annual production per well is tax exempt.

Despite the State's sliding rate structure for severance taxes, this analysis assumes that the effective State severance tax rate on XTO would be four percent.

In the Supreme Court case Cotton Petroleum Corporation v. New Mexico (490 U.S. 163), the court upheld the legality of imposing State severance taxes on production of oil and gas resources on Tribal lands by non-Indian lessees. Therefore, XTO would pay State and Tribal severance tax for development occurring on Tribal minerals within the RBU Project Area.

As shown in **Table 4.11-2**, XTO would pay an annual average of approximately $2.5 million in State severance taxes over the 42-year production LOP and $106.2 million cumulatively.

Conservation Fees

A conservation tax is collected by the Utah State Tax Commission at a rate of two-tenths of one percent (0.002) of the value of oil and gas produced, sold, or transported from any oil and gas field in Utah. Revenue generated from the conservation tax is paid to the Utah State Tax Commission and deposited into the State's general tax fund.

As shown in **Table 4.11-2**, on average, the State would collect approximately $126,371 annually in conservation fees over the LOP. Over the 42-year production life, XTO would pay approximately $5.3 million.

Sales and Use Taxes

Sales and use taxes on purchases of taxable goods in the region would also be collected in Uintah County. Some purchases made by XTO, plus retail purchases by contractors and the holders of secondary jobs, would generate sales tax revenues. Sales taxes are an important revenue source for Utah local government. There is insufficient information available to estimate the amount of sales and use taxes that would be generated by the Proposed Action.

4.11.1.3 Tribal Revenues

Tribal Mineral Royalties

Tribal royalty rates can vary from approximately 12.5 percent to 25 percent. For calculation purposes, an average royalty rate of 18 percent was used. As shown in **Table 4.11-2**, if the Proposed Action were implemented, the Ute Tribe would collect an annual average of $454,936 and a cumulative amount of $19 million, over the production life of the project.

Tribal Severance Tax

Severance taxes are also paid to the Ute Tribe for all oil and gas, produced, sold, or transported from Tribal minerals at rate of approximately six percent. Within the RBU Project Area, the Tribe would collect an annual average of $151,645 over the production life of the project, which equals approximately $6.4 million cumulatively.

4.11.1.4 Surface-Use Agreements

In cases where mineral and surface ownership are held in split estate, mineral developers (XTO) and the surface land owner (Ute Tribe) may enter into a surface use agreement. The specific details of a surface use agreement are negotiable.

In general, the compensation agreed upon through surface use agreements exceeds the direct and indirect financial losses that occur from surface disturbance. Some agreements may specify that the land owner would collect an overriding royalty interest (ORI) payment, in which case a certain percentage of oil and gas revenue would be paid to the Tribe. In other cases, the Tribe may collect surface use and damage payments on a per acre or annual basis. Because surface use agreements are confidential, no attempt has been made to calculate what revenues would be created for the Tribe.

4.11.1.5 Employment

Uintah and Duchesne County

For the Proposed Action, an IMPLAN (Impact Analysis for Planning) economic model was used to estimate the impacts that could occur in Uintah and Duchesne Counties as a result of implementing this project. The IMPLAN software automatically integrates economic data from both counties into a single economic unit known as a study area. The benefit of this approach is that the interaction between counties is captured in the economic analyses. The limitation is that it is that impacts cannot be apportioned to individual counties within the study area. Based on the location of this project, the level of impact to Uintah County would be larger than the impacts to Duchesne County. Nonetheless, by including Duchesne County, the majority of the impacts that would occur from oil and gas development in the RBU Project Area are taken into consideration.

Employment estimates for construction, drilling, completion, and production activities which provide the basis of the analysis were provided by XTO. Many of the personnel employed in different phases of the project would not be full-time, but would be employed for short periods of time as needed. For the modeling exercise, the employment estimates for each phase were converted into full-time equivalent employment by dividing by 2,080 (average hours worked by one employee in a year) or 260 (average days worked by one employee in a year), as appropriate.

Employment numbers for each phase are also presented as annual averages. As was shown in **Table 2.1-3**, the number of wells drilled each year could vary during the development phase. Therefore, employment would be the highest during peak-development. **Table 4.11-3** shows the average full-time equivalent employment required for each phase of the project.

Employment numbers presented in **Table 4.11-3** were used to estimate the direct effects of the Proposed Action. However, the direct effect is just the beginning of the economic impacts. For example, if the Proposed Action were implemented, XTO would need materials, supplies, and services from other businesses in order to produce oil and gas. These suppliers would also need to purchase materials and supplies needed by their businesses. The sum of these increases in spending for materials, equipment, and supplies from businesses to other businesses is the indirect effect. Finally, wages and salaries paid to workers in the oil and gas industry and their supplier industries generate household expenditures for items such as housing, food, and utilities. This is the induced effect. As personal income rises, households spend more on housing, food, transportation, clothing, entertainment, and other items, which stimulates the local economy. **Table 4.11-4** shows total estimated employment impacts from implementation of the Proposed Action.

Table 4.11-3. Average Annual Equivalent Full-Time Employment

Project Phase	Full-Time Equivalent Employment[1]
Development	
Pre-Construction	7
Construction	35
Drilling	133
Completion	84
Total	**259**
Production	
Total Production[2]	45

[1]Full-time equivalent employment includes both direct employment by XTO and employment by XTO contractors.
[2]Production employment includes employment associated with production activities as well as with workovers.

Table 4.11-4. Estimated Average Annual Employment during the Development and Production Phase

Project Phase	Employment	
Development	Direct Employment	259
	Indirect Employment	60
	Induced Employment	103
	Total	**422**
Production	Direct Employment	45
	Indirect Employment	8
	Induced Employment	19
	Total	**72**

As was shown in **Table 3.2-14**, in 2008, total employment across all non-agricultural sources of employment in the study area was approximately 23,701. Based on employment projections shown in **Table 4.11-4**, during the development phase, total employment would increase by approximately 2.1 percent.

Study area information contained within the IMPLAN data shows that the total value of all employment sectors within the study area is approximately 2.7 billion dollars annually. The addition of 422 jobs during the development phase would add 50.5 million dollars into the study area annually, which is approximately two percent.

Ute Tribe

Projected employment effects due to the Proposed Action have not been quantified in this analysis due to the lack of available data. However, it should be noted that the Ute Tribe passed a "Contracting Preference Ordinance" in 1992 which "is intended to facilitate and enhance economic opportunities for businesses owned and operated by members of the Ute Indian Tribe by establishing a procedure by which enterprises doing business with the Tribe on the Reservation may locate and contract and subcontract with member-owned businesses." More specifically, the Ordinance would generally obligate XTO by contract, lease, or other agreement to employ, to the greatest extent possible, Tribal members and to contact and subcontract with Tribally owned businesses. The Ordinance requires any employer conducting work on the Reservation to give preference in awarding contracts and subcontracts to Indian-owned businesses that have been certified by the Ute Employment Commission. Indian preference means that qualified Indian-owned businesses and individuals would be hired before qualified non-Indian individuals and businesses.

In addition, as required by the Tribe, XTO would post a notice of staking at the BIA office for five days during which time Tribal members could apply for jobs in the RBU Project Area. If qualified, Tribal members would be given preference over non-members.

4.11.1.6 Population and Housing

As shown in **Table 4.11-4**, average annual employment (direct, indirect, and induced) during the development phase would be approximately 422 full-time equivalents. However, it should be noted that employment could be approximately 33 percent (561 full-time equivalents) higher during peak development. Actual employment would fluctuate with drilling patterns throughout the development phase. In order to conduct an impact analysis that is representative of the various phases of oil and gas development, population and housing demand were calculated during the peak year of development *and* the average year of development.

Total population increase due to implementation of the Proposed Action was estimated by calculating a population to employment ratio. Based on data from Utah's DEA as presented in **Section 3.2.10.1**, every one employee in the study area represents 1.9 individuals in the general population. Therefore, an employment increase of 422 full time equivalents during an average year of well development implies an annual population increase of 802 individuals in the study area. Likewise, adding 561 jobs to the economy during a peak development year would create an estimated population increase of 1,066 individuals. Based on a 2010 population of 51,195 in Duchesne and Uintah Counties, the population increase from the Proposed Action represents 1.5 to 2.1 percent of the current population.

The above analysis can be extended further to forecast the increase in housing demand as a direct result of a population increase in the study area. Data in Section 3.2.9.1 show an average of 2.8 persons per household in Uintah and Duchesne Counties. Based on a population increase of between 802 and 1,066 individuals per year, there would be a demand for between 286 and 380 housing units in the study area. **Table 4.11-5** below summarizes the demographic impacts to the study area from the Proposed Action.

According to DEA projections, from 2008 to 2015 (the 8-year development phase), the average annual increase in housing units would be 2.3 percent. Numerically, this equates to approximately 341 new housing units a year. The Proposed Action would increase annual demand for housing units over forecasted levels by approximately 286 to 380 housing units, or 1.2 to 1.6 percent.

Table 4.11-5. Demographic Impacts to the Study Area from the Proposed Action

	Annual Peak Development	Average Development
Employment Increase	561	422
Population Increase	1,066	802
Demand for Housing Units	380	286

It should be noted that housing demand due to oil and gas development is likely implicit in the State's projection models. A proportion of the 341 housing units in the study area are likely a result of forecasted oil and gas development. However, in order to provide the most conservative analysis, it was assumed that the Proposed Action would create an additive impact to the State's forecasted housing units.

As previously discussed, for this analysis, employment estimates were converted into full-time equivalent employment. However, it should be recognized that many personnel would not be employed full-time, but would be employed for short periods of time, as needed. Short-term employment, as well as a fluctuating pattern of economic activity during the development phase, would lead to a demand for temporary housing (e.g., motel rooms and RV spaces).

Current housing stock in both Duchesne and Uintah Counties totals approximately 21,465. The annual demand for housing generated from the Proposed Action represents approximately 1.2 percent of the current housing stock. The ability of the current housing market to meet the increased demand for housing depends on a multitude of factors including housing vacancy rates, new residential construction rates. According to the 2010 U.S. Census, the vacancy rate in Uintah and Duchesne Counties was 11 and 37 percent respectively (US Census Bureau 2010b). For comparison purposes, the State of Utah and the Nation as a whole had residential vacancy rates of 10 and 11.4 percent, respectively (U.S. Census Bureau 2000c). Therefore, at the time the housing vacancy rate in the study area was considerably higher than the State and the nation.

In 2010, eighty percent of Duchesne County's and twenty-two percent of Uintah County's vacant housing units were for seasonal, recreational or occasional use. This proportion is significantly higher than the vacant seasonal, recreation or occasional use housing in the State and the nation (47 and 31 percent, respectively) (U.S. Census Bureau 2000c). This characteristic of the vacant housing units in the study area likely reflects the transient nature of oil and gas workers. Census data also reveal that 21 and 13 percent of vacant housing units in Duchesne and Uintah Counties, in 2010 were mobile homes (U.S. Census Bureau 2000b). This housing unit type is often ideal for oil and gas employees. Therefore, the housing demand created by the Proposed Action could partially be filled by existing vacant units. The vacant housing units together with new construction and motel rooms would likely fulfill the demand for housing created by the Proposed Action.

4.11.1.7 Social Impacts

As discussed in the preceding section, implementation of the Proposed Action would lead to an increase in transient workforce and population within Uintah and Duchesne Counties.

Research provides empirical support that increases in population can have a disruptive effect on the social well-being of some segments of the local population within a rural community. Negative social consequences could include: a collapse of informal social structures; conflict and tension between advocates and opponents of growth; the absence of social integration; changes in neighboring ties; decreases in community satisfaction, and deteriorating quality of life.

On a more specific level, rural communities impacted by boom periods have observed increases in school drop-out rates, juvenile delinquency, criminal activity, domestic/family violence, and drug and alcohol problems, which can in turn affect police and social services (Smith et al. 2001).

A 2001 study which focused on patterns of population change in four rural communities that have experience extremely rapid growth due to energy-related development in the past, showed that social disruptive effects may not be permanent. As stated in the study, the disruptive effects associated with boom growth dissipate in the years after the boom phase has ended, with no evidence of lasting disruption. Vernal, which is the largest community with multi-county study area, was one of the communities evaluated in the study (Smith et al. 2001).

4.11.1.8 Environmental Justice

Information contained in **Table 3.2-18** show that the members of the Ute Tribe located on the Uintah and Ouray Indian Reservation constitute both a minority and low income population.

In the memorandum that accompanied Executive Order 12898, the President specifically recognized the importance of procedures under NEPA for identifying and addressing environmental justice concerns. The memorandum particularly emphasizes the importance of NEPA's public participation process, direction "each agency shall provide opportunities for community input in the NEPA process."

As discussed in **Section 6.2**, Native American Tribes with cultural ties to the Uinta Basin, including the Ute Tribe, were consulted during the scoping process for this EA. In addition, public scoping was conducted in compliance with CEQ regulations.

Although Tribal lands are included in the RBU Project Area, there are no Tribal members living on, or adjacent to, these lands. Minority and low-income populations within the Tribal communities of Fort Duchesne, White Rocks, and Randlett would not be disproportionately adversely affected by implementation of the Proposed Action.

The economic effects of development in RBU Project Area would be positive for the Ute Tribe. Tribal severance tax would benefit individuals needing Tribal services, such as housing, educational assistance, loans, and social services. Tribal minerals revenue also benefits Tribal households because the Tribe makes per capita payments to enrolled members.

In addition, the Ute Contracting Preference Ordinance requires that employers give preference to qualified Tribal contractors and subcontractors before employing non-Indians.

In terms of health and safety, it should be realized that natural gas development and production are inherently hazardous activities. As such, Tribal employees are likely to be exposed to the occupational hazards associated with construction, drilling, completion, and production activities in proportion to their positions of employment.

4.11.2 Alternative B – No Action Alternative

Under the No Action Alternative, only 16 new oil and gas wells would be developed on State and Tribal lands in the RBU Project Area. Oil and gas extraction would likely continue at the present rate of development over the short-term, which would only temporarily sustain the current level of employment and reinforce support for an already established oil and gas field service sector in the Project Area. Direct project employment of construction workers would be reduced over the construction phase of the project.

In addition, the overall economic benefits of the Project direct at Uintah and Duchesne Counties would be reduced relative to the Proposed Action. With no additional federal wells, there would be no additional royalties.

For the purposes of analysis, it is assumed that total employment and the amount of taxes and royalties generated by production would be reduced in proportion to reductions in the amount of proposed development. Alternative B would represent an approximately 97 percent reduction in development from the Proposed Action, therefore, employment and revenue are expected to be reduced by the same percentage. **Table 4.11-6** shows the revenue, employment and other figures for Alternative B, in comparison with the Proposed Action. The categories are those used in **Table 4.11-2** and **Table 4.11-5**.

Table 4.11-6. Socioeconomic Impacts Under Alternative B

Category	Proposed Action (Alternative A)	Alternative B
Total Production Value	$2,653,792,498	$87,728,678
Total Federal Mineral Royalties	$289,794,141	$9,579,972
State of Utah	$144,897,071	$4,789,986
UDOT for Special Service Districts	$57,958,828	$1,915,994
PCIF	$47,091,548	$1,556,745
Dept. of Community for Special Services Districts	$2,354,577	$77,837
SITLA Mineral Royalties	$15,922,755	$526,372
State Severance Tax	$106,151,700	$3,509,147
State Conservation Tax	$5,307,585	$175,457
Tribal Mineral Royalty	$19,107,306	631,646
Tribal Severance Tax	$6,369,102	$210,549
Average Employment Increase	422	14
Average Population Increase	802	27
Average Demand for Housing Units	286	9

4.11.3 Alternative C – Moderate Recovery Alternative

Taxes, royalties, and other revenues generated by oil and natural gas development in the RBU Project Area under Alternative C would be similar to those described for the Proposed Action. However, under Alternative C, 234 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action.

For the purposes of analysis, it is assumed that total employment and the amount of taxes and royalties generated by production would be reduced in proportion to reductions in the amount of proposed wells and associated development. Therefore, the estimated value of production under Alternative C would be approximately 48 percent less than the production value that would be generated under the Proposed Action. **Table 4.11-7** shows the revenue, employment and other figures for Alternative C, in comparison with the Proposed Action. The categories are those used in **Table 4.11-2** and **Table 4.11-5**.

Table 4.11-7. Socioeconomic Impacts Under Alternative C

Category	Proposed Action (Alternative A)	Alternative C
Total Production Value	$2,653,792,498	$1,370,760,588
Total Federal Mineral Royalties	$289,794,141	$149,687,056
State of Utah	$144,897,071	$74,843,528
UDOT for Special Service Districts	$57,958,828	$29,937,411
PCIF	$47,091,548	$24,324,147
Dept. of Community for Special Services Districts	$2,354,577	$1,216,207
SITLA Mineral Royalties	$15,922,755	$8,224,564
State Severance Tax	$106,151,700	$54,830,424
State Conservation Tax	$5,307,585	$2,741,521
Tribal Mineral Royalty	$19,107,306	$9,869,476
Tribal Severance Tax	$6,369,102	$3,289,825
Average Employment Increase	422	218
Average Population Increase	802	414
Average Demand for Housing Units	286	148

4.11.4 Alternative D – Resource Protection Alternative

Taxes, royalties, and other revenues generated by oil and natural gas development in the RBU Project Area under Alternative D would be similar to those described for the Proposed Action. However, under Alternative D, 334 fewer wells and associated access roads, pipelines, and other project facilities would be constructed than under the Proposed Action.

For the purposes of analysis, it is assumed that total employment and the amount of taxes and royalties generated by production would be reduced in proportion to reductions in the amount of proposed wells and associated development. Therefore, the estimated value of production under Alternative D would be approximately 69.0 percent less than the production value that would be generated under the Proposed Action. **Table 4.11-8** shows the revenue, employment and other figures for Alternative D, in comparison with the Proposed Action. The categories are those used in **Table 4.11-2** and **Table 4.11-5**.

Table 4.11-8. Socioeconomic Impacts Under Alternative D

Category	Proposed Action (Alternative A)	Alternative D
Total Production Value	$2,653,792,498	$822,456,353
Total Federal Mineral Royalties	$289,794,141	$89,812,234
State of Utah	$144,897,071	$44,906,117

UDOT for Special Service Districts	$57,958,828	$17,962,447
PCIF	$47,091,548	$14,594,488
Dept. of Community for Special Services Districts	$2,354,577	$729,724
SITLA Mineral Royalties	$15,922,755	$4,934,738
State Severance Tax	$106,151,700	$32,898,254
State Conservation Tax	$5,307,585	$1,644,913
Tribal Mineral Royalty	$19,107,306	$5,921,686
Tribal Severance Tax	$6,369,102	$1,973,895
Average Employment Increase	422	131
Average Population Increase	802	249
Average Demand for Housing Units	286	89

4.11.5 Recommended Mitigation Measures

No mitigation measures were recommended for socioeconomic resources under Alternatives A, B, C or D.

5.0 CUMULATIVE ANALYSIS

As defined by CEQ regulations, cumulative impacts result from the incremental impacts of an action when added to past, present, and reasonably foreseeable future actions, regardless of who takes the action (40 CFR 1508.7). Concurrently, the ESA defines cumulative impacts as effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR §402.02). The ESA definition only applies to Section 7 analysis and should not be confused with the broader use of this term in NEPA or other environmental laws.

This chapter discusses cumulative impacts as the incremental effect to specific resources or issues that would occur from the Proposed Action or alternatives, in conjunction with other cumulative actions (i.e., past, ongoing, recently approved, and reasonably foreseeable actions).

Cumulative actions include, but are not limited to, rangeland management, livestock grazing, habitat treatments, recreation, wildlife management, and mineral development. In the sections that follow, and where applicable, oil and gas activities are generally discussed on a quantitative basis, whereas all other actions are discussed on a qualitative basis. Collective review of all of these actions provides an estimate of cumulative impacts in a given area. It also provides a framework for forecasting and evaluating future environmental changes that may affect the quality and extent of the natural and human environment.

5.1 CUMULATIVE IMPACT ASSESSMENT AREAS

Although the Vernal Planning Area may be loosely used as a generalized cumulative impact assessment area (CIAA), cumulative impacts may be more accurately assessed using resource-specific CIAAs. As such, cumulative impacts in this EA were analyzed using CIAAs with spatial boundaries that vary by resource. **Table 5.1-1** defines the CIAA for each resource examined in this EA, provides rationale for selecting each CIAA boundary, and lists interrelated projects that intersect each CIAA.

Table 5.1-1. Cumulative Impact Assessment Areas

Resource	Cumulative Impacts Study Area	Study Area Rationale
Air Quality	Uinta Basin, Nearby Class I areas	Construction, development and production activities from implementation of the Proposed Action would cumulatively contribute to changes in air quality occurring immediately adjacent to the Project Area and within the greater Uinta Basin.
Cultural Resources	RBU Project Area and the Willow Creek area (i.e., from the creek bottoms to adjacent ridgetops)	Construction activities impacting cultural resources would only affect those present in the RBU Project Area and would not cause additive affects to those occurring elsewhere. Indirect impacts from traffic activities would add to impacts created from other projects utilizing Willow Creek roads for access.

Resource	Cumulative Impacts Study Area	Study Area Rationale
Fish and Wildlife[1]	Uintah and Duchesne Counties	Besides neotropical migratory birds, the home ranges of wildlife species analyzed in this document are contained within Uintah and Duchesne Counties.
Livestock Grazing	Green River AMP, Sand Wash, and Wild Horse Bench Grazing allotments	As all project activities on BLM-administered lands would occur on these allotments, impacts associated with these activities would only affect these areas and would not cause additive effects to those occurring elsewhere.
Paleontology	RBU Project Area and the Willow Creek area (i.e., from the creek bottoms to adjacent ridgetops)	Project activities impacting paleontological resources would only affect those present in the RBU Project Area and would not cause additive affects to those occurring elsewhere.
Socioeconomics and Environmental Justice	Uintah and Duchesne Counties	Fiscal benefits and costs related to project activities would be felt at the county and municipal levels. Communities that house labor, as well as provide goods and services necessary for this project are located within these counties. Minority, low-income, and Tribal communities potentially impacted by the project would occur in Uintah and Duchesne Counties.
Soil Resources	Hill Creek and Willow Creek watersheds	Project activities impacting soils would only affect soil types present in the Hill Creek and Willow Creek watersheds, and would not cause additive affects to those occurring elsewhere.
Special Status Plant Species	Extent of potential habitat for the Uinta Basin hookless cactus and clay-reed mustard in the Vernal Planning Area[2]	Only activities occurring within potential habitat for the Uinta Basin hookless cactus and clay-reed mustard would contribute to potential impacts to these species. However, conservation measures would reduce impacts to the Uinta Basin hookless cactus and clay reed-mustard.
Vegetation[3]	Hill Creek and Willow Creek watersheds	Project activities impacting vegetation would only affect species present in the Hill Creek and Willow Creek watersheds, and would not cause additive affects to those occurring elsewhere.
Visual Resources	RBU Project Area and the Willow Creek area (i.e., from the creek bottoms to adjacent ridgetops)	Project activities impacting visualresources would only affect those present in the RBU Project Area and would not cause additive affects to those occurring elsewhere.
Water Resources[4]	Hill Creek and Willow Creek watersheds	As all project activities would occur in the Hill Creek and Willow Creek watersheds, impacts associated with these activities would only affect these watersheds and would not cause additive affects to those occurring elsewhere.

[1] Includes Special Status wildlife species.
[2] The CIAA does not include the extent of potential habitat for the clay reed-mustard (plus a 300-foot buffer) because potential habitat for this species has not been comprehensively delineated in the Vernal Planning Area.
[3] Includes noxious and invasive weeds, and wetland/riparian zones.
[4] Includes floodplains.

5.2 CUMULATIVE IMPACTS

Cumulative impacts would occur under all four alternatives presented in this EA (Alternative A – Proposed Action; Alternative B – No Action Alternative; Alternative C – Moderate Recovery Alternative; Alternative D – Resource Protection Alternative). These impacts are discussed below on a resource-specific basis. Surface disturbance estimates were derived by first determining the spatial extent of existing, ongoing, and pending projects that fall within a given CIAA. These percentages were then used to estimate the number of wells, well pads, and surface disturbance for each project and alternative considered in this EA. For example, if 10 percent of the project area for any particular project falls within a given CIAA, it was assumed that 10 percent of the project's total development would also occur within the CIAA.

5.2.1 Air Quality

Cumulative air quality impacts are defined as the combination of emissions resulting from the Proposed Project, existing nearby permitted sources, and Reasonably Foreseeable Development (RFD) within the region. Areas of concern include the Uinta Basin, the High Uinta Wilderness Area, as well as nearby PSD Class I areas such as Arches and Canyonlands National Parks and Flat Tops Wilderness. Potential Air Quality Related Value (AQRV) impacts to sensitive areas include regional impacts on visibility and acid deposition.

Cumulative impacts of potential oil and gas and other emission sources in the region of the RBU have been extensively evaluated in two recent Final EISs: Greater Natural Buttes (BLM 2011a) and Gasco Energy (BLM 2011b). Both the Greater Natural Buttes FEIS (GNB) and Gasco Energy FEIS (Gasco) evaluated the potential impact of existing, proposed, and reasonably foreseeable development (RFD) in the Uinta Basin. The RFD in GNB and Gasco included the RBU Proposed Action. The GNB analysis was completed after Gasco, and included a larger number of known NEPA projects as well as projections for sources based on the WRAP Phase III inventory. Accordingly, only results from the GNB analysis will be presented here. GNB analyzed the cumulative air quality impact of 8,196 gas wells (Table 3-2 of GNB Appendix G) plus the 3,675 wells proposed to be developed by GNB by calendar year 2018. The 484 wells in the proposed RBU constitute 4 percent of the total cumulative sources analyzed in GNB.

5.2.1.1 Impact of Criteria Pollutants Other Than Ozone

The threshold of concern for near-field impacts are the NAAQS. GNB evaluated both near-field and long range transport potential impacts with respect to the NAAQS for NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$. GNB concluded that the near-field cumulative impact of GNB, RFD, and existing background concentrations due to natural emissions and emissions from existing sources would not cause an exceedance of a NAAQS. The maximum cumulative impacts with respect to the NAAQS were for the 1-hour NO_2 and annual $PM_{2.5}$ impacts. The majority of the maximum 1-hour NO_2 impacts result from local impacts of the proposed GNB project (87 percent of the total). On the other hand, the proposed GNB project represents only 6 percent of the total $PM_{2.5}$ impact, with 94 percent from existing sources and natural background. For all except 1-hour NO_2, the incremental RFD source (i.e., the 8,196 gas wells that would be developed without GNB; which includes the 484 RBU Proposed Action wells) contribution to the maximum NAAQS impacts is essentially zero. For 1-hour NO_2, the RFD sources (not including GNB, but including the RBU) contributed a one-tenth of one percent incremental increase over the maximum impacts of GNB alone. The GNB analysis demonstrated that, when evaluating maximum NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$, cumulative impacts from distant sources are de minimis. Thus the cumulative impacts of the proposed RBU will not be different than the impacts presented in **Chapter 4** for the RBU alone; and the cumulative impacts with RBU and all other sources will be less than the applicable NAAQS.

Far-field impacts at areas of special interest are assessed by comparison to the NAAQS and regulatory PSD allowed increments. To assess potential cumulative air quality impacts for NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ at distant areas of interest, GNB analyzed the cumulative impacts of the proposed GNB plus RFD (including the proposed RBU) at 12 distant Class I areas (including the closest Class I areas of Arches and Canyonlands National Parks and the Flat Tops Wilderness Area) and 8 Class II areas of special interest (including the High Uinta Wilderness Area and Dinosaur National Monument). The analysis demonstrated that the cumulative impacts at these Class I and Class II areas were all much less than the NAAQS and the PSD increments. Thus the proposed RBU will not contribute to an exceedance of the NAAQS at these areas of interest.

5.2.1.2 Impact of Ozone

Potential ozone impacts are evaluated by comparing maximum potential ozone concentrations to the NAAQS and by determining the maximum incremental increase of ozone concentrations. Potential cumulative impacts of emissions from GNB, Gasco, RBU, and RFD emissions on regional ozone concentrations were evaluated in the GNB and Gasco FEISs and this RBU EA. All three of these analyses use a combination of emissions from existing plus proposed action and RFD; although the total emission estimate values for the combined emissions may vary due to differences in the time at which the emission estimates were prepared.

The results of the RBU cumulative ozone assessment were reported in **Chapter 4**. The RBU analysis showed that cumulative impact of the proposed RBU plus existing plus RFD did not cause an exceedance of the 75 ppb NAAQS, and the maximum "relative non-monitored area" incremental impact of the Proposed Action was zero for one of the two meteorological years modeled (2005) and less than 0.4 ppb for the second meteorological year (2006). The RBU results are consistent with the Gasco and GNB analyses. None of the emission scenarios in the GNB and Gasco analyses indicated an exceedance of the 75 ppb NAAQS.

The GNB, Gasco, and RBU ozone impact assessments all used the current state of the art photochemical models. These models have been demonstrated reasonable for traditional ozone formation, which typically occurs during the summer when photochemical reactions in the atmosphere are the largest. However, during the winters of 2009-2010 and 2010-2011, prior to initiation of the GNB, Gasco, and RBU projects, monitored ozone concentrations in the Uinta Basin exceeded the 8-hour NAAQS of 75 ppb; even though none of the summer days exceeded the NAAQS. Winter-time exceedance of the ozone standard is a new phenomenon and is not well understood nor modeled. Accordingly as discussed in **Chapter 4**, the BLM has established an Ozone Action Plan, and is conducting an updated ozone modeling study and other efforts as part of an ARMS to help ensure that winter time ozone is mitigated.

5.2.1.3 Regional Haze

Regional haze is assessed by evaluating the incremental change in "deciviews" which is a unit of measure of regional haze or visual air quality. A 1.0 deciview change is considered "just barely noticeable" by an observer. GNB analyzed the cumulative and incremental impacts of GNB on regional haze in 12 Class I areas and 8 Class II areas of interest. The analysis showed that GNB would not cause an incremental increase over the baseline greater than the 1.0 deciview threshold for the GNB Proposed Action (3,675 wells). For Class II areas the GNB analysis showed that the proposed GNB Proposed Action could cause an incremental impact of 102 days per year greater than 1.0 deciview at Flaming Gorge, and 32 days per year greater than 1.0 deciview at Dinosaur National Monument. However, the RBU Proposed Action is only 484 wells (less than 15 percent of the GNB total). Accordingly, although it is possible that RBU could cause an incremental increase of 1.0 deciview at the Flaming Gorge Class II area, the frequency of such an increase would be small to non-existent. At the Dinosaur National Monument, it is highly

unlikely that RBU could cause an incremental increase of 1.0 deciview. Although the 1.0 deciview threshold is discussed for Class II areas, the Federal Land Managers have not published guidance regarding thresholds of concern for visibility in such areas.

5.2.1.4 Acid Deposition

Potential acid deposition is analyzed in two different forms: deposition of nitrogen and sulfur and change in acid neutralizing capacity (ANC). The threshold of concern used in the GNB FEIS for nitrogen deposition was 3 kilograms per hectare per year (kg/ha-yr) and 5 kg/ha-yr of sulfur deposition. The threshold for change in ANC is a change of more than 10 percent for lakes with a background ANC of 25 micro equivalents per liter (ueq/l) or less than 1.0 ueq/l change in ANC for lakes with background ANC of less than 25 ueq/l. GNB analyzed the cumulative and incremental impacts of GNB on acid deposition at 12 distant Class I areas and 8 Class I areas of interest. The maximum nitrogen deposition for emissions from GNB was 0.06 kg/ha-yr (less than 2 percent of the threshold) and maximum sulfur deposition from GNB was 0.0017 kg/ha-yr (less than 0.03 percent of the threshold). Since RBU consists of less than 15 percent of the wells of GNB, the potential nitrogen and sulfur deposition from RBU would be much smaller. GNB assessed the potential for ANC change at 23 different lakes in both Class I and II areas. The maximum impact of GNB was less than 0.5 percent change in ANC, less than one-twentieth the threshold of concern. Accordingly, the maximum impact of RBU would be less than one one-hundredth of the threshold.

5.2.1.5 Greenhouse Gases

Many elements of human society and the environment are sensitive to climate variability and change. Human health, agriculture, natural ecosystems, coastal areas, and heating and cooling requirements are examples of climate-sensitive systems.

Rising average temperatures are already affecting the environment. Some observed changes include shrinking of glaciers, thawing of permafrost, later freezing and earlier break-up of ice on rivers and lakes, lengthening of growing seasons, shifts in plant and animal ranges and earlier flowering of trees (IPCC 2007).

Global temperatures are expected to continue to rise as human activities continue to add carbon dioxide, methane, nitrous oxide, and other greenhouse (or heat-trapping) gases to the atmosphere. Most of the United States is expected to experience an increase in average temperature (IPCC 2007). Precipitation changes, which are also very important to consider when assessing climate change effects, are more difficult to predict. Whether or not rainfall will increase or decrease remains difficult to project for specific regions.

The extent of climate change effects, and whether these effects prove harmful or beneficial, will vary by region, over time, and with the ability of different societal and environmental systems to adapt to or cope with the change.

The Intergovernmental Panel on Climate Change (IPCC) concludes that “impacts of climate change will vary regionally but, aggregated and discounted to the present, they are very likely to impose net annual costs which will increase over time as global temperatures increase.” The IPCC estimates that for increases in global mean temperature of less than 1-3°C (1.8-5.4° F) above 1990 levels, some places and sectors will see beneficial impacts while others will experience harmful ones. Some low-latitude and polar regions are expected to experience net costs even for small increases in temperature. For increases, in temperature greater than 2-3°C (3.6-5.4°F), the IPCC says it is very likely that all regions will experience either declines in net benefits or increases in net costs. “Taken as a whole,” the IPCC

concludes, "the range of published evidence indicates that the net damage costs of climate change are likely to be significant and to increase over time."

Figure 5.2-1 shows the trend in global and United States total greenhouse gas and CO_2 from fossil fuel combustion from 1990 to 2004 (EPA 2008a). United States emissions rose until 2000, and then have been relatively constant to present. However, worldwide greenhouse gas emissions have steadily risen from approximately 8.5 billion metric tons per year in 1990 to 10.8 billion metric tons per year in 2004, an increase of 27.1 percent. Although data are not readily available, it is reasonable to expect international greenhouse gas emissions have continued to increase beyond 2004 levels because of the economic development especially in China and India. EPA data indicate that United States emissions have been relatively constant beyond 2004 levels (EPA 2008a).

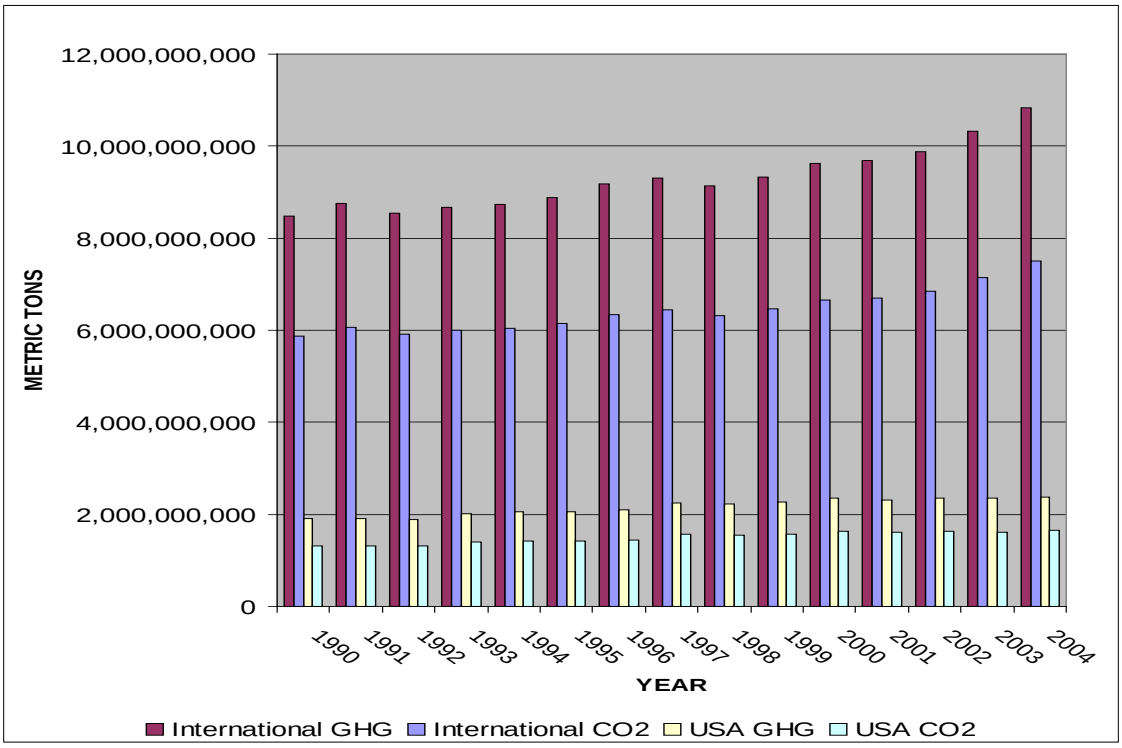

Figure 5.2.-1. Greenhouse Gas Emissions CO2 Equivalents 1990-2004

Estimated greenhouse gas emissions from the RBU Proposed Action would equal approximately 320,650 metric tons. When compared to annual greenhouse gas emissions for the United States and worldwide, potential emissions from the RBU project are less than 1/100 of 1 percent of United States emissions (0.0075%) and only 15 ten thousandths of 1 percent of the worldwide emissions.

In light of the uncertainties of the spatial distribution of precipitation pattern changes, global warming could cause the Uinta Basin to warm if greenhouse gas emissions increase and if the long-term computer models are correct. At the same time, precipitation could increase or decrease. If precipitation decreases, semi-arid desert conditions could worsen in the Uinta Basin. However, if precipitation increases, vegetation could increase in the Uinta Basin. The bottom line is that no one can tell for sure what will happen from the middle to the end of the 21st century.

5.2.1.6 Impacts to Air Quality under Proposed Alternatives

Under the No Action Alternative, cumulative emissions and impacts on criteria pollutants (included ozone), regional haze, acid deposition, and greenhouse gases would be less than discussed above since proposed RBU emissions would no longer be part of the RFD impacts analyzed in GNB and Gasco. Likewise under Alternatives B, C, and D, the RBU emissions are less than the Proposed Action. Thus the cumulative impacts under those scenarios would be slightly less than for the Proposed Action.

5.2.2 Soil Resources

The CIAA for soil resources is defined as the Hill Creek and Willow Creek watersheds. Any surface-disturbing activity that removes native vegetation and topsoil from these watersheds may cumulatively and incrementally affect soil resources by increasing erosion and sediment yield, thereby reducing soil productivity and stability as measured by the amounts and types of vegetative cover and forage. Past, present, and reasonably foreseeable actions that could result in increased erosion and sediment yield within the CIAA include oil and gas development, forage use for livestock grazing and wildlife, recreation, mining activities (gilsonite, sand and gravel, and, potentially oil shale), and county and private road construction. Of these actions, impacts related to road construction are the highest concern. Because active roadways would not be reclaimed for the long term, it is assumed sediment yield from existing roads and proposed road construction, including those roads used for oil and gas development, would continue at rates two to three times above background rates into the indefinite future, as compared to other authorized actions.

As shown in **Table 5.2-1.**, surface disturbance associated with the Proposed Action, when added to past, present, and other reasonably foreseeable actions, would cumulatively and incrementally affect soil resources across the CIAA. Approximately 4,742 acres have been or will be disturbed in the past, present, and reasonably foreseeable future from oil and gas activities. Depending on the alternative selected, XTO's proposed infill project would incrementally increase the total cumulative disturbance in the CIAA to 5,497 acres (Alternative A - Proposed Action), 4,750 acres (Alternative B - No Action Alternative), 5,390 acres (Alternative C – Moderate Recovery Alternative), or 5,157 acres (Alternative D – Resource Protection Alternative). Throughout the CIAA, disturbed soil acreages and reduced soil productivity would last for the lifetime of oil and gas development and production, until such time that reclamation is deemed successful. Depending on reclamation requirements, drought conditions and other factors may affect reclamation success in the CIAA.

Table 5.2-1. Surface Disturbance Estimates for Existing, Ongoing, and Pending Oil and Gas Projects in the CIAA for Soil Resources, Water Resources, and General Vegetation Including Invasive or Noxious Weeds

Project Name	Totals per Project				Totals in CIAA	
	Project Area (acres)[1]	Wells (#)[2]	Well Pads (#)[3]	Surface Disturbance (acres)	Portion of Project Area in CIAA (acres)	Estimated Surface Disturbance in CIAA (acres)
Existing Development within the RBU Project Area	16,719	805	306	861	11,756	605
KMG Love Unit EA	12,229	125	125	706	1,452	84
WRR North Hill Creek EA	24,893	150	150	560	24,893	560

Project Name	Totals per Project				Totals in CIAA	
	Project Area (acres)[1]	Wells (#)[2]	Well Pads (#)[3]	Surface Disturbance (acres)	Portion of Project Area in CIAA (acres)	Estimated Surface Disturbance in CIAA (acres)
Enduring Resources Big Pack EA	34,437	644	292	1,620	220	10
KMG Greater Natural Buttes EIS	162,855	3,675	1,484	8,147	16,488	1,282
XTO Hill Creek Unit EA	5,418	144	108	287	5,418	287
XTO Kings Canyon EA	25,027	297	166	1,131	997	45
XTO Little Canyon Unit EA	32,367	510	362	1,882	32,134	1,869
Total Existing, Operational, and Proposed Projects	**-**	**6,350**	**5,184**	**19,705**	**-**	**4,742**
XTO River Bend Unit Infill EA (If Proposed Action is Selected)	16,719	484	106	1,075	11,756	756
Grand Total (If Proposed Action is Selected)	**-**	**6,834**	**5,290**	**20,780**	**-**	**5,498**
XTO River Bend Unit Infill EA (If No Action is Selected)	16,719	16	1	13	11,756	9
Grand Total (If No Action is Selected)	**-**	**6,366**	**5,185**	**19,718**	**-**	**4,751**
XTO River Bend Unit Infill EA (If Alternative C Selected)	16,719	250	70	923	11,756	649
Grand Total (If Alternative C Selected)	**-**	**6,600**	**5,254**	**20,628**	**-**	**5,391**
XTO River Bend Unit Infill EA (If Alternative D Selected)	16,719	150	42	592	11,756	416
Grand Total (If Alternative D Selected)	**-**	**6500**	**5,226**	**20,297**	**-**	**5,158**

[1] Acreage for each project area was compiled from various notices and NEPA documents;
[2] Number of proposed wells for each project was compiled from various notices and NEPA documents; and
[3] Number of well pads includes development of new pad locations and expansion of existing pads. If the number of pads was not stated, all wells were assumed to be drilled vertically (i.e., one well per pad).

For the projects listed above, soil compaction due to construction activities at well pads, along access roads, and in other disturbed areas would result in a small increase in surface runoff from the area. This increased runoff could in turn cause increased sheet, rill, and gully erosion. The construction and operation of each well would also incrementally increase the chance that leaks or spills of saline water, hydro-fracturing chemicals, fuels, and lubricants would occur within the CIAA. Spills of this nature could increase the loss of soil productivity within the area.

Under the No Action Alternative, site-specific mitigation measures for soil resources would be implemented on a well-by-well basis as part of the APD approval process. Under the action alternatives, certain design features (**Sections 2.1**) and ACEPMs (**Section 2.1.12.4**) including berms, sediment control

structures, and proper grading of well pads and access roads would reduce impacts to soil resources by minimizing soil erosion, and by reducing the potential for soil contamination.

5.2.3 Water Resources

The CIAA for water resources (including floodplains) is defined as the Hill Creek and Willow Creek watersheds. Any surface-disturbing activity that removes native vegetation and topsoil from these watersheds may cumulatively and incrementally affect water resources by increasing erosion and sediment yield to area drainages and surface water features. Past, present, and reasonably foreseeable actions that could result in increased erosion and sediment yield within the CIAA include oil and gas development, forage use for livestock grazing and wildlife, recreation, mining activities (gilsonite, sand and gravel, and, potentially oil shale), and county and private road construction. Of these actions, surface disturbing activities such as construction of oil and gas facilities and associated infrastructure would likely have the greatest potential impact on water resources due to increased erosion and sedimentation rates and an increased number of road/pipeline water crossings.

As shown in **Table 5.2-1**, surface disturbance associated with the Proposed Action and alternatives when added to past, present, and other reasonably foreseeable actions would cumulatively and incrementally affect water resources (including floodplains) across the CIAA. Approximately 4,742 acres of surface disturbance have been or will be disturbed in the past, present, and reasonably foreseeable future from oil and gas activities. Depending on the alternative selected, XTO's proposed infill project would incrementally increase the total cumulative disturbance in the CIAA to 5,497 acres (Alternative A - Proposed Action), 4,750 acres (Alternative B - No Action Alternative), 5,390 acres (Alternative C – Moderate Recovery Alternative), or 5,157 acres (Alternative D – Resource Protection Alternative). Throughout the CIAA, increased erosion and sediment yield, and the risk of spills, would last for the lifetime of oil and gas development and production, until such time that reclamation is deemed successful. Depending on reclamation requirements, drought conditions and other factors may affect reclamation success in the CIAA.

For the projects listed in **Table 5.2-1**, soils compacted on existing roads, new access roads, and well pads would contribute to slightly greater runoff than undisturbed sites. The increased runoff could lead to slightly higher peak flows in the CIAA drainage system, potentially increasing erosion of the channel banks. Such increased erosion, when combined with increased erosion from other authorized actions, could have negative impacts on aquatic habitat within affected drainages and on the proper functioning condition of floodplains. These impacts include increased turbidity and salinity, the covering of stream substrates with fine sediment and clogging of the interstitial pores of the substrate, increased transport of pollutants, including trace metals, herbicides, and petroleum constituents, and increased down-cutting of the channel and bank destabilization. The construction and operation of each well would also incrementally increase the potential for leaks or spills of saline water, hydro-fracturing chemicals, fuels, and lubricants to occur within the CIAA. Spills of this nature could contaminate surface water or shallow alluvial groundwater within the area.

Under Alternative B - No Action Alternative, site-specific mitigation measures for soil resources would be implemented on a well-by-well basis as part of the APD approval process. Under the remaining alternatives, certain design features (**Section 2.1**) including closed-loop drilling in floodplains, cleanup procedures for spills, berms, sediment control structures, and proper grading of well pads and access roads would reduce impacts to water resources by minimizing soil erosion, and by reducing the potential for soil contamination.

5.2.4 Paleontological Resources

The CIAA for paleontological resources is defined as the existing RBU Project Area and the Willow Creek area (i.e., from the creek bottoms to adjacent ridgetops). Cumulative impacts to paleontological resources are defined as any damage to, or destruction of, paleontological resources which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions (40 CFR 1508.7). The magnitude of impacts may be greater or lesser depending on 1) the paleontological resource site densities present in the areas of project-related activity; 2) the importance of the paleontological resources present; and 3) the final magnitude and scope of reasonably foreseeable actions over the next 20 years. However, it is important to remember that destruction to, or damage of, paleontological resources is often site-specific and not additive in nature.

Impacts to paleontological resources in the CIAA would primarily result from past, present, and reasonably foreseeable activities associated with surface and subsurface disturbance of fossiliferous rocks for oil and gas development. These activities could damage or destroy fossils. Destruction of scientifically-important fossils would irreversibly and irretrievably damage the paleontological information base and destroyed fossils would not be available for future analysis. In addition, increased vandalism and theft of fossils could result from improved vehicle and pedestrian access to fossil localities and increased visitation to the area.

Table 5.2-2. Surface Disturbance Estimates for Existing, Ongoing, and Pending Oil and Gas Projects in the CIAA for Cultural and Paleontological Resources

Project Name	Totals per Project				Totals in CIAA	
	Project Area (acres)[1]	Wells (#)[2]	Well Pads (#)[3]	Surface Disturbance (acres)	Portion of Project Area in CIAA (acres)	Estimated Surface Disturbance in CIAA (acres)
Existing Development within the RBU Project Area	16,719	805	306	861	16,719	861
KMG Love Unit EA	12,229	125	125	706	71.5	4
WRR North Hill Creek EA	24,893	150	150	560	1,813.3	41
EOG North Alger II EA	2,390	22	22	110	21	1
Gasco Uinta Basin EIS	206,829	1,298	575	3,604	172	9
KMG Greater Natural Buttes EIS	162,855	3,675	3,675	12,658	2,798	218
XTO Hill Creek Unit EA	5,418	144	108	287	1,440	76
XTO Kings Canyon EA	25,027	297	166	1,131	44	2
XTO Little Canyon Unit EA	32,367	510	362	1,882	5,654	329
Total Existing, Operational, and Proposed Projects	**-**	**7,266**	**6,452**	**28,497**	**-**	**1,541**
XTO River Bend Unit Infill EA (If Proposed Action is Selected)	16,719	484	106	1,075	16,719	1,075
Grand Total (If Proposed Action is Selected)	**-**	**7,750**	**6,558**	**29,572**	**-**	**2,616**
XTO River Bend Unit Infill EA (If No Action is Selected)	16,719	16	1	13	16,719	13
Grand Total (If No Action is Selected)	**-**	**7,282**	**6,453**	**28,510**	**-**	**1,554**

Project Name	Totals per Project				Totals in CIAA	
	Project Area (acres)[1]	Wells (#)[2]	Well Pads (#)[3]	Surface Disturbance (acres)	Portion of Project Area in CIAA (acres)	Estimated Surface Disturbance in CIAA (acres)
XTO River Bend Unit Infill EA (If Alternative C Selected)	16,719	250	70	923	16,719	923
Grand Total (If Alternative C Selected)	**-**	**7,516**	**6,522**	**26,420**	**-**	**2,464**
XTO River Bend Unit Infill EA (If Alternative D Selected)	16,719	150	42	592	16,719	592
Grand Total (If Alternative D Selected)	**-**	**7,416**	**6,494**	**29,089**	**-**	**2,133**

[1] Acreage for each project area was compiled from various notices and NEPA documents;
[2] Number of proposed wells for each project was compiled from various notices and NEPA documents; and
[3] Number of well pads includes development of new pad locations and expansion of existing pads. If the number of pads was not stated, all wells were assumed to be drilled vertically (i.e., one well per pad).

As shown in **Table 5.2-2**, approximately 1,541 acres of surface disturbance have been or will be disturbed in the past, present, and reasonably foreseeable future from oil and gas activities. Depending on the alternative selected, XTO's proposed infill project would incrementally increase the cumulative disturbance in the CIAA to 2,616 acres (Alternative A - Proposed Action), 1,554 acres (Alternative B - No Action Alternative), 2,464 acres (Alternative C – Moderate Recovery Alternative), or 2,133 acres (Alternative D – Resource Protection Alternative).

Where surface-disturbing activities occur on previously-disturbed areas, fossil resources would not be directly affected. However, specific direct impacts to presently unknown paleontological resources in the CIAA, as a result of the proposed project or other reasonably foreseeable actions, would not be known until surveys are completed for all areas proposed for surface disturbance. While the potential for direct impacts to fossils is likely to increase with increased surface disturbance in the CIAA, these impacts would be mitigated by preparation and execution of appropriate mitigation measures, approved by the responsible Federal, State, and Tribal agencies. Surface-disturbing activities could also have a beneficial effect on paleontological resources by drawing the attention of a qualified paleontologist to areas that are not currently being researched, and may result in the collection of specimens and data that would not otherwise be recovered.

Although paleontological sites located within disturbance areas would be avoided or mitigated, sites located outside of and adjacent to disturbance areas would be vulnerable to indirect impacts. When considered in addition to other past, present, and reasonably foreseeable actions, implementation of the Proposed Action or alternatives could cumulatively affect unknown paleontological resources in the CIAA by introducing atmospheric intrusions and increasing visitation and pedestrian traffic during well field development and operation. It is anticipated that these changes could result in a cumulative increase in vandalism, illegal collection, and damage from increased dust and erosion at sites located in the vicinity of well pads, roads, and pipelines where vegetation cover has been reduced or eliminated. All of these impacts would incrementally and cumulatively add to the loss of scientifically-important fossils across the CIAA. These types of impacts present consequences for the breadth, completeness, and value of the paleontological record.

Under the No Action Alternative, paleontological resources would be protected because site-specific mitigation measures would be implemented on a well-by-well basis as part of the APD approval process. The remaining alternatives would also protect paleontological resources, as these alternatives each

incorporate several ACEPMs (**Section 2.1.12**) that are intended to reduce, minimize, or avoid project-specific and cumulative impacts to paleontological resources. In addition, for all alternatives, many potential cumulative impacts to paleontological resources would be reduced or eliminated through the implementation of Federal regulatory laws, actions, and guidelines designed to protect paleontological resources, and through the coordination with the appropriate SMA.

5.2.5 Cultural Resources

The CIAA for cultural resources is defined as the existing RBU Project Area and the Willow Creek area (i.e., from the creek bottoms to adjacent ridgetops). Cumulative impacts to cultural resources are defined as any damage to, or destruction of, cultural resources which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions (40 CFR 1508.7). The magnitude of impacts may be greater or lesser depending on 1) the cultural resource site densities present in the areas of project-related activity; 2) the importance of the cultural resources present; and 3) the final magnitude and scope of reasonably foreseeable actions over the next 20 years. However, it is important to remember that destruction to, or damage of, cultural resources is often site-specific and not additive in nature.

Impacts to the cultural resources in the CIAA would primarily result from past, present, and reasonably foreseeable activities associated with surface and subsurface disturbance. Impacts to cultural resources in the CIAA may also result from specific cultural resource management decisions and from non-surface-disturbing activities that create atmospheric, visual, and/or auditory effects. These latter impacts would apply to sites or locations that together comprise the overall cultural experience for all visitors to the area, and especially to those deemed sacred or traditionally important by Native American Tribes and used by these groups in such a manner that atmospheric changes, visual obstructions, and/or noise levels impinge upon that use. These types of impacts cumulatively affect not only the historic setting, feeling, and viewshed of cultural properties, but also their eligibility potential for nomination to the NRHP.

As shown in **Table 5.2-2**, approximately 1,541 acres have been or will be disturbed in the past, present, and reasonably foreseeable future from oil and gas activities. Depending on the alternative selected, XTO's proposed infill project would incrementally increase the cumulative disturbance in the CIAA to 2,616 acres (Alternative A - Proposed Action), 1,554 acres (Alternative B - No Action Alternative), 2,464 acres (Alternative C – Moderate Recovery Alternative), or 2,133 acres (Alternative D – Resource Protection Alternative)..

As discussed in **Section 3.2.5**, there are 51 known archaeological sites within the RBU Project Area. Specific direct impacts to presently unknown cultural resources as a result of reasonably foreseeable actions in the CIAA would not be known until surveys are completed for all of the areas proposed for surface disturbance and cultural resource properties are evaluated for their eligibility for listing on the NRHP. While the potential for direct impacts to eligible cultural resources is likely to increase with increased surface disturbance, these impacts can be mitigated by preparation and execution of appropriate mitigation measures approved by the responsible Federal, State, and Tribal agencies. As cultural resource surveys would occur prior to any surface-disturbing activities in the RBU Project Area, and as all NRHP eligible cultural resources would be avoided or appropriately mitigated, direct cumulative impacts to these resources are expected to be minimal.

Although archaeological sites located within disturbance areas would be avoided or mitigated, sites located outside of and adjacent to disturbance areas would be vulnerable to indirect impacts. When considered in addition to other past, present, and reasonably foreseeable actions, implementation of the Proposed Action or No Action Alternative could cumulatively affect unknown cultural resources in the RBU Project Area by introducing atmospheric, visual, and auditory intrusions; increased visitation and

pedestrian traffic during well field development and operation; OHV and other motorized vehicle use; and unknown impacts to unidentified TCPs and cultural landscapes. It is anticipated that there would be a cumulative increase in vandalism, illegal collection, and dust due to the increase in roads throughout the CIAA, and increased erosion at sites located in the vicinity of well pads, roads, and pipelines where vegetation cover has been reduced or eliminated. All of these impacts may contribute to an alteration of the overall historic setting and feeling of the CIAA. Generally speaking, project-related activities incrementally and cumulatively add to the loss of important cultural resources across the CIAA. These types of impacts present consequences for the breadth, completeness, and interpretive value of the archaeological record. Beneficial cumulative impacts would also likely occur as undocumented cultural resources could be discovered and preserved.

Under the No Action Alternative, cultural resources would be protected because site-specific mitigation measures would be implemented on a well-by-well basis as part of the APD approval process. The remaining alternatives would also protect cultural resources, as these alternatives each incorporate several design features (**Section 2.1**) that are intended to reduce, minimize, or avoid project-specific and cumulative impacts to cultural resources. In addition, for all alternatives, many potential cumulative impacts to cultural resources would be reduced or eliminated through the implementation of Federal regulatory laws, actions, and guidelines designed to protect cultural resources, and through the consultation process with the SHPO and Native American Tribal representatives.

5.2.6 Livestock Grazing

The CIAA for livestock grazing is defined as the combined Green River AMP, Sand Wash, and Wild Horse Bench Grazing Allotments. Cumulative impacts from oil and gas development to livestock grazing would include the direct loss of usable acres during the life of the disturbance. Recreation activities, mining activities, and prescribed burns also contribute to the direct loss of useable acres, but the incremental contribution is impossible to quantify.

As shown in **Table 5.2-3**, approximately 5,889 acres have been or will be disturbed in the past, present, and reasonably foreseeable future from oil and gas activities. Depending on the alternative selected, XTO's proposed infill project would incrementally increase the cumulative disturbance to grazing allotments in the CIAA to 6,738 acres (Alternative A - Proposed Action), 5,899 acres (Alternative B - No Action Alternative), 6,609 acres (Alternative C – Moderate Recovery Alternative), or 6,351 acres (Alternative D – Resource Protection Alternative).

Table 5.2-3. Surface Disturbance Estimates for Existing, Ongoing, and Pending Oil and Gas Projects in the CIAA for Livestock Grazing

Project Name	Totals per Project				Totals in CIAA	
	Project Area (acres)[1]	Wells (#)[2]	Well Pads (#)[3]	Surface Disturbance (acres)	Portion of Project Area in CIAA (acres)	Estimated Surface Disturbance in CIAA (acres)
Existing Development within the RBU Project Area	16,719	805	306	861	13,041	674
KMG Love Unit EA	12,229	125	125	706	10,551	609
Enduring Resources Big Pack EA	34,437	644	292	1,620	11	<1
XTO Kings Canyon EA	25,027	297	166	1,131	6,257	283
XTO Little Canyon Unit EA	32,367	510	362	1,882	4,653	271
EOG North Alger II EA	2,390	22	22	110	831	38
KMG Greater Natural Buttes	162,855	3,675	3,675	12,658	51,332	3,990

Project Name	Totals per Project				Totals in CIAA	
	Project Area (acres)[1]	Wells (#)[2]	Well Pads (#)[3]	Surface Disturbance (acres)	Portion of Project Area in CIAA (acres)	Estimated Surface Disturbance in CIAA (acres)
EIS						
Gasco Uinta Basin EIS	206,829	1,538	1,538	10,302	24	1
XTO Hill Creek Unit EA	5,418	144	108	287	437	23
Total Existing, Operational, and Proposed Projects	**-**	**7,760**	**6,594**	**29,557**	**-**	**5,889**
XTO River Bend Unit Infill EA (If Proposed Action is Selected)	16,719	484	106	1,075	13,041	839
Grand Total (If Proposed Action is Selected)	**-**	**8,244**	**6,700**	**30,632**	**-**	**6,728**
XTO River Bend Unit Infill EA (If No Action is Selected)	16,719	16	1	13	13,041	10
Grand Total (If No Action is Selected)	**-**	**7,776**	**6,595**	**29,570**	**-**	**5,899**
XTO River Bend Unit Infill EA (If Alternative C Selected)	16,719	250	70	923	13,041	720
Grand Total (If Alternative C Selected)	**-**	**8,010**	**6,664**	**30,460**	**-**	**6,609**
XTO River Bend Unit Infill EA (If Alternative D Selected)	16,719	150	42	592	13,041	462
Grand Total (If Alternative D Selected)	**-**	**7,910**	**6,636**	**30,149**	**-**	**6,351**

[1] Acreage for each project area was compiled from various notices and NEPA documents;
[2] Number of proposed wells for each project was compiled from various notices and NEPA documents; and
[3] Number of well pads includes development of new pad locations and expansion of existing pads. If the number of pads was not stated, all wells were assumed to be drilled vertically (i.e., one well per pad).

In addition to loss of useable forage, increased road development within the RBU Project Area would cumulatively contribute to difficulties in controlling livestock as more natural barriers to livestock movement are removed, and as more livestock use roads as travel routes.

Other impacts that may cumulatively affect livestock would include reduced flows to livestock ponds caused by changes to water flow regimes from construction activities; and increased livestock displacement as a result of increased vegetation loss, traffic, and human activity in the RBU Project Area. If displaced, livestock could move to adjacent undisturbed areas, thereby leading to additional livestock impacts on vegetation in those locations.

Under the No Action Alternative, livestock grazing would be protected because site-specific mitigation measures would be implemented on a well-by-well basis as part of the APD approval process. The remaining alternatives would also impact livestock grazing, as these alternatives each incorporate several ACEPMs (**Section 2.1.12.8**) that are intended to reduce, minimize, or avoid project-specific and cumulative impacts to livestock grazing. Specifically, XTO would be responsible for repairing or replacing barriers used to control livestock that are damaged as a result of the proposed project. In

addition, cattleguards or gates would be installed for livestock control on roads when fences are crossed. These structures would be maintained by XTO for the life of the wells.

5.2.7 Vegetation including Special Status Plant Species and Invasive or Noxious Weeds

5.2.7.1 General Vegetation

The CIAA for general vegetation is defined as the Hill Creek and Willow Creek watersheds. Any surface-disturbing activity that removes native vegetation and topsoil from these watersheds may cumulatively and incrementally affect general vegetation by fragmenting plant communities and increasing competition with invasive and noxious weeds. Surface-disturbing activities that compact soil, increase erosion and sediment yield, and increase fugitive dust may also cumulatively and incrementally affect general vegetation, as such changes to the landscape may decrease plant productivity and composition in the CIAA. Past, present, and reasonably foreseeable actions that could result in adverse impacts to general vegetation within the CIAA include oil and gas development, forage use for livestock grazing and wildlife, recreation, mining activities (gilsonite, sand and gravel, and, potentially oil shale), and county and private road construction. Of these actions, impacts related to road construction are the highest concern. Because active roadways would not be reclaimed, it is assumed sediment yield from existing roads and proposed road construction, including those roads used for oil and gas development, would continue at rates two to three times above background rates into the indefinite future, as compared to other authorized actions.

As shown in **Table 5.2-1**, surface disturbance associated with the Proposed Action and No Action Alternative, when added to past, present, and other reasonably foreseeable actions, would cumulatively and incrementally affect vegetation communities across the CIAA. Approximately 4,742 acres have been or will be disturbed in the past, present, and reasonably foreseeable future from oil and gas activities. Depending on the alternative selected, XTO's proposed infill project would incrementally increase the total cumulative disturbance in the CIAA to 5,497 acres (Alternative A - Proposed Action), 4,750 acres (Alternative B - No Action Alternative), 5,390 acres (Alternative C – Moderate Recovery Alternative), or 5,157 acres (Alternative D – Resource Protection Alternative). Throughout the CIAA, disturbed vegetation communities and reduced plant productivity would last for the lifetime of oil and gas development and production, until such time that reclamation is deemed successful. Depending on reclamation requirements, drought conditions and other factors may affect reclamation success in the CIAA.

Under the No Action Alternative, site-specific mitigation measures for vegetation would be implemented on a well-by-well basis as part of the APD approval process. Under the remaining alternatives, interim and final reclamation, in combination with mitigation measures including noxious weed management and erosion control, would reduce impacts to vegetation communities by minimizing soil erosion, decreasing fragmentation of plant communities, and reducing the potential for competition with invasive and noxious weed species.

5.2.7.2 Invasive and Noxious Weeds

The CIAA for invasive and noxious weeds is defined as the Hill Creek and Willow Creek watersheds. Any surface-disturbing activity that removes native vegetation and topsoil from these watersheds may cumulatively and incrementally contribute to the introduction and/or spread of invasive and noxious species. Specific negative impacts associated with the introduction and/or spread of invasive and noxious species include: 1) a reduction in the overall visual character of an area; 2) competition with, or elimination of native plants; 3) a reduction or fragmentation of forage for livestock and wildlife use; and 4) increased soil erosion. Weeds infestations may enter previously undisturbed areas, or increase the size

or density of existing weed populations. These impacts would be expected to be greatest along road corridors, which often provide a major conduit for the spread of weeds into natural areas.

As shown in **Table 5.2-1**, surface disturbance associated with the Proposed Action and No Action Alternative, when added to past, present, and other reasonably foreseeable actions, would cumulatively and incrementally affect vegetation communities across the CIAA. Approximately 4,742 acres have been or will be disturbed in the past, present, and reasonably foreseeable future from oil and gas activities. Depending on the alternative selected, XTO's proposed infill project would incrementally increase the total cumulative in the CIAA to 5,497 acres (Alternative A - Proposed Action), 4,750 acres (Alternative B - No Action Alternative), 5,390 acres (Alternative C – Moderate Recovery Alternative), or 5,157 acres (Alternative D – Resource Protection Alternative). Throughout the CIAA, disturbed areas would last for the lifetime of oil and gas development and production, until such time that reclamation is deemed successful. Depending on reclamation requirements, drought conditions and other factors may affect reclamation success and timelines in the CIAA.

Under the No Action Alternative, site-specific mitigation measures for weeds would be implemented on a well-by-well basis as part of the APD approval process. Under the remaining alternatives, interim and final reclamation, in combination with mitigation measures including noxious weed management and erosion control, would reduce the introduction or spread of invasive and noxious species into native vegetation communities.

5.2.7.3 Special Status Plant Species

In this section, the Uinta Basin hookless cactus and clay reed-mustard are hereinafter referred to as special status plant species. The CIAA for special status plant species is the extent of potential habitat for the Uinta Basin hookless cactus in the Vernal Planning Area. The CIAA does not include the extent of potential habitat for the clay reed-mustard because potential habitat for the clay reed-mustard has not been mapped throughout the Vernal Planning Area. As such, cumulative impacts to the Uinta Basin hookless cactus are discussed both qualitatively and quantitatively, whereas cumulative impacts to the clay reed-mustard are only discussed qualitatively.

Cumulative impacts to special status plant species would be similar in nature to those discussed above for general vegetation. However, given their ongoing habitat losses, sensitivity to disturbance and declining population numbers, special status plant species would be expected to be more sensitive than other, more common plant species to impacts related to development and land uses in the CIAA.

Uinta Basin Hookless Cactus

Cumulative effects to the cactus include direct and indirect impacts as discussed above for general vegetation. Direct impacts would result from the trampling and crushing of individuals, temporary or permanent removal of above ground cover, the temporary or permanent loss of suitable habitat, and soil compaction as the result of construction and operation activities, grazing, and recreational use. Indirect impacts include habitat fragmentation, increased dust effects, introduction and spread of invasive species, temporary or permanent loss of suitable habitat, and changes to the composition of the native vegetative community from surface disturbance activities such as oil and gas development, grazing, road construction, seismic surveys, well staking, cultural resources surveys, biological surveys, and other human activities. Changes in land use patterns or increased human encroachment also would adversely impact occupied and suitable habitats. In addition, recovery and reclamation of suitable habitats could be compounded by limiting reclamation conditions (e.g., drought).

According to the latest potential habitat polygon for the Uinta Basin hookless cactus, the total area of potential habitat is currently 530,270 acres and includes federal, tribal, state, and private lands. The most current geographic data for the Uinta Basin hookless cactus includes over 18,400 points representing approximately 40,528 individual cacti. These numbers include both living and dead plants, but do not include hybrids of the Uinta Basin hookless cactus and Pariette cactus, which occur outside of the area where these two species overlap. Based on recent survey data (BLM and USFWS, 2011) and extrapolation to unsurveyed suitable habitat, the total count for the Uinta Basin hookless cactus is predicted to be at least 50,000 individuals.

To estimate the approximate amount of surface disturbance currently existing within the potential habitat polygon for the Uinta Basin hookless cactus, GIS data was used from UDOGM that show approximately 5,161 oil and gas well locations within the Uinta Basin hookless cactus potential habitat polygon **(Table 5.2-4).** A conservative estimate of 5 acres of surface disturbance for each well, which includes associated roads and pipelines was used to calculate the amount of habitat within the Uinta Basin hookless cactus potential habitat polygon that is already disturbed by energy development. Based on this information its estimated that over 25,805 acres (5 percent) of habitat within the Uinta Basin hookless cactus potential habitat polygon is currently disturbed by energy development. A yet undetermined number of additional wells are planned for development in the Uinta Basin in upcoming years, and thus the amount of surface disturbance across Uinta Basin hookless cactus habitat can be expected to increase substantially.

Table 5.2-4. Summary of Impacts to Uinta Basin Hookless Cactus Habitat within the CIAA.

Habitat Type	Area (Acres)	Estimated Number of Wells within Habitat	Estimated Acreage of Disturbance from Past, Present, and Future Oil and Gas Activity	Disturbance from Proposed Action (Acres)	Cumulative Total Disturbance (Acres)
Potential Habitat	530,270	5,161	25,805	980	26,785
Level 1 Core Habitat	38,769	647	3,235	14	3,249
Level 2 Core Habitat	85,134	1,487	7,435	58	7,493

GIS data from UDOGM was also used to evaluate the number of oil and gas wells within Level 1 and 2 core conservation areas for the Uinta Basin hookless cactus. Based on this information, approximately 524 and 1,270 wells currently exist within Level 1 and Level 2 core conservation areas, respectively. Another 123 and 217 wells are proposed to be drilled in Level 1 and Level 2 core conservation areas, respectively at some future date. Again, using the conservative estimate of 5 acres of surface disturbance for each well, which includes associated roads and pipelines, an estimated 3,235 acres (8.3 percent) in Level 1 and 7,435 acres (8.7 percent) in Level 2 core conservation areas has been or will be disturbed by past, present, and reasonably foreseeable future oil and gas activities **(Table 5.2-4).**

Implementation of the Proposed Action would result in the direct disturbance of approximately 980 acres of potential habitat for the Uinta Basin hookless cactus within the Project Area. This would incrementally increase the total cumulative disturbance of potential habitat for the Uinta Basin hookless cactus within the Project Area to 26,780 acres.

Under the Proposed Action, approximately 3 proposed wells would be drilled within Level 1 core conservation areas for the Uinta Basin hookless cactus and approximately 11 proposed wells would be drilled within Level 2 core conservation areas. The development of these wells along with associated road and pipeline installation would initially result in the direct loss of approximately 14 acres of Level 1 core habitat and 58 acres of Level 2 core habitat within the Project Area. This would incrementally increase the total cumulative disturbance of Level 1 and 2 core conservation areas to 3,249 acres and 7,493 acres, respectively. Under Alternatives C and D, no new surface disturbance would occur with USFWS proposed Level 1 or 2 core conservation areas for Uinta Basin hookless cactus; thus, the incremental contribution of impacts to Level 1 or 2 core conservation areas would not be cumulatively considerable.

Clay-reed Mustard

Within the CISA, potential habitat of 322 acres for clay-reed mustard is found in only one location and has minimal potential for overlap with most, if not all past, present, and reasonably foreseeable development activities. Due to the extremely limited distribution of this species, direct impacts from the Proposed Action and interrelated projects would be minimal. Indirect impacts, including effects from fugitive dust, increased spread and establishment of noxious and invasive species in suitable habitat, and road construction leading to increased access to isolated populations could increase slightly as a result of the Proposed Action and other past, present, and reasonably foreseeable development activities.

To prevent or reduce the negative impacts of habitat encroachment on special status plant species, the BLM in cooperation with the USFWS drafted a list of species-specific conservation measures that would moderate development in these areas and afford protective distances from proposed development to plants and/or their occupied habitats. As these measures (see **Appendix B**) would be implemented under the Proposed Action, impacts to special status plant species would be minimized and monitored. Under the No Action Alternative, site-specific mitigation measures for special status plant species would be implemented on a well-by-well basis as part of the APD approval process.

5.2.8 Fish and Wildlife including Special Status Species

The CIAA for fish and wildlife, including special status species, is defined as the spatial boundary of Uintah and Duchesne counties. This cumulative impact analysis focuses on regional wildlife resources and how species in these two counties may be susceptible to cumulative impacts. This analysis assumes that: 1) human use of the CIAA would increase with implementation of the proposed project; and 2) the overall region has been previously affected by past and present (existing and ongoing) oil and gas activities. It is also assumed that cumulative impacts to special status wildlife species would be similar in nature to those for general wildlife. However, given their ongoing habitat losses, sensitivity to disturbance and declining population numbers, special status wildlife species would be expected to be more sensitive than other, more common wildlife species to impacts related to development and land uses in the CIAA.

Past, present and reasonably foreseeable surface disturbance from oil and gas activities in the CIAA has and will continue to reduce wildlife habitat, contribute to habitat fragmentation, disrupt seasonal patterns or migration routes, displace individual wildlife species, result in collisions between wildlife and vehicles, and potentially contribute to poaching and harassment of animals. Other permitted activities, such as recreational activities, livestock grazing, mining activities, and prescribed burns have and will also continue to contribute to cumulative impacts to wildlife, but the incremental contribution of these activities is difficult to quantify. As such, this analysis assumes future disturbance in the CIAA would primarily result from surface disturbance from oil and gas development, but it is understood that livestock

grazing, recreation and development of dedicated recreational facilities, and growth of Uinta Basin communities may also remove habitat from use by or otherwise disturb wildlife.

As shown in **Table 5.2-5**, approximately 79,143 acres have been or will be disturbed in the past, present, and reasonably foreseeable future from oil and gas activities. Depending on the alternative selected, XTO's proposed infill project would incrementally increase the cumulative disturbance in the CIAA to 80,218 acres (Alternative A - Proposed Action), 79,156 acres (Alternative B - No Action Alternative), 80,066 acres (Alternative C – Moderate Recovery Alternative), or 79,735 acres (Alternative D – Resource Protection Alternative).

Table 5.2-5. Surface Disturbance Estimates for Existing, Ongoing, and Pending Oil and Gas Projects in the CIAA for Uintah and Duchesne Counties

Project Name	Totals per Project				Totals in CIAA	
	Project Area (acres)[1]	Wells (#)[2]	Well Pads (#)[3]	Surface Disturbance (acres)	Portion of Project Area in CIAA (acres)	Estimated Surface Disturbance in CIAA (acres)
Newfield Gusher EA	34,952	75	75	375	34,952	375
Newfield Castle Peak and Eightmile Flat EIS	65,381	973	973	3,701	65,381	3,701
Enduring Resources Rock House EA	4,859	60	24	106	4,859	106
Gasco Riverbend EA	13,323	49	49	245	13,323	245
RDG Uinta Basin EIS	79,807	420	420	2,100	79,807	2,100
KMG Love Unit EA	12,229	125	125	706	12,229	706
KMG Bonanza EA	12,149	95	95	877	12,149	877
Enduring Resources West Bonanza EA	27,993	133	133	665	27,993	665
QEP Greater Deadman Bench EIS	98,538	1,239	1,239	4,561	98,538	4,561
EOG Chapita Wells Stagecoach EIS	31,861	627	627	1,735	31,861	1,735
Elk Production Roosevelt Unit EA	3,306	53	53	210	3,306	210
WRR North Hill Creek EA	24,893	150	150	560	24,893	560
Berry Petroleum and BBC Lake Canyon EA	63,667	200	150	991	63,667	991
Gasco Wilkin Ridge EA	12,085	54	54	270	12,085	270
Berry Petroleum Brundage Canyon Infill EA	7,507	300	195	765	7,507	765
BRC Brundage Canyon EA	38,774	120	120	370	38,774	370
Existing Development within the RBU Project Area	16,719	**805**	**306**	**861**	16,719	861
El Paso Altamont Bluebell EA	487,988	112	112	817	487,988	817
Enduring Resources Big Pack EA	34,437	664	292	1,620	34,437	1,620

Project Name	Totals per Project				Totals in CIAA	
	Project Area (acres)[1]	Wells (#)[2]	Well Pads (#)[3]	Surface Disturbance (acres)	Portion of Project Area in CIAA (acres)	Estimated Surface Disturbance in CIAA (acres)
XTO Kings Canyon EA	25,027	297	166	1,131	25,027	1,131
XTO Little Canyon Unit EA	32,367	510	326	1,882	32,367	1,882
EOG North Alger II EA	2,390	2	22	110	2,390	110
BBC West Tavaputs Plateau EIS	137,937	807	538	3,656	137,937	3,656
KMG Greater Natural Buttes EIS	162,855	3,675	3,675	12,658	162,855	12,658
Gasco Uinta Basin EIS	206,829	1,538	1,538	10,302	206,829	10,302
EOG Greater Chapita Wells Natural Gas Infill Project EIS	42,019	7,028	1,679	5,688	42,019	5,688
Enduring Resources Southam Canyon EA	10,575	249	152	858	10,575	858
XTO Hill Creek Unit EA	5,418	144	108	287	5,418	287
Newfield Monument Butte EIS	119,805	5,750	3,250	15,612	119,805	15,612
Newfield EDA #1 EA	77,661	500	500	3,424	77,661	3,424
Berry Petroleum ANF South Unit EIS	25,608	400	400	2,000	25,608	2,000
Total Existing, Operational, and Proposed Projects	**-**	**27,154**	**17,546**	**79,143**	**-**	**79,143**
XTO River Bend Unit Infill EA (If Proposed Action is Selected)	16,719	484	106	1,075	16,719	1,075
Grand Total (If Proposed Action is Selected)	**-**	**27,638**	**17,652**	**80,218**	**-**	**80,218**
XTO River Bend Unit Infill EA (If No Action is Selected)	16,719	16	1	13	16,719	13
Grand Total (If No Action is Selected)	**-**	**22,517**	**17,547**	**79,156**	**-**	**79,156**
XTO River Bend Unit Infill EA (If Alternative C Selected)	16,719	250	70	923	16,719	923
Grand Total (If Alternative C Selected)	**-**	**27,404**	**17,616**	**80,066**	**-**	**80,066**
XTO River Bend Unit Infill EA (If Alternative D Selected)	16,719	150	42	592	16,719	592
Grand Total (If Alternative D Selected)	**-**	**27,304**	**17,588**	**79,735**		**79,735**

[1] Acreage for each project area was compiled from various notices and NEPA documents;
[2] Number of proposed wells for each project was compiled from various notices and NEPA documents; and
[3] Number of well pads includes development of new pad locations and expansion of existing pads. If the number of pads was not stated, all wells were assumed to be drilled vertically (i.e., one well per pad).

While surface disturbance does correspond to associated wildlife impacts, accurate calculations of cumulative wildlife habitat loss are not determinable because the direct impacts are species-specific and depend on the following: status and condition of the population(s) or individual animals being affected; seasonal timing of the disturbances; value or quality of the project area habitats as well as adjacent habitats; physical parameters of the affected and nearby habitats (e.g., extent of topographical relief and vegetative cover); and type of surface disturbance. On Federal lands, surveys are required in potential or known habitats of threatened, endangered or otherwise special status species prior to project implementation. These surveys help determine the presence of any special status wildlife species or extent of habitat, and protective measures would generally be taken to avoid or minimize direct disturbance in these areas.

As shown in **Table 5.2-5**, surface disturbance associated with the Proposed Action or No Action Alternative, when added to past, present, and reasonably foreseeable actions, would have minimal impacts on wildlife habitats across the CIAA (1.6%). Yet in the context of cumulative impact analyses each acre of vegetation disturbance increases erosion, which incrementally adds to overall native vegetation loss, and potentially increases invasion of noxious weeds. Ongoing and future oil and gas activities and other land uses within the CIAA would further reduce the amount of available cover, foraging opportunities, and breeding areas for a wide variety of wildlife species levels. Additional development could displace wildlife or preclude wildlife from using areas of more intensive human activity.

Under the No Action Alternative, wildlife and their habitats would be protected because site-specific mitigation measures would be implemented on a well-by-well basis as part of the APD approval process. The remaining alternatives would also protect wildlife and their habitats, as these alternatives each incorporate several ACEPMs (**Section 2.1.12.3**) that are intended to reduce, minimize, or avoid project-specific and cumulative impacts to wildlife.

Water depletions associated with the Proposed Action or alternatives, in combination with depletions from other activities in the CIAA, would reduce the ability of the Upper Colorado River Basin to create and maintain the physical habitat (areas inhabited or potentially habitable to special status fish for use of spawning, development of fish larvae, feeding, or serving as corridors between these areas) and the biological environment for the Colorado River Endangered Fish Species. In addition, the Colorado River Endangered Fish Species could also be directly affected by project activities if fish become impinged on intakes for water pumping systems. Furthermore, implementation of the Proposed Action or alternatives, in combination with other activities in the CIAA, could also degrade USFWS-designated critical habitat for the Colorado River Endangered Fish Species utilizing the Green River by increasing erosion and sediment yield, and the potential for leaks for spills. Under the No Action Alternative, the Colorado River Endangered Fish Species would be protected because site-specific mitigation measures would be implemented on a well-by-well basis as part of the APD approval process. The remaining alternatives would also protect fish and their habitats, as these alternatives each incorporate several ACEPMs (**Section 2.1.12.3**) that are intended to reduce, minimize, or avoid project-specific and cumulative impacts to the Colorado River Endangered Fish Species. These measures include provisions to implement appropriate erosion control measures, prevent intake on water pumping systems, and use of closed-loop drilling techniques for all proposed wells located in the 100-year floodplain of Willow Creek and in all named drainages within 5 miles of the Green River. As these measures would be implemented under the Proposed Action and No Action Alternative, many of the aforementioned impacts to special status fish species would be minimized and monitored.

5.2.9 Visual Resources

The CIAA for visual resources is defined as the existing RBU Project Area and the Willow Creek area (i.e., from the creek bottoms to adjacent ridgetops). This CIAA accounts for impacts to visual resources that are collectively affected by ongoing resource management and energy extraction in this area, and are generally managed under a common land use plan. Development of oil and gas typically includes construction of roads, well pads, pipelines, power lines, compressors, and other facilities. Development to this degree has transformed the land to a more roaded, developed, and somewhat industrial landscape. Depending on the landform, vegetation type, and well spacing, the surface disturbance and production facilities are evident to varying degrees. In most of the CIAA, development dominates the landscape. Development associated with oil and gas activities, or other similar surface disturbing activities, are consistent with VRM Class III and IV management objectives. Surface disturbing activities on lands with VRM Class II objectives may not be consistent with those objectives. Disturbances would have to be mitigated to a level where they would not attract the attention of a casual observer, unless they are associated with pre-RMP leases, in which case the lease would be a valid pre-existing contractual right that would not be subject to visual objectives.

Past, present, and reasonably foreseeable future oil and gas activities has disturbed approximately 1,541 acres of land in the CIAA (**see Table 5.2-2)**. Other public land uses have resulted in an unknown acreage of surface-disturbing activities, such as livestock grazing, OHV driving, and vegetation treatments, and have also affected the character of the landscape. Construction of livestock facilities (e.g., fences and waters) and wildlife waters, cross-country OHV driving, and vegetation treatments (e.g., chainings), have also altered the existing character of the landscape with changes in vegetation pattern and the introduction of human-made features on the land.

Under the Proposed Action, development of 484 oil and gas wells would cumulatively contribute 1,075 additional acres of surface disturbance to future changes in the landscape. The RBU Project would incrementally increase the cumulative disturbance in the CIAA to 2,616 acres. Under Alternative B, 16 new wells would result in approximately 13 additional acres of surface disturbance to the characteristic landscape. Under Alternative C, 250 new wells result in approximately 923 additional acres of surface disturbance to the characteristic landscape. Under Alternative D, 150 new wells would result in approximately 592 additional acres of surface disturbance to the characteristic landscape. The impacts to the landscape, and visual resources, under Alternatives C and D would be the same as for the Proposed Action described above. Variations in the amount of surface disturbance, road construction, and placement of facilities under the alternatives would create differences between the alternatives, but the cumulative effects would be similar under all alternatives.

5.2.10 Socioeconomics and Environmental Justice

The CIAA for socioeconomics and environmental justice is defined as the spatial boundary of Uintah and Duchesne counties. This spatial boundary was selected because oil and gas development within the Uinta Basin has had a substantial impact on taxes and royalties collected by the State of Utah, many of which are reallocated back to Uintah and Duchesne counties. These counties also house minority, low-income, and Tribal communities, which are all considered when evaluating environmental justice concerns for oil and gas projects. Furthermore, oil and gas development is the largest variable component of reasonably foreseeable actions in the CIAA. As an industry, it supports large segments of the local economy (e.g., funding for local public facilities and services) and is also a key driver affecting local population, demographic, and migration trends. Other historically and economically important segments of the region’s economic base are grazing and recreation; however, information regarding trends in those segments is lacking and can only be considered on a qualitative basis.

As a result of the ongoing oil and gas growth in the Uinta Basin, the rural communities in the CIAA have experienced considerable population growth. Research suggests that dramatic increases in population can have a disruptive effect on the social well-being of some segments of the local population within a rural community. Negative social consequences could include: a collapse of informal social structures; conflict and tension between advocates and opponents of growth; the absence of social integration; changes in neighboring ties; decreases in community satisfaction, and deteriorating quality of life. Rural communities impacted by boom periods can experience increases in school drop-out rates, juvenile delinquency, criminal activity, domestic/family violence, and drug and alcohol problems, which can in turn affect police and social services (Smith et al. 2001).

Because energy-related population growth and decline can be sudden and/or unexpected, it is difficult for rural communities with limited resources to prepare for these cycles (GOED 2006). Increased population growth can increase the demand for government services. Even if revenues from oil and gas development within the CIAA would eventually exceed the costs of providing these services, impacts associated with the immediacy of these issues would not be resolved.

The Natural Resource Extraction Impact Working Group (Working Group) was organized by the Utah Governor's Office of Economic Development to discuss the impacts of natural resource extraction on rural counties in Utah including the CIAA. The Working Group concluded that the primary impact of resource extraction activity is the need for construction, upgrading, and maintenance of roads. According to this working group, a mechanism for addressing transportation needs currently does not exist (GOED 2006).

Literature suggests that social disruptive effects in rural communities that have experienced extremely rapid growth due to energy-related development in the past, may not be permanent. Rather, the disruptive effects associated with boom growth dissipate in the years after the boom phase has ended, with no evidence of lasting disruption (Smith et al. 2001). Vernal, and other communities within the Uinta Basin that have experienced rapid population change from energy development in the past may also respond to these changes more favorably than a communities that have not experienced boom and bust cycles (Smith et al. 2001).

6.0 CONSULTATION & COORDINATION

6.1 INTRODUCTION

The issue identification section of **Chapter 1** identifies those issues analyzed in detail in **Chapter 4**. **Appendix A** provides the rationale for issues that were considered but not analyzed further. CEQ regulations under NEPA require an "early and open process for determining the scope of issue to be addressed and for identifying significant issues related to a Proposed Action" (40 CFR 1501.7). In order to satisfy this CEQ requirement, announcement of the Proposed Action was posted on the Utah BLM Environmental Notification Bulletin Board (ENBB) on July 17, 2007. BLM resource specialists in the BLM VFO reviewed XTO's plan of development and conferred with the BIA, U.S. Fish and Wildlife Service (USFWS), Utah Division of Wildlife Resources (UDWR), and Uintah County to assess the type and magnitude of potential impacts to the elements of the human environment and other resources. A draft EA was prepared, and a 30-day public comment period was held from December 8, 2008 to January 6, 2009.

The EPA submitted a comment letter encompassing the XTO Riverbend EA, the Enduring Resources Southam Canyon EA, and the XTO Big Pack EA that raised questions regarding the adequacy of the air quality analysis. In the meantime, BLM's knowledge of the air quality in the Uinta Basin was rapidly expanding with the completion of three large photochemical models (the UBAQS, the Gasco Study, and the Greater Natural Buttes Study), in addition to the installation and operation of air quality monitors in the Red Wash and Ouray areas.

Following review of the public comments, and in particular those submitted by the EPA, the BLM VFO determined that additional air quality analyses were needed in order to adequately address public concerns.

With the addition of the new air quality modeling results and Emissions Inventory comparison, a new public comment period was determined to be necessary. All comments that were received on the original EA have been treated as scoping comments, and have been taken into account during the revision of this EA. Disposition of the original comments is recorded in the administrative file for the EA. A second 30-day public comment period will be held from XXXXXX to XXXXXXX.

6.2 PERSONS, GROUPS, AND AGENCIES CONSULTED

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
U.S. Fish & Wildlife Service (USFWS)	Information on Consultation, under Section 7 of the ESA (16 USC 1531)	Consultation with the U.S. Fish and Wildlife Service is pending.
Utah State Historic Preservation Office (SHPO)	Consultation for undertakings, as required by the National Historic Preservation Act (NHPA) (16 USC 470)	Consultation with the SHPO is pending.
Utah Division of Wildlife Resources	Coordinate with UDWR as the agency with expertise on impacts on game species.	Data and analysis regarding big game species incorporated into Chapters 3 and 4.
Uintah County Road Department	Coordinate with county road department as agency with expertise on roads within the RBU Project Area.	Data on county roads incorporated into Chapters 2, 3, and 4.
Native American Tribes	Consultation with Native American Tribes with cultural ties to the Uinta Basin.	Consultation with the Native American Tribes is pending.
Air Resource Technical Advisory Group: BLM, NPS, EPA, Utah, USFS	Coordinate the appropriate methodology for analyzing and mitigating air quality impacts.	Emissions inventory and draft EA were provided for review prior to the public comment period. Comments were addressed.
Environmental Protection Agency	Coordinate the appropriate methodology for analyzing and mitigating resource impacts, especially air quality, water quality, and floodplains.	Draft EA was provided for review prior to the public comment period. Comments were addressed.
Bureau of Indian Affairs: Uintah and Ouray Agency	Coordinate the appropriate methodology for analyzing and mitigating resource impacts on the Uintah and Ouray Reservation.	Draft EA was provided for review prior to the public comment period. No comments were received.

6.3 LIST OF PREPARERS

The following people participated in initial scoping, were members of the Interdisciplinary Team, and/or provided direction and assistance during the preparation of this EA.

6.3.1 BLM

Name	Title	Responsible for the Following Section(s) of this Document
Stephanie Howard	Environmental Coordinator	Project Lead, Air Quality, Water Quality, Socioeconomics
Cameron Cox	Archaeologist	Cultural Resources, Native American Religious Concerns
Stan Olmstead	Range Conservationist	Surface Water Quality, Floodplains
Aaron Roe	Botanist	Invasive and Noxious Weeds and Vegetation including T&E Plant Species
Daniel Emmett	Wildlife Biologist	Wildlife including Special Status Wildlife Species
Elizabeth Gamber	Geologist	Ground Water Resources, Paleontology
Steve Strong	Natural Resource Specialist	Soils
Dusty Carpenter	Rangeland Management Specialist	Livestock Grazing

6.3.2 Non-BLM Preparers

Name	Affiliation	Title	Responsible for the Following Section(s) of this Document
Brad Norling	Kleinfelder	NEPA Project Manager	Project Manager, Vegetation, Noxious Weeds, Wildlife, Special Status Species
Dave Nicholson	Buys & Associates, Inc.	Senior Hydro-geologist	Water Resources, Soils, Paleontology
Daniel Pring	Buys & Associates, Inc.	Senior Air Quality Specialist	Air Quality
Russ Erbes	Kleinfelder	Senior Air Quality Specialist	Air Quality
Karin McShea	Buys & Associates, Inc.	Biologist	Vegetation, Noxious Weeds, Wildlife, Special Status Species, Livestock Grazing
Melissa Bridendall	Buys & Associates, Inc.	Biologist	Vegetation, Noxious Weeds, Wildlife, Special Status Species, Livestock Grazing
Tyler Ashcroft	Buys & Associates, Inc.	Environmental Planner	Socioeconomics
Aliina Fowler	Kleinfelder	Environmental Planner	Socioeconomics
Shina duVall	Buys & Associates, Inc.	Cultural Resource Specialist	Cultural Resources (Archaeology)
Nicole Peace	Buys & Associates, Inc.	GIS Coordinator	GIS Mapping
Don Hamilton	Buys & Associates, Inc.	Regulatory Specialist	Proposed Action
Sue Nall	U.S. Army Corps of Engineers	Environmental Engineer	Water Resources, Wetlands
Kendell Johnson	Buys & Associates, Inc.	Word Processor	Word Processing
Chrissy Lawson	Kleinfelder	Assistant Project Manager	Document Production and Formatting
Ashley Hawes	Kleinfelder	Environmental	Document Production

Name	Affiliation	Title	Responsible for the Following Section(s) of this Document
		Planner	

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