

5.0 Cumulative Impacts

CEQ (40 CFR 1508.7) defines cumulative impacts as:

“...the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.”

The Proposed Action incorporates a number of committed environmental protection measures structured to reduce, minimize, or avoid adverse impacts on the environment. These measures are presented in Section 2.1.6 of the Phase I EA (BLM 2003a) and Section 2.1.4 of this Phases III/IV EA. Additionally, components of the Proposed Action described for the project in Chapter 2.0 provide further resource protection, where applicable.

As summarized in Section 4.19, Unavoidable Adverse Impacts, residual effects remain after application of these measures to minimize environmental impacts from implementation of the Proposed Action. Other past, present, and reasonably foreseeable future projects in the region also may have residual impacts, and in conjunction with the residual impacts identified for the Proposed Action would result in cumulative effects to specific resources located in and near the Salt Creek Basin. While much of the following discussion focuses on cumulative adverse impacts, it should be noted that beneficial cumulative impacts also would occur, as described.

5.1 Past, Present, and Reasonably Foreseeable Actions

Chapter 5.0 of the Phase I EA (BLM 2003a) details a number of past, present, and reasonably foreseeable future projects identified for Salt Creek Oil Field and its surrounding region. Those projects or actions most directly related to the proposed Phases III/IV EOR Project would be the past 116-year development of the entire Salt Creek Oil Field, including the recent Phases I and II development within the SCLOU; ongoing waterflood and CO₂ EOR projects; and future phase development (through Phases V-X) extending from the SCLOU into the SCSU. From a regional perspective, the Phase I EA also delineates other oil recovery and development projects. Given the current momentum of the oil and gas industry in the Salt Creek and Powder River Basins, future expansions of oil and gas recovery are only expected to increase.

Two new projects identified for the Salt Creek Oil Field area include the 1) WC1 and Minor Horizon CO₂ Flood Development and 2) Powder River Basin Water Pipeline Project. The following summary information provides an overview of these proposed future projects.

5.1.1 WC1 and Minor Horizon CO₂ Flood Development

The Salt Creek field is a large geological structure with multiple hydrocarbon bearing horizons deposited in the central or crestal area of the anticline. These formations have typically been eliminated from consideration for CO₂ development due to miscibility pressure constraints or insufficient reserve potential. Howell is currently pilot testing the reserve recovery efficiency of immiscible CO₂ flooding in the WC1 formation. If proven economically viable, Howell would

plan for crestal development of the WC1 and WC2 formations subsequent to the miscible CO₂ development, likely occurring after 2013. CO₂ flood facilities for the WC1 and WC2 on the crest would be constructed using a similar 20- or 40-acre, 5-spot design basis as used with the previously installed miscible Phases I and II. Howell would evaluate the feasibility of completing multiple formations within a single wellbore to reduce capital requirements and surface disturbance. Expected surface disturbance would be proportional, based on developed acreage, to previous phase development.

The installation of infrastructure for immiscible CO₂ flooding of the WC1 and WC2 would significantly reduce the capital requirement for the Lakota, Sundance, and Tensleep formations, also known as the Minor Horizons. Pilot testing of the Minor Horizons would most likely not occur until at least 2007. If feasible, these formations would be developed similarly to the WC1 and WC2, as described, and Minor Horizon development would be expected to commence subsequent to the WC1 in approximately 2018.

5.1.2 Powder River Basin Water Pipeline Project

The Powder River Basin Water Pipeline Project would transport produced water from coalbed natural gas (CBNG) production in the Wyoming portion of the Powder River Basin to a WDEQ-approved Class V water injection well facility for injection into the Tensleep and Madison formations. These formations are both DEQ Class III aquifers (for livestock use), and injection would be proposed to occur in the vicinity of Midwest, Wyoming. The pipeline system, as proposed, would encompass up to three water pump station facilities to collect and boost the pressure of the CBNG produced water from various fields for transportation to the injection facilities. The system would commence in the County Line Field in Johnson County, Wyoming (T47N R78W). The water would be delivered into a 24-inch, steel water pipeline for transport to the Midwest Injection Facilities where it would again be boosted in pressure to allow for injection into up to five wells. The initial design capacity of the system would be 400,000 barrels of water per day (BWPD).

The Midwest Injection Station would be located on lands owned by Howell immediately within the boundaries of the SCLOU (T40N, R79W, NW¼ S12) in Natrona County. The station site would encompass 5.74 acres. The facility would have an inlet pig catcher, a 47,500-barrel water storage tank, two pump buildings (each housing four 60,000 BWPD centrifugal pumps), and a series of filters. There also would be an electrical substation and an office/shop building.

It is anticipated that there would be up to five wells drilled in the western half of Section 12 and the western half of Section 13 (T40N, R79W), also on lands owned by Howell. These wells would be drilled to the base of the Madison formation and would be used as injection wells for aquifer recharge in the Madison and Tensleep formations. Each well location would be anticipated to disturb approximately 2 acres, or 10 acres of total well pad disturbance. Approximately 2.5 acres of additional disturbance is estimated for roads, assuming a 40-foot-wide access road. An injection header for well control and fluid measurement also would be included for each location.

The distribution system for the wells would consist of a 24-inch, steel pipeline as a backbone and 12-inch, steel lateral lines to deliver the water to the individual wells. The pipeline would

require a 100-foot ROW for construction that would be reclaimed following project completion. The distribution line would be approximately 1.5 miles long from the plant boundary to approximately the southwest quarter of Section 13. This disturbance would be approximately 18.2 acres. The lateral lines would require a construction ROW of approximately 80 feet and have a combined length of 2,754 feet, or a total of 5.05 acres.

The pipeline into the plant from the north would require the same 100-foot-wide ROW and would be approximately 1,500 feet long in Section 12. This distance would equate to 3.45 acres of additional surface disturbance.

Total surface disturbance would, therefore, be approximately 45 acres, of which 18.2 acres would remain disturbed for plant and well operations. All pipeline ROWs would be reclaimed and re-vegetated upon construction completion.

5.1.3 Other CO₂ Development

Other ROWs projects associated with CO₂ development may include extension of the CO₂ pipeline to the Sussex Field to support potential CO₂ development in the Sussex, West Sussex, and Meadow Creek fields. The proposed route for this extension was approved under a previous environmental assessment conducted for PetroSource Corp. These three fields were discovered by Conoco during the 1950s. They are located approximately 15 miles north of Salt Creek Oil Field in Johnson County, Wyoming. The fields contain multiple producing horizons and have been under secondary recovery waterflood operations for many years. Anadarko/Howell acquired these properties from Westport in 2003. CO₂ pilot testing conducted at West Sussex by Conoco and, more recently, by Anadarko at Sussex suggests that these fields may be candidates for future CO₂ flood development. Anadarko is currently conducting detailed reservoir studies to evaluate the tertiary potential. 3D seismic also was recently acquired over this area to help support this potential development and is currently being processed for evaluation. Long-range plans may include additional extension of the CO₂ pipeline to support EOR flooding further north into the Powder River Basin in, as yet, unidentified fields.

5.2 Cumulative Impacts

As discussed, the project area has experienced intensive oil field development and surface disturbance since 1889, encompassing an extensive network of roads, well pads, pump jacks, pipelines, electric power lines, processing facilities, and ancillary actions. Overall, the Proposed Action would incrementally add to the existing and proposed level of development and disturbance within Salt Creek Oil Field. However, as discussed above, measures have been developed to minimize potential impacts, including ongoing reclamation efforts through field development, closure, and abandonment. Section 5.2 of the Phase I EA (BLM 2003a) details the net or residual cumulative impacts identified for development of Phases I-X by resource. The following information outlines those new, cumulative issues identified during the analyses for the proposed Phases III/IV Project in conjunction with the past, present, and reasonably foreseeable actions, as described.

5.2.1 Air Quality

As discussed in Section 5.2.1.1 of the Phase I EA (BLM 2003a), substantial development and oil recovery actions have been ongoing since the field's inception in 1889. Anticipated cumulative effects to air quality from past, present, and reasonably foreseeable future actions in conjunction with the proposed Phases III/IV Project would be incremental and temporary. A temporary increase in emissions of PM₁₀/PM_{2.5} would be expected to occur from initial land surface disturbance activities. Incremental increases in emissions of NO_x, SO₂, CO, and VOCs would be expected to occur in the short term from mobile combustion sources associated with drilling/workover rig engines ("nonroad engines") and the temporary increase in vehicle traffic. However, cumulative air quality impacts would not be anticipated to exceed state or federal ambient air quality standards (NAAQS/WAAQS). No cumulative effects from potential CO₂ releases from current or future CO₂ seeps would be anticipated based on the analyses completed for the Proposed Action and Howell's existing CO₂ Seep Containment Plan.

5.2.2 Geology

No additional cumulative impacts to area geology or topography would be anticipated beyond the modifications to surface topography and recontouring of construction sites, as described in the Phase I EA (BLM 2003a, Table 42).

5.2.3 Water Resources

5.2.3.1 Surface Water

The overall cumulative effects to surface water resources were essentially described both in the Phase I EA (BLM 2003a, Section 5.2.1.3) and in Section 4.3.1 of this EA, as the effects on surface water resources, and specifically Salt Creek, have been described for the EOR program as a whole and not segregated for each development phase. Because a gradual decline in produced water from waterflooding alone is projected, the cumulative effect of the temporary increases in water volumes from the entire EOR program would be to slow the overall decline in produced water discharge volumes to Salt Creek and thence to the Powder River water budget.

Additional oil and gas development in the Salt Creek Basin by other past, present, and reasonably foreseeable future actions on a scale sufficient to significantly influence water quality is not expected, as APC (including Howell) currently discharges over 75% of the total produced water in the Basin, with another 20% by the Naval Petroleum Reserve #3. No significant industrial or residential development would be expected for the foreseeable future in the area that may further affect water quality.

5.2.4 Groundwater

No additional cumulative impacts to groundwater resources would be anticipated based on the ACEPMs, as described in the Phase I EA (BLM 2003a, Section 5.2.1.3) and in Chapter 2.0 of this EA.

5.2.5 Human Health & Safety and Ecological Risks

No additional cumulative impacts to human health and safety or ecological resources would be anticipated. Section 4.4 describes the relative impact assessment for the ongoing Phases I and II projects, forecasting future potential occurrences and exposure probabilities. The implementation of Howell's CO₂ Seep Containment Plan and approaches for controlling and monitoring CO₂ flooding as part of the Phases III/IV Proposed Action (see Chapter 2.0) would be anticipated to continue to locate, control, and minimize future seep occurrences. No other CO₂ sources would apply to the cumulative impacts analysis for human health and ecological risks. In summary, the likelihood of exposure to CO₂ is very low for humans and low for small burrowing mammals and ground-dwelling birds, and potential cumulative effects would essentially be the same as those discussed in Section 4.4 of this EA.

5.2.6 Soils and Reclamation

No additional cumulative impacts to soils and reclamation efforts would be anticipated beyond the incremental increase in soil loss, surface compaction, and potential contamination, as described in the Phase I EA (BLM 2003a, Table 42). However, the majority of cumulative impacts to soil resources would be expected to be short-term and associated primarily with initial land disturbances associated with construction activities in the Salt Creek Basin related to upgrading existing infrastructure and adding new wells, roads, and pipelines.

5.2.7 Wetlands

No impacts to wetlands or riparian habitats would be anticipated for the Proposed Action; therefore, no cumulative effects would apply to this analysis.

5.2.8 Vegetation and Weeds

Removal of vegetative cover and disturbance of soils from cumulative projects may result in accelerated wind and water erosion, and an associated increase in sediment yield above natural background levels in the short term. Following successful reclamation measures of the project area, native vegetation would be expected to re-establish. Cumulative disturbances delineated within the entire Salt Creek Oil Field were estimated at 4,900 acres in the Phase I EA (BLM 2003a). Adding the potential future projects, WC1 and Other Minor Horizon Development and the Powder River Basin Water Pipeline Project, would increase anticipated cumulative surface disturbance to be approximately 5,000 to 5,200 acres, assuming similar development scenarios as used for previous and current Salt Creek Oil Field developments.

Noxious weed populations would likely increase to some degree in the short term, as additional well, corridor, and facility sites are disturbed. Implementation of the NWMP (Appendix B, Noxious Weed Management Plan) during operations would serve to decrease to manageable levels or, in some instances, eliminate noxious weed populations in the proposed disturbed areas. The successful application of the NWMP would result in a decrease in such weed populations in the region as compared to projects and developments that do not have a similar plan in place. Therefore, the activities associated with the project would not contribute to the long-term increase in noxious weed populations in the region and no increase in cumulative impacts would be expected.

5.2.9 Terrestrial Wildlife

Potential cumulative impacts to terrestrial wildlife would primarily involve the incremental habitat fragmentation and loss throughout the region, as oil and gas development projects continue to be implemented. The increase in field infrastructure, human presence and activities, and ongoing projects' operations would continue to displace some terrestrial wildlife species more susceptible to disturbances than those species that are more likely to habituate to human activities and increasing surface disturbance. Loss of some animals also would occur. However, given the historic use by the oil and gas industry, relative habitat values, the existing levels of habitat fragmentation, ongoing habitat loss, and direct effects to individual animals occurring over the last 100 years in and near the Salt Creek Basin, the incremental cumulative impacts to wildlife would not be expected to significantly affect these populations.

5.2.10 Aquatic Biology

No adverse impacts to aquatic biological resources would be anticipated for the Proposed Action; therefore, no cumulative effects would apply to this analysis.

5.2.11 Special Status Species

5.2.11.1 Plants

No threatened, endangered, or sensitive plant species are known to occur in the project area. Habitat for these species is lacking for all but the sensitive species, Nelson's milkvetch. Habitat for this species is minimal, and occurs in limited areas. Environmental protection measures limiting development on steep slopes, where such habitat may occur, has been committed to by Howell (BLM 2003a). Therefore, no cumulative impacts to special status plant species would be anticipated.

5.2.11.2 Terrestrial Animals

No federally listed wildlife species are known to occur in the area of the Proposed Action; therefore, no cumulative effects to federally endangered or threatened species would occur. Potential cumulative effects to the federal candidate species (black-tailed prairie dog) and the other BLM sensitive species examined for the Proposed Action would predominantly entail the incremental habitat fragmentation and loss throughout the region, as described for terrestrial wildlife species (Section 5.2.8).

5.2.12 Aquatic Species

No adverse impacts to sensitive aquatic biological resources would be anticipated for the Proposed Action; therefore, no cumulative effects would apply to this analysis.

5.3 Cultural Resources

No additional cumulative impacts to archaeological or cultural resources would be anticipated beyond the potential impacts to known or unknown cultural sites, as described in the Phase I EA (BLM 2003a, Table 42, Section 5.2.1.7). The past use and disturbances associated with Salt

Creek Oil Field do not preclude the possibility of intact archaeological remains existing at depth as is suggested on site forms for some previously recorded sites (see Table 3-9). However, the ACEPMs developed to protect any undiscovered sites would minimize potential cumulative impacts to archaeological or cultural finds.

5.3.1 Range Management and Grazing Resources

Cumulative issues anticipated for range and grazing resources would parallel those discussed for the Proposed Action in Section 4.12. Cumulative grazing impacts would entail the incremental loss of livestock forage and reduction in associated AUMs throughout the project region until successful reclamation mitigation efforts restore or replace loss of livestock forage production.

5.3.2 Land Use

Potential cumulative impacts associated with regional land use would primarily involve cumulative effects to grazing, as discussed in Section 5.2.12. Other cumulative land use impacts would include the incremental increase in oil field infrastructure and use in and near the Salt Creek Basin.

5.3.3 Socioeconomics

No additional cumulative impacts to socioeconomical conditions would be anticipated beyond the beneficial increase in regional employment opportunities and tax base and the incremental increase in housing and other public services demands, as described in the Phase I EA (BLM 2003a, Table 42, Section 5.2.1.8) and in Section 4.14 for the Proposed Action.

5.3.4 Recreation

Minimal, if any, adverse impacts to recreational resources would be anticipated for the Proposed Action; therefore, no cumulative effects would apply to this analysis.

5.3.5 Visual Resources

Cumulative impacts to visual resources would be similar to those discussed for the Proposed Action in Section 4.16. An incremental increase in oil field infrastructure would introduce new visual features to the landscape, adding to the industrial character of the area. Some of the cumulative effects would be offset by the ongoing reduction in pump jacks and related facilities in the well field and by reclamation of obsolete disturbance areas.

5.3.6 Noise

No additional cumulative impacts to sensitive receptors from an incremental increase in noise levels would be anticipated beyond localized short-term increase in construction-related noise levels, as described in the Phase I EA (BLM 2003a, Section 5.2.1.4) and long-term noise sources during project operation (Section 4.17 of this EA).

5.3.7 Transportation

No additional cumulative impacts to transportation would be expected beyond the incremental increase in traffic volumes during project construction and operation, as described in Section 4.18 of this EA. No adverse impacts to traffic safety would be anticipated for the Proposed Action; therefore, no cumulative effects would apply to this resource issue.