APPENDIX PART II

SENSITIVE AREA INDENTIFICIATON GUIDANCE DOCUMENT

A. PURPOSE OF THE GUIDANCE DOCUMENT

The Sensitive Area Identification Guidance Document specifically applies to the determination of areas in which unlined earthen produced water pits installed for use by oil and gas operations may be restricted.

This guidance document was developed to provide direction to both operators and COGCC staff for determination of Sensitive Areas (SAs). This document supports the implementation of the 900 Series of COGCC Rules, which establish the permitting, construction, operating and closure requirements for all pits used in oil and gas operations.

This document was prepared with the assistance of our stakeholders, including the oil and gas industry and the Water Quality Control Division (WQCD). This document may be revised periodically, when additional facts and data indicate a change is needed. Each document revision will be presented to the COGCC Commissioners for adoption by order of the Commission after a public hearing.

B. METHOD OF IDENTIFICATION OF SENSITIVE AREAS

Identification criteria were chosen to ensure the protection of ground water in accordance with WQCC standards and classifications, relative to oil and gas operations. After much discussion, the initial list of criteria was narrowed to the factors which would result in the most accurate identification of SAs using reasonable sources of available information. These identification criteria include:

- quality of the produced water,
- presence of unconfined aquifers or recharge areas,
- hydraulic conductivity of soils and geologic material under pit,
- presence of a WQCC classified area or wellhead protection area,
- proximity to public or domestic water supply wells,
- depth and quality of ground water.

The decision tree method was employed for easy use by operators. The operator may determine whether a location is in a SA by answering the questions posed in the following decision tree. The operator will make a SA determination for each existing and new pit only once.

Various sources of information available for answering the questions are noted. If vital information or data are incomplete or missing, then it is the responsibility of the operator to provide the minimum information necessary. The operator may also provide field observations and data to fulfill determination requirements.

When a discrepancy or question regarding the sensitivity of an area arises, the COGCC staff should be consulted. The COGCC will make the final determination in any dispute over whether a location is in a SA.

C. THE DECISION TREE

The decision tree consists of a series of technical questions. Explanations of these questions follow:

Box 1: Does the produced water to be placed in pit meet WQCC standards for ground water for the following contaminants of concern?

< Total Dissolved Solids (TDS) at 1.25 x background
< 250 ppm Chloride or background, whichever is higher
< 250 ppm Sulfate or background, whichever is higher
< 5 ppb Benzene
< 1,000 ppb Toluene
< 680 ppb Ethylbenzene
< 10,000 ppb Xylenes

YES - Produced water quality is below action levels stated in WQCC ground water standards. The risk to ground water resources posed by placing this produced water into unlined pits is considered insignificant and will be allowed.

NO - Contaminants of concern are present in the produced water at concentrations above the ground water standards. The risk to ground water posed by placing this produced water into unlined pits may be significant. Continue with decision tree.

The levels noted above are derived from ground water standards established by the WQCC. Their use in Box 1 does not imply that produced water must meet these standards in all pit situations.

Data References: These data must be obtained from testing the produced water. For a proposed new pit, the concentrations may be estimated from produced water quality data from wells in a common producing area.

Box 2: Is the pit location underlain by an unconfined aquifer or recharge zone?

An unconfined aquifer may occur in bedrock or in unconsolidated deposits, primarily alluvium adjacent to the Platte or other rivers. This does not include a small isolated occurrence of ground water that is not in communication with other hydrologic units. Wetlands should also be considered as they are likely to be in communication with shallow ground water and surface water.

YES - The location is in a SA and produced water placed into an unlined earthen pit here has a high potential to adversely impact ground water. Continue with decision tree.

NO - The location is not in a SA, and produced water placed in an unlined earthen pit here would have a low potential to adversely impact ground water.

References: USGS Hydrologic and Geologic Maps, NRCS (SCS) maps, wetland designation maps and field designations by the Army Corps of Engineers, and State Engineer's records.

Box 3: Is the hydraulic conductivity of the underlying soils and geologic material between the pit bottom and the aquifer less than or equal to 10^{-6} cm/sec?

Where the permeability of the soil and geologic material is high, produced water percolating from the pit may move easily to lower zones. As an example, sandy soil would allow a high rate of percolation of produced water from an unlined pit.

YES - The potential for adversely impacting ground water is high. Continue with decision tree.

NO - The ground water should be protected by the existing soils acting as a barrier to percolation of produced water. The location is not in a SA.

References: NRCS (SCS) Soil Surveys (for soil characterizations to about 5' below surface).

Box 4A: Is the **existing** pit location within a specified area for which the WQCC has classified the ground water or within a wellhead protection area (WHPA) as of 7/1/95? OR

Box 4B: Is the **new** pit location within a specified area for which the WQCC has classified the ground water or within a wellhead protection area (WHPA) at the date of construction?

The ground water in specified areas must be protected because it is used as a drinking water or other public water supply. Local entities may also designate areas for protection for similar reasons.

YES - The potential for adversely impacting ground water used as a public water supply exists. This location is in a SA.

NO - An unlined pit is not likely to adversely impact a public water supply. Continue with decision tree.

References: See WQCC regulations, which includes maps of specified areas. WHPA information may be obtained from local governments.

Box 5: Is the pit location within:
660' (1/8 mi.) of a domestic water well, OR
1320' (1/4 mi.) of a public water supply well, and completed in the same aquifer that may be adversely impacted from an unlined earthen pit?

YES - The potential for adversely impacting ground water used by the public exists. The location is in a SA.

NO - An unlined pit has a low potential for adversely impacting ground water used by the public. Continue with decision tree.

References: Colorado State Engineer's database, landowners, and local water well drillers.

Box 6: Is the depth from the pit bottom to the ground water table less than 20', estimated to be the average high ground water level, including influence of irrigation? The average high should be the level of the ground water table during spring runoff or crop irrigation (whichever is higher).

YES - The potential for adversely impacting the ground water is high. This location is in a SA.

NO - An unlined pit has a low potential for adversely impacting ground water, so the location is not in a SA.

References: USGS Hydrologic and Geologic maps and Water Supply studies, landowners, local water well drillers, NCRS (SCS), and agriculture organizations such as the CSU Extension Service.

D. DECISION TREE RESULTS

1. IF THE LOCATION **IS NOT** IN A SENSITIVE AREA:

Unlined earthen pits (and buried concrete sumps or other non-leakproof vessels) are an acceptable method for handling produced water. A pit permit must be obtained in accordance with COGCC Rule 903. Points of Compliance may be included as permit conditions.

2. IF THE LOCATION **IS** IN A SENSITIVE AREA:

Unlined earthen pits ARE NOT an acceptable method for disposing of produced water. Equipment such as aboveground tanks, below-grade leakproof tanks or vessels (such as FRP or lined/coated steel), or adequate lining in an earthen pit may be used. Other methods of produced water disposal may be used such as evaporation, injection into a permitted UIC Class II well or surface discharge in accordance with WQCD Colorado Discharge Permit System (CDPS).

An operator may provide data that demonstrates that the proposed unlined pit will not impact ground water. An operator may also provide information that demonstrates the existing ground water is not currently nor likely to be used by the public. The COGCC will evaluate the proposal and supporting data, and may allow an unlined pit, where the placement of produced water into an unlined pit will not adversely impact ground water resources.

The operator may choose to perform analyses to determine the quality of the existing ground water that may be impacted. Should the produced water quality analyses show it to be of better quality than the existing ground water, the unlined pit may be authorized. This concept is further explained on attached Produced Water Quality Decision Tree.