1.0 Introduction

Howell Petroleum Corporation (Howell), a subsidiary of Anadarko Petroleum Corporation (APC), proposes to commence Phases III and IV of its ongoing carbon dioxide (CO_2) Enhanced Oil Recovery (EOR) Project within Salt Creek Oil Field, which is located in Natrona County, Wyoming. The first two phases of EOR in this field (Phases I and II) have been completed, with associated increases in oil recovery rates reported. In the next two phases, Howell intends to continue its injection of CO_2 into the Wall Creek 2 (WC2) formation in an effort to further increase oil recovery. This Environmental Assessment (EA) examines the proposed implementation of Phases III and IV.

Salt Creek Oil Field is located in northern Natrona County approximately 45 miles northeast of Casper, Wyoming primarily on land administered by the Bureau of Land Management (BLM) (Figure 1-1). The field boundaries contain the towns of Midwest and Gas Plant Camp, while the town of Edgerton lies immediately to the east of the field. The entire Salt Creek Oil Field encompasses 34.3 square miles of predominately semi-arid grasslands and shrublands and a portion of the Salt Creek watershed. Salt Creek flows in a northerly direction into the Powder River near Sussex, Wyoming. During Phases I and II, Howell injected CO_2 in the northern and western portions of the field, while Phases III and IV would involve injection of CO_2 in the northeast/central portion of the field (Figure 1-2).

In November of 2003, the BLM prepared the *Salt Creek Environmental Assessment CO_2 Enhanced Oil Recovery Project* (EA # WY-060-04-001; hereafter referred to as the "Phase I EA") (BLM 2003a) to assess the potential environmental impacts of permitting full-field development of Salt Creek Oil Field using CO_2. The Phase I EA addressed the full-field development of the CO_2 project for 10 expansion phases, as proposed by Howell, and analyzed the detailed development for the first phase of the expansion (i.e., Phase I). In April 2004, BLM prepared the *Environmental Assessment of Howell Petroleum Corporation's CO_2 Phase II Expansion, CO_2 Enhanced Oil Recovery Project, Salt Creek Oil Field* ("Phase II EA") (BLM 2004a) to examine the site-specific development scenario associated with the Phase II expansion.

This EA will address the detailed development of both Phases III and IV. The proposed expansion into Phases III/IV would utilize existing infrastructure within Salt Creek Oil Field to the extent possible. Existing flow lines, access roads, and power distribution lines would be used or upgraded. Chapter 2.0 details the proposed drilling development and use of ancillary facilities.

1.1 Existing Development

Salt Creek Oil Field (Figure 1-2) produces oil and gas from 11 horizons with the majority of the recovery coming from the largest of these reservoirs, the Wall Creek 2 (WC2). Wall Creek is the local nomenclature for the Upper Cretaceous Frontier Formation, the most prolific producing horizon of Salt Creek Oil Field. Existing infrastructure in the area includes access roads, pipelines, storage tanks, gas re-compression facilities, electric distribution lines, oil and gas production wells, CO_2 and water injection wells, and other related facilities. Current produced oil volumes from Salt Creek Oil Field are approximately 7,000 barrels of oil per day (BOPD), of

Figure 1-1

Figure 1-2 11x17

which 4,000 BOPD are recovered from the waterflood process and 3,000 BOPD recovered from the CO_2 flood in the Phases I and II areas.

1.1.1 Historical Development and Use

The presence of oil in the Salt Creek area has been know since the late 1800s in part because of the natural oil seeps that occurred in the area. Some of these natural oil seeps still exist, and Howell collects oil from the seeps using vacuum trucks and other production techniques. Initial development of Salt Creek Oil Field commenced in 1889 with the majority of primary development occurring between 1915 and 1930. Early records indicate that oil was found at depths as shallow as 22 feet in 1911.

The Salt Creek Light Oil Unit (SCLOU) was formed on September 1, 1939 and was operated by Stanolind Production, which later became Amoco Production Company. Howell acquired Salt Creek Oil Field and succeeded Amoco as operator in 1998. Howell and APC subsequently merged in December 2002. The Salt Creek South Unit (SCSU), also operated by Howell, is located directly south of the SCLOU and encompasses the remainder of Salt Creek Oil Field (Figure 1-2).

Oil production at Salt Creek Oil Field comes from several geologic horizons at varying depths. The most prolific horizon, both in areal coverage and volume, is the WC2 horizon, which was discovered in 1917. Production levels for the field peaked in the late 1920s when over 85,000 BOPD were recovered, and have since declined to the current levels. Cumulative production for Salt Creek Oil Field from all horizons is estimated to be in excess of 670 million barrels of oil (MMBO).

Historically, Salt Creek Oil Field produced under primary depletion (driven by high pressures inherent to the reservoir) until gas re-injection was implemented from 1926 through 1961. Waterflooding was tested at Salt Creek as early as 1961 and was implemented field-wide in 1971. The WC2 has been under active waterflood since 1961.

Approximately 754 production wells and 568 injection wells were active in the SCLOU waterflooding operations. The SCSU contains an additional 76 production and 75 injection wells. The mature state of the waterflood operations has resulted in very high water-oil ratios (WOR) for the current producing wells. For every barrel of oil produced, over 99 barrels of water must be produced and re-injected (a 0.6% oil-cut). The extensive waterflood facilities required to maintain this operation are the largest of any field in the state, rendering the field economics susceptible to minor fluctuations in oil price and operating costs.

1.1.2 Phases I and II

Within Salt Creek Oil Field, oil production has declined steadily from a peak of 85,000 BOPD in the 1920s to approximately 4,000 BOPD prior to CO_2 injection. In an effort to reverse the declining trend of oil production, Howell constructed an extension of the Shute Creek to Bairoil pipeline to deliver up to 250 million cubic feet (mcf) of CO_2 to be used for tertiary waterflood operations in the field. Howell introduced the state-of-the-art tertiary EOR technology by injecting the CO_2 to increase oil production that would otherwise not be recoverable by existing

waterflood operations. With the implementation of Phases I and II, oil recovery in Salt Creek Oil Field has increased from 4,000 to 7,000 BOPD. Howell estimates that by the end of 2006 more than half of the total field production will be the result of CO_2 flooding operations in Phases I and II.

The locations of Phases I and II (Figure 1-2) were based on factors such as proximity to local communities and populations; geologically representative areas; and existing roads, facilities, and wells. The surface disturbances for Phases I and II are summarized in Table 1-1.

In the Phase I area, a small amount of the CO_2 injected during Phases I and II seeped to the surface in the NE ¼ of Section 14. These seeps are limited in extent and comprise only approximately 0.008% of the total CO_2 injected within the area currently under CO_2 flood. Howell has been working to identify the source, migration pathways and subsurface behavior of CO_2 and has developed a CO_2 mitigation plan. Howell is currently planning, installing, and field-testing multiple mitigation approaches in the Phases I and II areas. Once these approaches have been field verified, Howell will have the ability to implement mitigation efforts to address CO_2 events should they occur in the future. This process is summarized in Chapter 2 (Section 2.1.3, CO_2 Seep Containment Plan).

1.2 Purpose and Need

The phased expansion (Phases III/IV) of the CO_2 EOR project would continue to replace the current secondary EOR technology involving waterflooding, thereby increasing oil production by another 3,700 BOPD or 22 MMBO over the life of the project. Use of the combined waterflood and tertiary EOR could ultimately recover as much as 150 MMBO for the entire Salt Creek Oil Field, extending operations for another 30 to 40 years and the economic life of the field. For comparison, if only the waterflood technology is employed, economically feasible oil extraction would be projected to continue for another 16 years.

1.3 Authorizing Actions

Necessary permits and authorizations from the BLM would be issued pursuant to the Mineral Leasing Act of 1920, as amended, and the Federal Land Policy and Management Act of 1976, as amended, and would be subject to the rules and regulations in 43 CFR 2800 and 43 CFR 3100. Section 1.3 of the Phase I EA contains a complete discussion on Authorizing Actions applicable to continued development of Salt Creek Oil Field and is incorporated herein by reference. Table 1 in Section 1.3 of the Phase I EA also provides a brief synopsis of potentially applicable permit requirements by federal, state, and local agencies that have jurisdiction over different aspects of the proposed Phases III/IV.

1.4 Public Involvement

Howell held a town meeting in Midwest on July 26, 2005 to present the proposed development for the Phases III/IV and answer questions regarding the development. Approximately 50 people attended the meeting. Topics discussed included: 1) future phase development within Salt Creek Oil Field, 2) CO_2 seeps from the Phases I/II development, 3) CO_2 Seep Containment Plan developed by Howell, and 4) monitoring plans for the town of Midwest.

Table 1-1 Phases I and II Surface Disturbance

Action	Estimated (acres)			Actual
	Previous Disturbed	**New Disturbance**	**New Long-Term Disturbance**	**Measured (acres)**
Wells	121	40	10	97
LACTs	0.8	0.01	0	0.2
Waterflood Boosters	0	0.5	0.5	1.5
Headers	223	0.8	0.8	218
Trunk Lines	62	33	0	101
Temporary Use Areas	0	0	0	11.5
Compressor Station	2.1	0.9	0.9	7.1
Production Main Lines	18.1	18.1	0	13.4
Electrical Lines	2.2	4.8	0	6
Total Phases I and II Disturbances	**429**	**98**	**12**	**456**
Total New Long-Term Disturbance				**12**