COLORADO DIVISION OF WILDLIFE'S
ACTIONS TO MINIMIZE ADVERSE IMPACTS TO WILDLIFE RESOURCES

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The purpose of this document is to enumerate potential actions that may avoid, minimize, and/or mitigate adverse impacts of oil and gas operations on Colorado's wildlife resources.

I. PLANNING INFRASTRUCTURE PLACEMENT AND DEVELOPMENT ACTIVITIES

Planning infrastructure placement and the timing of development activities to avoid and minimize impacts to wildlife resources is a critical component to any development strategy that balances the needs of wildlife with the rights of the oil and gas operator to produce oil and gas. To accomplish this objective, a Wildlife Impact Avoidance and Minimization Plan should be prepared prior to development that incorporates the following strategies:

A. Bring operators, CDOW personnel and surface owners together early in the planning process to assess wildlife needs and operational constraints, and to collaborate on a planning document that provides guidelines to avoid or minimize impacts to wildlife resources.

B. Plan development activities at the largest scale possible (i.e. landscape level) in order to allow for phased or clustered development to avoid or minimize impacts to wildlife resources. Use unitization, operator agreements, and other agreements to improve communication, to consolidate and minimize infrastructure, and to allow for effective landscape level planning.

C. Develop and implement an adaptive management program that provides for monitoring and evaluation, that documents environmental changes, and that implements mid-course corrections to development and operational practices. Correlate oil and gas operations with environmental changes through ongoing monitoring and evaluation and adaptively adjust future oil and gas development activities as necessary to protect wildlife resources.

II. ELEMENTS OF AN IMPACT AVOIDANCE AND MINIMIZATION PLAN

The following elements may be used collectively for the development of a landscape Wildlife Impact Avoidance and Minimization Plan, or individually as Avoidance Measures on a well-by-well basis.

A. GENERAL WILDLIFE AND ENVIRONMENTAL PROTECTION MEASURES: *These measures are meant to educate field personnel regarding specific wildlife concerns.*

1. Provide annual educational training for staff and contractors on specific wildlife issues of concern, (e.g., how to recognize lek sites, the location and importance of seasonal wildlife habitats and migratory patterns, how to locate mountain plover nests, the effects of winter range disturbance on wildlife, etc.,) and on the overall aspects of the landscape planning documents and any agreements with CDOW.

2. Establish policies to protect wildlife (e.g., no poaching, no firearms, no dogs on location, no feeding of wildlife, etc.).

3. Promptly report spills that affect wildlife to the Water Quality Control Division of CDPHE and CDOW.

4. Store and stage emergency spill response equipment at strategic locations along perennial water courses so that it is available to expedite effective spill response.

5. Avoid locating staging, refueling, and storage areas within 300 feet of any reservoir, lake, wetland, or natural perennial or seasonally flowing stream or river.

6. Install automated emergency response systems (e.g., high tank alarms, emergency shut-down systems, etc.).

B. INFRASTRUCTURE LAYOUT WILDLIFE PROTECTION MEASURES (including production facilities, ancillary facilities, and roads): *The purpose of these measures is to consolidate development activities and production facilities in order to minimize direct habitat loss and fragmentation, and to minimize displacement of wildlife due to audible, olfactory and visual disturbances.*

1. Avoid new surface disturbance and placing new facilities in key wildlife habitats in consultation with CDOW.

2. Phase and concentrate all development activities, so that large areas of undisturbed habitat for wildlife remain. Maintain undeveloped areas within development boundaries sufficient to allow wildlife to persist within development boundaries during all phases of construction, drilling, and production. Minimize the duration of development and avoid repeated or chronic disturbance of developed areas. Complete all anticipated drilling within a phased, concentrated, development area during a single, uninterrupted time period.

3. Develop a transportation plan to incorporate the following strategies:

    a. Minimize the number, length, and footprint of oil and gas development roads;

    b. Use existing routes where possible;

c. Combine utility infrastructure (gas, electric, and water) planning with roadway planning to avoid separate utility corridors;

d. Combine and share roads to minimize habitat fragmentation

e. Place roads to avoid obstructions to migratory routes for wildlife, and to avoid displacement of wildlife from public to private lands.

f. Design roads with visual and auditory buffers or screens (e.g., topographic barriers, vegetation, and distance).

g. Surface roads to ensure that the anticipated volume of traffic and the weight and speed of vehicles using the road do not cause environmental damage, including generation of fugitive dust and contribution of sediment to downstream areas.

h. Locate roads as far from riparian areas and bottoms of drainages as possible and outside of riparian habitat.

i. Avoid constructing any road segment in the channel of an intermittent or perennial stream.

j. Avoid low water crossings. Structures for perennial or intermittent stream channel crossings should be engineered using bridges or appropriately sized culverts.

k. Design road crossings of streams to allow fish passage at all flows and to minimize the generation of sediment.

l. Design road crossings of streams at right angles to all riparian corridors and streams to minimize the area of disturbance.

m. Construct stream crossings “in the dry” to minimize sedimentation.

n. Protect culvert inlets from erosion and sedimentation and install energy dissipation structures at outfalls.

o. Implement fugitive dust control measures.

p. Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.

q. Coordinate employee transport, encourage carpooling or provide bus transport to work sites.

r. Prohibit or substantially limit the amount of traffic on lease roads in important wildlife habitats within 3 hours of sunrise and sunset.

s. Install and use locked gates or other means to prevent unauthorized vehicular travel on roads and facility rights-of-way.

t. Limit parking to already disturbed areas.

u. Use man camps to reduce travel related disturbance when the benefits outweigh the disadvantages of developing human concentrations in wildlife habitats.

4. Develop and implement appropriate density caps or thresholds on wells sites, facilities and infrastructure (see the species-specific well site density recommendations in this document).

5. Maximize the utility of surface facilities by developing multiple wells from a single pad (directional drilling), and by co-locating multipurpose facilities (for example, well pads and compressors) to avoid unnecessary habitat fragmentation and disturbance of additional geographic areas.

6. Minimize the number, size and distribution of well pads and locate pads along existing roads where possible.

7. Cluster well pads in the least environmentally sensitive areas.

8. Consolidate and centralize fluid collection and distribution facilities.

9. Share/consolidate corridors for pipeline ROW's to the maximum extent possible.

10. Engineer pipelines to avoid field fitting and reduce excessive ROW widths and reclamation.

11. Adequately size infrastructure and facilities to accommodate both current and future gas production. Economize gas transportation.

C. AQUATIC and WETLAND ENVIRONMENT PROTECTION MEASURES: *The purpose of these measures is to avoid, minimize or mitigate disturbances to aquatic and wetland habitats and the unique wildlife communities associated with these habitats.*

1. Minimize activities and operations within 300 feet of the ordinary high water mark of any reservoir, lake, wetland, or natural perennial or seasonally flowing stream or river.

2. Schedule necessary construction in stream courses to avoid critical spawning times. General spawning avoidance guidelines are found under Species Specific chapters in this document.

3. Bore pipelines that cross perennial streams.

4. Use the minimum right-of-way width where pipelines cross riparian areas and streams.

5. Construct all crossings at right angles to the stream.

6. Do not remove native riparian canopy or stream bank vegetation where possible.

7. Avoid direct discharge of pipeline hydrostatic test water to any reservoir, lake, wetland, or natural perennial or seasonally flowing stream or river.

8. Avoid dust suppression activities within 300 feet of the ordinary high water mark of any reservoir, lake, wetland, or natural perennial or seasonally flowing stream or river.

9. Screen water suction hoses to exclude fish.

10. Disinfect heavy equipment, hand tools, boots and any other equipment that was previously used in a river, stream, lake, pond, or wetland prior to moving the equipment to another water body. The disinfection practice should follow this outline:

    a. Remove all mud and debris from equipment and spray/soak equipment with a 1:15 solution of disinfection solution containing the following ingredients:

        i. Dialkyl dimethyl ammonium chloride, 5-10% by weight;
        ii. Alkyl dimethyl benzyl ammonium chloride, 5-10% by weight;
        iii. Nonyl phenol ethoxylate, 5-10% by weight;
        iv. Sodium sesquicarbonate, 1-5%;
        v. Ethyl alcohol, 1-5%; and
        vi. Tetrasodium ethylene diaminetetraacetate, 1-5%;
        vii. and water, keeping the equipment moist for at least 10 minutes and managing rinsate as a solid waste in accordance with local, county, state, or federal regulations; or

    b. Spray/soak equipment with water greater than 140 degrees Fahrenheit for at least 10 minutes.

    c. Sanitize water suction hoses and water transportation tanks (using methods described above) and discard rinse water at an appropriately permitted disposal facility.

D. DRILLING AND PRODUCTION OPERATIONS WILDLIFE PROTECTION MEASURES: *The purpose of these measures is to reduce disturbance on the actual drill site and the surrounding area, to reduce direct conflict with wildlife and hunters, and to prevent wildlife access to equipment.*

1. Schedule construction, drilling, and completion activities to avoid particularly sensitive seasonal wildlife habitats in consultation with CDOW.

2. Schedule construction, drilling, and completion activities to avoid seasons and locations when public use of lands is at its highest (e.g., big game hunting seasons).

3. Reduce visits to well-sites through remote monitoring (i.e. SCADA) and the use of multi-function contractors.

4. Use centralized hydraulic fracturing operations.

5. Transport water through centralized pipeline systems rather than by trucking.

6. Where possible, locate pipeline systems under existing roadways, or roadways that are planned for development.

7. Maximize use of state-of-the-art drilling technology (e.g., high efficiency rigs, coiled-tubing unit rigs, closed-loop or pitless drilling, etc.) to minimize disturbance.

8. Conduct well completions with drilling operations to limit the number of rig moves and traffic.

9. Employ state-of-the-art technology to protect existing vegetation (e.g., use mats if possible to preserve topsoil/vegetative root stock).

10. Install exclusionary devices to prevent bird and other wildlife access to equipment stacks, vents and openings.

11. Ensure that surface discharged produced water meets minimum standards for Total Dissolved Solids (TDS) and Sodium Adsorption Ratio (SAR) to benefit wildlife.

12. Reduce noise by using effective sound dampening devices or techniques (e.g., hospital-grade mufflers, equipment housing, insulation, installation of sound barriers, earthen berms, vegetative buffers, etc.). Appropriate noise limits are included in the species-specific recommendations in included in this document.

13. Locate above-ground facilities to minimize the visual effect (e.g., low profile equipment, appropriate paint color, vegetation screening in wooded areas, etc.).

14. During pipeline installations install trench plugs, earthen ramps, or other means as necessary to ensure that open pipeline trenches do not trap wildlife, and that pipe strings to not impair wildlife movements.

E. FLUID PIT WILDLIFE PROTECTION MEASURES: *The purpose of these measures is to prevent wildlife access to fluid pits and to reduce potential for contamination of water and soil by pit contents.*

1. Avoid locating fluid pits within 300 feet of the ordinary high water mark of any reservoir, lake, wetland, or natural perennial or seasonally flowing stream or river.

2. Install and maintain adequate measures to exclude all types of wildlife (e.g., big game, birds, and small rodents) from all fluid pits (e.g., fencing, netting, and other appropriate exclusion measures).

3. Construct fluid pit fences and nets that are capable of withstanding animal pressure and environmental conditions and that are appropriately sized for the wildlife encountered.

4. Install impermeable barriers beneath fluid pits to protect groundwater, riparian areas and wetlands.

5. Skim and eliminate oil from produced water ponds and fluid pits at a rate sufficient to prevent oiling of birds or other wildlife that could gain access to the pit.

6. Construct fluid pits with a 4:1 escape ramp to allow entrapped wildlife to escape.

7. Treat waste water pits and/or any associated pit containing water with Bti (*B. thuringiensis v. israelensis*)**,** commonly known as Mosquito Dunks, to control mosquito larvae that may spread West Nile Virus to wildlife or take other effective approaches to controlling mosquito larvae in ponds and pits.

a. The appropriate application rate of Bti is 1 dunk/100 sq. ft. of standing water, applied each 30 day period during 1 June – 30 September.

F. INVASIVE/NON-NATIVE VEGETATION CONTROL: *The purpose of these measures is to ensure proper planning, assessment and control of weed infestations on all locations.*

1. Develop an aggressive, integrated, noxious and invasive weed management plan. Utilize an adaptive management strategy that permits effective responses to monitored findings and reflects local site and geologic conditions. Use of dedicated personnel with single responsibility for weed control is often the most effective approach.

2. Map the occurrence of existing weed infestations prior to development to effectively monitor and target areas that will likely become issues after development.

3. Establish a systematic and thorough noxious and invasive monitoring program for all disturbed areas and maintain monitoring records.

4. Continue control programs for the life of the well field.

5. Use reclamation as a weed management tool. Plant competition provided by established reclamation is the most effective weed management tool.

6. Thoroughly clean vehicles and other equipment to remove weed seeds before moving equipment to new sites.

7. Educate employees and contractors about noxious and invasive weed issues.

G. RESTORATION, RECLAMATION AND ABANDONMENT: *The purpose of these measures is to restore disturbed sites to their pre-development conditions, using native vegetation that can be used by the indigenous wildlife. Develop a reclamation plan in consultation with CDOW, NRCS, and the land owner or land management agency that incorporates wildlife species-specific goals and that defines reclamation performance standards, including the following components:*

1. Soil

   a. Store topsoil in windrows no higher than 5 feet.

   b. Strip and segregate topsoil prior to construction. Appropriately configure topsoil piles and immediately seed to control erosion, prevent weed establishment and maintain soil microbial activity.

   c. Maintain separation between pit contents and soils.

   d. Salvage topsoil from all road construction and other rights-of-way and re-apply during interim and final reclamation.

   e. Evaluate the utility of soil amendment application or consider importing topsoil to achieve effective reclamation.

2. Seed

   a. Use only certified weed-free native seed in seed mixes, unless use of non-native plant materials is recommended by CDOW.

   b. Test seed rigorously and frequently for purity, germination/viability, and the presence of weeds.

c. Use locally adapted seed whenever available, especially for species which have wide geographic ranges and much genetic variation (e.g., big sagebrush (*Artemesia tridentata*), antelope bitterbrush (*Purshia tridentata*), etc.).

d. Where more than one ecotype of a given species is available and potentially adapted to the site, include more than one ecotype per species in the seed mix.

e. Use appropriately diverse reclamation seed mixes that mirror an appropriate reference area for the site being reclaimed (see also species-specific recommendations).

f. Conduct seeding in a manner that ensures that seedbed preparation and planting techniques are targeted toward the varied needs of grasses, forbs and shrubs (e.g., seed forbs and shrubs separately from grasses, broadcast big sagebrush but drill grasses, etc.).

g. Emphasize bunchgrass over sod-forming grasses in seed mixes in order to provide more effective wildlife cover and to facilitate forb and shrub establishment.

h. Seed immediately after recontouring and spreading topsoil. Spread topsoil and conduct seeding during optimal periods for seed germination and establishment. Use of the same contractor for re-contouring land as used for seeding is often the most effective approach.

i. Do not include aggressive, non-native grasses (e.g., intermediate wheatgrass, pubescent wheatgrass, crested wheatgrass, smooth brome, etc.) in reclamation seed mixes. Site specific exceptions may be considered.

j. Distribute quick germinating site adapted native seed or sterile non-native seed for interim reclamation on cut and fill slopes and topsoil piles.

k. Plan for reclamation failure and be prepared to repeat seeding as necessary to meet vegetation cover, composition, and diversity standards.

l. Consider reclaiming with tubelings/plantings where seed failure is likely or has occurred.

3. Vegetative Cover Standard

a. Choose reference areas as goals for reclamation that have high wildlife value, with attributes such a diverse and productive understory of vegetation, productive and palatable shrubs, and a high prevalence of native species.

b. Establish vegetation with total perennial non-invasive plant cover of at least eighty (80) percent of pre-disturbance or reference area levels.

c. Establish vegetation with plant diversity of non-invasive species which is at least half that of pre-disturbance or reference area levels. Quantify diversity of vegetation using a metric that considers only species with at least 3 percent relative plant cover.

d. Establish permanent and monumented photo points and vegetation measurement plots or transects; monitor at least annually until plant cover, composition, and diversity standards have been met.

e. Observe and maintain a performance standard for reclamation success characterized by the establishment of a self-sustaining, vigorous, diverse, locally appropriate plant community on the site, with a density sufficient to control erosion and non-native plant invasion and diversity sufficient to allow for normal plant community development.

4. Timing

a. Use early and effective reclamation techniques, including interim reclamation to accelerate return of disturbed areas for use by wildlife.

b. Remove all unnecessary infrastructure.

c. Close and reclaim roads not necessary for development immediately, including removing all bridges and culverts and recontouring/reclaiming all stream crossings.

d. Reclaim reserve pits as quickly as possible after drilling and ensure that pit contents do not contaminate soil.

e. Remediate hydrocarbon spills on disturbed areas prior to reclamation.

f. Reclaim sites during optimum seasons (e.g. late fall/early winter or early spring).

g. Complete final reclamation activities so that seeding occurs during the first optimal season following plugging and abandonment of oil and gas wells.

5. Interim reclamation

a. Use a variety of native grasses and forbs to establish effective, interim reclamation on all disturbed areas (e.g., road shoulders and borrow areas), including disturbed areas where additional future ground disturbance is expected to occur.

b. Perform interim reclamation to final reclamation species composition and establishment standards.

c. Perform "interim" reclamation on all disturbed areas not needed for active support of production operations.

6. Riparian areas

a. Replace all riparian vegetation removed during development at a rate of at least 3:1.

b. Restore both form and function of impacted wetlands and riparian areas and mitigate erosion.

7. Disposal

a. Remove well pad and road surface materials that are incompatible with post-production land use and re-vegetation requirements.

b. Remove and properly dispose of degraded silt fencing and erosion control materials after their utility has expired.

c. Remove and properly dispose of pit contents where contamination of surface water, groundwater, or soil by pit contents cannot be effectively prevented.

8. Establishing reclaimed areas

a. Apply certified weed free mulch and crimp or tacify to remain in place to reclaim areas for seed preservation and moisture retention.

b. Utilize staked soil retention blankets for erosion control and reclamation of large surface areas with 3:1 or steeper slopes. Avoid use of plastic blanket materials, known to cause mortality of snakes.

c. Install cattle guards to regulate livestock pasture utilization;

d. Control weeds in areas surrounding reclamation areas in order to reduce weed competition.

e. Educate employees and contractors about weed issues.

9. Fencing

a. Support development and implementation of portable wildlife-proof fencing that could be used to protect vegetation during early stages of development then moved

to another area. These should be implemented in areas where establishment of browse species is a priority. Monitor production of browse in areas receiving protection and compare to browse production in an adjacent area.

b. Fence livestock and/or wildlife out of newly reclaimed areas until reclamation standards have been met and plants are capable of sustaining herbivory.

c. Inventory, monitor and remove obsolete, degraded, or hazardous fencing.

H. MONITORING: *These measures assess the ecological condition of a disturbed area and measure the success or failure of the reclamation effort as well as measuring effects of development activities on other resources.*

1. Conduct necessary reclamation and invasive plant monitoring.

2. Census and assess the utilization of the reclaimed areas by the target species.

3. Maintain pre and post development site inspection records and monitor operations for compliance.

4. For those surface waters supporting fisheries, establish baseline water chemistry prior to development and establish a regular and repeated water chemistry monitoring and reporting program for groundwater, surface waters, and produced water discharged on the surface to detect and allow effective response to water quality issues that may impact aquatic wildlife. Quantify levels of pH, alkalinity, specific conductance, major cations/anions (including Cl, Fl, Sulphate, Sodium), total dissolved solids, BTEX/GRO/DRO, TPH, PAH (including benzo (a) pyrene), and metals (including As, Ba, Ca, Cd, Cr, Fe, Mg, Pb, Se), nitrate, nitrite, ammonia-N, turbidity, dissolved oxygen, hydrogen sulfide, and water temperature.

5. Monitor soil chemistry and structure where CBM or other produced water is put to a beneficial use (i.e., irrigation, water sources for wildlife, etc.).

6. Utilize GIS technologies to assess the extent of disturbance and document the reclamation progression and the footprint of disturbances.

III. RESEARCH:

These measures are suggested where questions or uncertainties exist about the degree of impact to specific resources or other aspects of oil and gas development or reclamation is unknown.

A. Collaborate and/or fund research investigation into the impacts of oil and gas development activities on wildlife resources.

B. Support research to test the effectiveness of specific Best Management Practices.

C. Identify native species for which commercial seed sources are not available. Provide support to contractors for developing cultivation and seed production techniques for needed species.

D. Conduct reclamation field trials to match seed mixes, soil preparation techniques, and planting methods to local conditions.