

January 23, 2014

Jim Komatinsky
Land Use Specialist
Colorado Parks and Wildlife
711 Independent Avenue
Grand Junction, CO 81505

RE: De Beque Station Wildlife BMP Plan

Mr. Komatinsky:

On behalf of Black Hills Exploration and Production, WWC Engineering is submitting a proposed wildlife BMP plan for the De Beque Station project for review and approval. Approval of this plan will be submitted to the Colorado Oil and Gas Conservation Commission (COGCC) with permit Form 2A.

The De Beque station project is a proposed production water reuse and raw water facility to conserve water by recycling flow-back and produced water for re-use in well stimulations or drilling. The project is located in the SE ¼ of the SW ¼ of Section 29, Township 8 South, Range 97 West, 6th P.M. A site map is located in Attachment A. At this location, it was identified by Mr. Komatinsky that the project will be within mule deer critical winter range, black bear habitat, and potentially white-tailed prairie dog colonies. To mitigate impacts to these wildlife sensitive areas, the following wildlife best management practices will be incorporated into the project design and permitting:

1. A copy of the Colorado Parks and Wildlife Actions to Minimize Adverse Impacts to Wildlife Resources is located in Attachment B. This document provides general and species specific wildlife BMP guidelines that shall be followed.
2. Night lighting shall be of the full-cutoff type and/or timed or otherwise minimized to reduce disruption to wildlife.
3. The proposed location lies within year-round black bear habitat. There is potential for human/bear conflicts with gas exploration employees who are working and/or camping in these areas during development operations. The potential for human/bear conflicts within these project areas will be greatly reduced by placing and utilizing "bear proof" trash containers at work-site/camping locations during construction activities. Furthermore, workers affiliated with these projects shall be advised not to feed bears, whether intentional or not, since this activity is a violation of Colorado Parks and Wildlife Commission Regulations and is detrimental to wild bears. CPW has information on the design and purchase of "bear proof" trash containers, and will provide this information to anyone who is interested in preventing conflicts with bears during construction activities.

1/23/2014

4. Following the completion of construction activities, newly exposed soils shall be revegetated as soon as possible to prevent erosion and to reduce the likelihood of non-native plants becoming established in the area. Seed mix used for revegetation shall be certified as weed-free and consist of native seeds from plants that are common to the area.
5. To reduce the likelihood of truck – wildlife collisions, proper speed limits (< 25 mph) shall be posted and enforced on all service roads.
6. Fencing around the pit shall consist of a minimum of a 7-foot chain-link fence capable of preventing elk, deer and other wildlife from entering the pit; concurrently it shall have a small mesh type of fencing along the bottom of the fence (buried one-foot below grade level and extending a minimum of two-feet above grade) capable of preventing small animals from entering between the gaps (gaps should be no larger than three-inches).
7. The pits shall be constructed with a 4:1 slope escape ramp and/or with chain-link fencing in one corner of the pit to allow entrapped wildlife to escape.
8. The pits shall be adequately protected to ensure that waterfowl and other birds are prevented – excluded – from entering or coming in contact with water in the pits. Blacks Hill would like to use an innovative product called Hexprotect Cover. This HDPE cover has an AQUA version that self ballasts and is wind resistant up to 130 mph. Documentation for this product is included in Attachment C.
9. CPW shall be notified immediately if any birds and/or wildlife are found dead or trapped within or around the pits, netting, or fences.

It is our sincere hope that this plan adequately addresses the requirements of CPW and that the **De Beque Station Wildlife BMP Plan** be approved as soon as possible. Please do not hesitate to contact us should you have any further questions or require additional clarification.

Sincerely,



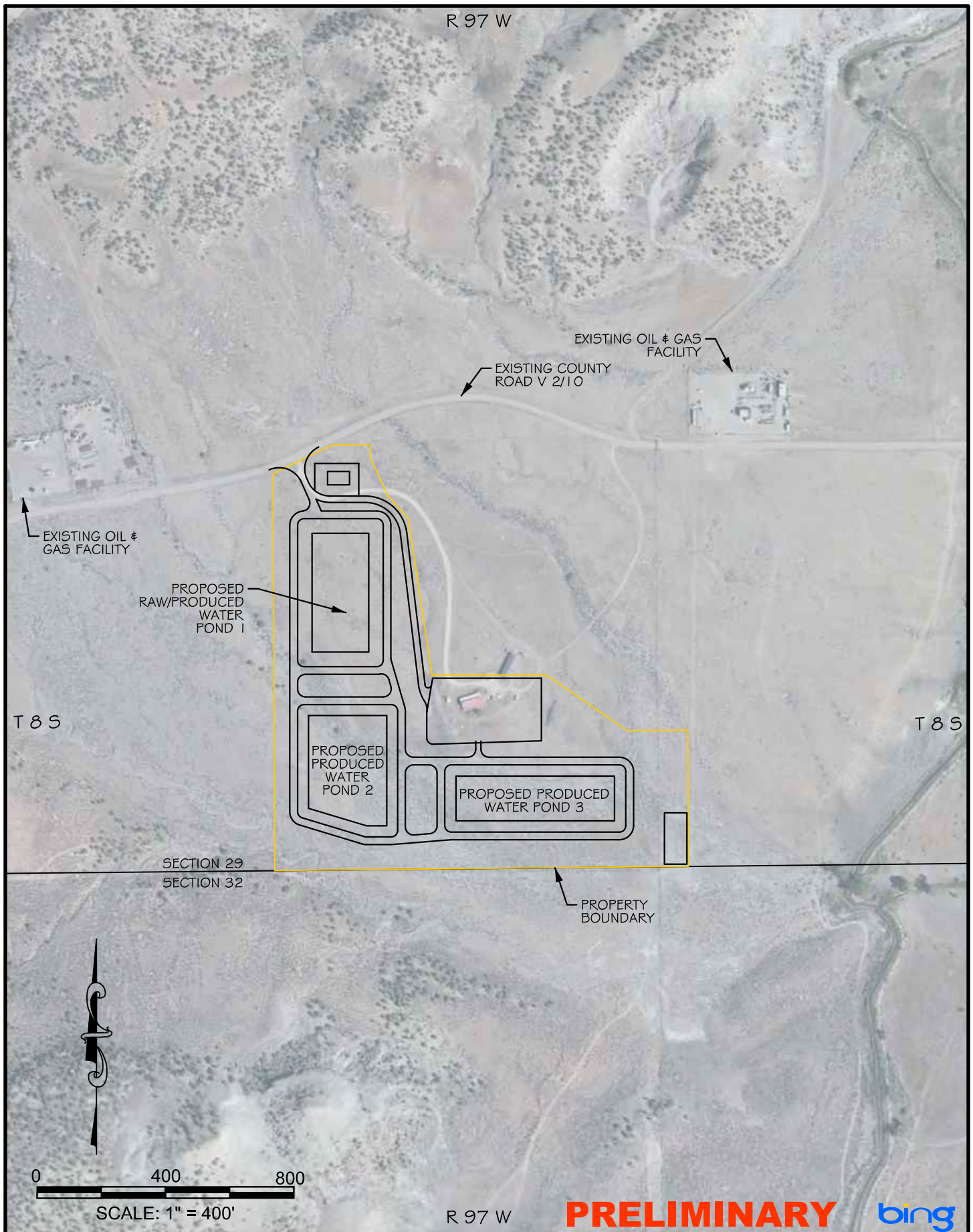
Drew Pearson, P.E.
Project Engineer



cc: File

Encl.: As Noted
DP

ATTACHMENT A

SITE MAP



ATTACHMENT A	<p align="center">DE BEQUE STATION SECTION 29, T8S, R97W 6TH P.M.</p> <p align="center">SITE MAP</p>	<table border="1"> <tr> <th>DSGN</th> <th>DATE</th> <th>CKD</th> </tr> <tr> <td>DDP</td> <td>01/14</td> <td>STH</td> </tr> <tr> <th>REV</th> <th>DATE</th> <th>CKD</th> </tr> <tr> <td>DDP</td> <td>2/7/14</td> <td>STH</td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </table>	DSGN	DATE	CKD	DDP	01/14	STH	REV	DATE	CKD	DDP	2/7/14	STH							<p>APPLICANT:</p> <p align="center">  Black Hills Exploration & Production <small>A DENVER AREA COMPANY</small> </p> <p>1515 WYNKOOP ST., SUITE 500 DENVER, CO 80202 (303) 566-3356</p>	<p align="center">  WWCENGINEERING </p> <p>1275 MAPLE STREET, SUITE F HELENA, MT 59601 (406) 443-3962</p>
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ATTACHMENT B

COLORADO PARKS AND WILDLIFE ACTIONS TO MINIMIZE ADVERSE IMPACTS TO WILDLIFE RESOURCES

ACTIONS TO MINIMIZE ADVERSE IMPACTS TO WILDLIFE RESOURCES

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:
 1. Dialkyl dimethyl ammonium chloride, 5-10% by weight;
 2. Alkyl dimethyl benzyl ammonium chloride, 5-10% by weight;
 3. Nonyl phenol ethoxylate, 5-10% by weight;
 4. Sodium sesquicarbonate, 1-5%;

5. Ethyl alcohol, 1-5%; and
 6. Tetrasodium ethylene diaminetetraacetate, 1-5%;
 7. 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 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 do 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 (*Artemisia 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 attribute 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 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 tacy 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.
9. Educate employees and contractors about weed issues. 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, F, 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.

IV. SPECIES SPECIFIC RECOMMENDATIONS

These reasonable recommendations are derived from the best available science and represent preferred management actions to protect wildlife and wildlife habitats where oil and gas development is occurring.

BAT ROOST SITES

- Consult with CDOW regarding locations of known bat roost sites.
- Avoid surface disturbance activities within 0.25 mile of all Townsend's Big-Eared Bat, Fringed Myotis, and Brazilian Free-Tailed Bat roost sites.

BIGHORN SHEEP

- Consult with CDOW regarding big game seasonal restrictions on wintering or production areas.
- Avoid surface disturbance and construction activities on or within any bighorn sheep production or wintering areas.
- Where oil and gas activities must occur in bighorn sheep production areas, avoid conducting these activities from April 15 to June 30 for Rocky Mountain Bighorn Sheep and from February 28 to May 1 for Desert Bighorn Sheep.
- Where oil and gas activities must occur in bighorn sheep winter range, avoid conducting these activities from November 1 through April 15.
- Avoid low elevation (below 500 feet altitude) helicopter overflights within 1 mile radius of bighorn sheep winter range between November 1 and April 15.
- Avoid low elevation (below 500 feet altitude) helicopter overflights within 1 mile radius of bighorn sheep production areas from April 15 to June 30 for Rocky Mountain Bighorn Sheep and from February 28 to May 1 for Desert Bighorn Sheep.
- Avoid surface facility density in excess of 10 well pads per 10-square mile area (one well pad per section) in bighorn sheep winter range and production areas.
- When surface density of oil and gas facilities exceeds 1 well pad/section, initiate a Comprehensive Development Plan (CDP) that includes recommendations for off-site and compensatory mitigation actions.
- Gate single-purpose roads to reduce traffic disruptions to wildlife.
- Close and immediately reclaim all roads that are redundant, not used regularly, or have been abandoned to the maximum extent possible to minimize disturbance and habitat fragmentation.
- Identify critical habitat types and adjust development sites to avoid these areas.
- Restrict post-development well site visitations to the hours of 10:00 a.m. to 3:00 p.m. and reduce well site visitations during winter months.

BLACK BEAR

- Identify, avoid and protect climax mast producing vegetation that annually provides a significant source of fall forage for black bear, especially those areas that can be identified as being consistently frost-free and that provide mast when unfavorable conditions exist elsewhere.
- Initiate a food and waste/refuse management program that uses bear-proof food storage containers and trash receptacles.
- Initiate an education program that reduces bear conflicts.
- Establish policy to prohibit keeping food and trash in sleeping quarters.
- Establish policy to support enforcement of state prohibition on feeding of black bear.
- Report bear conflicts immediately to CDOW.

BLACK-FOOTED FERRET

- Place surface facilities outside of prairie dog colonies in the Wolf Creek Management Area, the Coyote Basin Management Area, and the valley bisected by Highway 40 running from the Utah/Colorado border to the town of Dinosaur.

- Avoid oil and gas activities in prairie dog colonies where documented sightings of black-footed ferrets have occurred since 2005.
- Avoid surface disturbances between March 1 and July 15, with special attention to the period between May 1 and July 15, in prairie dog colonies where black-footed ferrets have been released or documented since 2001.
- Conduct seismic activity outside the period from March 1 to July 15 in prairie dog colonies where black-footed ferrets have been released or where black-footed ferret occurrence has been documented since 2001.
- Limit seismic activity to daylight hours in these colonies.
- Limit development of new roads within Wolf Creek Management Area and Coyote Basin Management Area.
- Gate single-purpose roads and restrict general public access to reduce traffic disruptions to wildlife.
- Close and immediately reclaim all roads that are redundant, not used regularly, or have been abandoned to the maximum extent possible to minimize disturbance and habitat fragmentation.
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Promptly reclaim disturbed areas within prairie dog colonies within the Wolf Creek Management Area, the Coyote Basin Management Area, and the valley bisected by Highway 40 running from the Utah/Colorado border to the town of Dinosaur, CO with native grasses and forbs appropriate to the ecological site.
- Aggressively control non-native and invasive weeds, particularly cheatgrass, in reclamation areas within the Wolf Creek Management Area, the Coyote Basin Management Area, and the valley bisected by Highway 40 running from the Utah/Colorado border to the town of Dinosaur, CO.
- Survey for black-footed ferret when impacting prairie dog colonies unless the site is less than 80 acres in size for black-tailed prairie dogs, less than 200 acres in size for white-tailed prairie dogs or Gunnison's prairie dogs, or within a designated block-cleared area.

COLUMBIAN SHARP-TAILED GROUSE

- Consult with CDOW at the earliest stage of development to review detailed maps of Columbian sharp-tailed grouse seasonal habitats and to help select development sites.
- Conduct comprehensive development planning that provides a clear point of reference in evaluating, avoiding, and mitigating large scale and cumulative impacts.
- No surface occupancy within 0.4 mile of any known Columbian sharp-tailed grouse lek.
- Avoid oil and gas operations within 1.25 miles of any known Columbian sharp-tailed grouse lek, and within mapped Columbian sharp-tailed grouse breeding, summer, and winter habitat outside the 1.25 mile buffer. Select sites for development that will not disturb suitable nest cover or brood-rearing habitats within 1.25 miles of an active lek, or within identified nesting and brood-rearing habitats outside the 1.25 mile perimeter.
- Where oil and gas activities must occur within 1.25 miles of Columbian sharp-tailed grouse leks or within other mapped Columbian sharp-tailed grouse breeding or summer habitat, conduct these activities outside the period between March 15 and July 30.
- Where oil and gas activities must occur within mapped Columbian sharp-tailed grouse winter habitat, conduct these activities outside the period between December 1 and March 15.
- Restrict well site visitations to portions of the day between 9:00 a.m. and 4:00 p.m. during the lekking season (March 1 to June 1).
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.

- Avoid surface facility density in excess of 10 well pads per 10-square mile area (one well pad per section) in Columbian sharp-tailed grouse breeding and summer habitat (within 1.25 miles of active leks).
- When surface density of oil and gas facilities exceeds 1 well pad/section, initiate a Comprehensive Development Plan (CDP) that includes recommendations for off-site and compensatory mitigation actions.
- Phase and concentrate all development activities, so that large areas of undisturbed habitat for wildlife remain and thorough reclamation occurs immediately after development and before moving to new sites. Development should progress at a pace commensurate with reclamation success.
- Retain core habitat areas and limit disturbance to ensure Columbian sharp-tailed grouse survival.
- Implement the species appropriate Infrastructure Layout and Drilling and Production Operations Wildlife Protection Measures found in Section II B. and Section II D. of this document.
- Minimize surface disturbance and fragmentation of Columbian sharp-tailed grouse habitat through use of the smallest facility footprints possible, use of multiple well pads, clustering of roads and pipelines, and the widest possible spacing of surface facilities.
- When compressor stations must be sited within 1.25 miles of Columbian sharp-tailed grouse active and inactive (within last 10 years) lek sites, locate compressor stations no closer than 2500 feet from the lek.
- Use noise reduction equipment on compressors and other development and production equipment.
- Use topographical features to provide visual concealment of facilities from known lek locations and as a noise suppressant.
- Muffle or otherwise control exhaust noise from pump jacks and compressors so that operational noise will not exceed 49 dB measured at 30 feet from the source.
- Design tanks and other facilities with structures such that they do not provide perches or nest substrates for raptors, crows and ravens.
- Install raptor perch deterrents on equipment, fences, cross arms and pole tops in Columbian sharp-tailed grouse habitat.
- Utilize a central generator to feed the entire field via underground electrical lines.
- Where feasible, bury new power lines and retrofit existing power lines by burying them or installing perch guards to prevent their use as raptor perches.
- Design wastewater pits to minimize retention of stagnant surface water.
- Treat waste water pits and any associated pit containing water that provides a medium for breeding mosquitos with Bti (*Bacillus thuringiensis v. israelensis*) or take other effective action to control mosquito larvae that may spread West Nile Virus to wildlife, especially grouse.
- In consultation with CDOW, replace any permanently impacted, disturbed, or altered Columbian sharp-tailed grouse seasonal habitats by enhancing marginal sagebrush steppe communities (sagebrush and mountain shrub) and grassland within or immediately adjacent to mapped seasonal Columbian sharp-tailed grouse habitat.
- Implement the species appropriate reclamation guidelines found in Section II G. of this document.
- Use early and effective reclamation techniques, including an aggressive interim reclamation program to return habitat to use by Columbian sharp-tailed grouse as quickly as possible.

- Reclaim/restore Columbian sharp-tailed grouse habitats with native grasses and forbs conducive to optimal Columbian sharp-tailed grouse habitat and other wildlife appropriate to the ecological site.
- Use high diversity (10 species or more) reclamation seed mixes in Columbian sharp-tailed grouse habitat.
- Use approved CP-4D (Columbian sharp-tailed grouse) seed mixes, based on soil type, available from Farm Service Agency or Natural Resources Conservation Service, or other seed mixes approved by CDOW.
- Avoid aggressive non-native grasses in Columbian Sharp-tailed Grouse habitat reclamation.
- A small percentage of the appropriate species of big sagebrush should be re-seeded on disturbed sites.
- Reclamation of breeding habitat should include a substantially higher percentage of forbs than other areas.
- Native and select non-native forbs and legumes should be considered a vital component of reclamation seed mixes.

CUTTHROAT TROUT

- No surface disturbance within 300 feet of any water within a Designated Cutthroat Trout Habitat watershed.
- Avoid surface facility density in excess of 10 well pads per 10-square mile area (one well pad per section) in Designated Cutthroat Trout Habitat watersheds.
- When surface density of oil and gas facilities exceeds 1 well pad/section, initiate a Comprehensive Development Plan (CDP) that includes recommendations for off-site and compensatory mitigation actions.
- Bridge stream crossings or use culverts to prevent stream bed damages and the transfer of disease organisms.
- Minimize stream disturbances during June and July to avoid impacts to spawning cutthroat trout.
- When working in designated cutthroat trout habitat, 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:
 - Remove all mud and debris from equipment and spray/soak equipment with a 1:15 solution of disinfection solution containing the following ingredients:
 - Dialkyl dimethyl ammonium chloride, 5-10% by weight;
 - Alkyl dimethyl benzyl ammonium chloride, 5-10% by weight;
 - Nonyl phenol ethoxylate, 5-10% by weight;
 - Sodium sesquicarbonate, 1-5%;
 - Ethyl alcohol, 1-5%; and
 - Tetrasodium ethylene diaminetetraacetate, 1-5%
 - 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
 - Spray/soak equipment with water greater than 140 degrees Fahrenheit for at least 10 minutes.
 - Sanitize water suction hoses and water transportation tanks (using methods described above) and discard rinse water at an appropriately permitted disposal facility.

DEER AND ELK

- Consult with CDOW at the earliest stage of development to identify the locations of mule deer and elk important wintering habitats and production areas. Adjust development sites to avoid critical habitat patches.
- Conduct comprehensive development planning that provides a clear point of reference in evaluating, avoiding, and mitigating large scale and cumulative impacts.
- Avoid oil and gas activities within mule deer critical winter range, elk winter concentration areas, elk production areas, and migration corridors.
- Where oil and gas activities must occur in mule deer critical winter range or elk winter concentration areas, conduct these activities outside the time period from December 1 through April 15.
- Where oil and gas activities must occur in elk production areas, conduct these activities outside the time period from May 15 through June 30.
- Restrict post-development well site visitations to between the hours of 10:00 a.m. and 3:00 p.m. and reduce well site visitations between December 1 and April 15 in mule deer and elk winter range.
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Avoid surface facility density in excess of 10 well pads per 10-square mile area (one well pad per section) in mule deer and elk winter range and in elk production areas.
- When surface density of oil and gas facilities exceeds 1 well pad/section, initiate a Comprehensive Development Plan (CDP) that includes recommendations for off-site and compensatory mitigation actions.
- Phase and concentrate all development activities, so that large areas of undisturbed habitat for wildlife remain and thorough reclamation occurs immediately after development and before moving to new sites. Development should progress at a pace commensurate with reclamation success.
- Implement the species appropriate Infrastructure Layout and Drilling and Production Operations Wildlife Protection Measures found in Section II B. and Section II D. of this document.
- Identify critical habitat types and patches and adjust development sites to avoid these areas.
- Prior to development, establish baseline vegetation condition and inventory and to provide a basis for post-development habitat restoration.
- Gate single-purpose roads and restrict general public access to reduce traffic disruptions to wildlife.
- Close and immediately reclaim all roads that are redundant, not used regularly, or have been abandoned to the maximum extent possible to minimize disturbance and habitat fragmentation.
- Implement the species appropriate reclamation guidelines found in Section II G. of this document.
- Avoid aggressive non-native grasses and shrubs in mule deer and elk habitat restoration.
- Reclaim mule deer and elk habitats with native shrubs, grasses, and forbs appropriate to the ecological site disturbed.
- Restore appropriate sagebrush species or subspecies on disturbed sagebrush sites. Use locally collected seed for reseeding where possible.

GREATER PRAIRIE CHICKEN

- Consult with CDOW at the earliest stage of development to review detailed maps of greater prairie chicken seasonal habitats and to help select development sites.

- Conduct comprehensive development planning that provides a clear point of reference in evaluating, avoiding, and mitigating large scale and cumulative impacts.
- No surface occupancy within 0.6 mile of any active or inactive (within past 10 years) greater prairie chicken leks.
- Avoid oil and gas operations within 2.2 miles of active leks and within greater prairie chicken nesting and early brood-rearing habitat outside the 2.2 mile buffer. Select sites for development that will not disturb suitable nest cover or brood-rearing habitats within 2.2 miles of an active lek, or within identified nesting and brood-rearing habitats outside the 2.2 mile perimeter.
- Where oil and gas activities must occur within 2.2 miles of active leks, conduct these activities outside the period between March 1 and June 30.
- Restrict well site visitations to portions of the day between 9:00 a.m. and 4:00 p.m. during the lekking season (March 1 to May 15).
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Avoid surface facility density in excess of 10 well pads per 10-square mile area (one well pad per section) in greater prairie chicken nesting and early brood-rearing habitat (within 2.2 miles of active leks).
- When surface density of oil and gas facilities exceeds 1 well pad/section, initiate a Comprehensive Development Plan (CDP) that includes recommendations for off-site and compensatory mitigation actions.
- Phase and concentrate all development activities, so that large areas of undisturbed habitat for wildlife remain and thorough reclamation occurs immediately after development and before moving to new sites. Development should progress at a pace commensurate with reclamation success.
- Implement the species appropriate Infrastructure Layout and Drilling and Production Operations Wildlife Protection Measures found in Section II B. and Section II D. of this document.
- Locate compressor stations at least 2.2 miles away from greater prairie chicken active and historic (within last 10 years) lek sites. When compressor stations must be sited within 2.2 miles of greater prairie chicken active and historic (within last 10 years) lek sites, locate compressor stations farther than 0.6 mile (3200 feet) from greater prairie chicken lek sites.
- Use topographical features to provide visual concealment of facilities from known lek locations and as a noise suppressant.
- Muffle or otherwise control exhaust noise from pump jacks and compressors so that operational noise will not exceed 49 dB measured at 30 feet from the source.
- Utilize a central generator to feed the entire field via underground electrical lines.
- Design tanks and other facilities with structures such that they do not provide perches or nest substrates for raptors, crows and ravens.
- Install raptor perch deterrents on equipment, fences, cross arms and pole tops in greater prairie-chicken habitat.
- Bury new power lines and retrofit existing power lines by burying them or installing perch guards to prevent their use as raptor perches.
- Design wastewater pits to minimize retention of stagnant surface water.
- Treat waste water pits and any associated pit containing water that provides a medium for breeding mosquitos with Bti (*Bacillus thuringiensis v. israelensis*) or take other effective action to control mosquito larvae that may spread West Nile Virus to wildlife, especially grouse.
- In consultation with CDOW, replace any permanently impacted, disturbed, or altered sand sagebrush habitat within identified nesting and brood rearing range through enhancement of

existing or marginal sand sagebrush habitat or reclamation of altered or converted habitat within or immediately adjacent to mapped nesting or brood rearing habitat.

- Implement the species appropriate reclamation guidelines found in Section II G. of this document.
- Use early and effective reclamation techniques, including an aggressive interim reclamation program, to return habitat to use by greater prairie-chicken as quickly as possible.
- Restore greater prairie chicken habitat with native grasses and forbs conducive to optimal greater prairie chicken habitat and other wildlife appropriate to the ecological site.
- Use one of several approved CP-4D (greater prairie chicken) seed mixes, based on soil type, available from Farm Service Agency or Natural Resources Conservation Service, or other seed mixes approved by CDOW.
- Do not plant buffalo grass, blue grama and sideoats grama in greater prairie chicken habitat as they will eventually dominate the resulting stand and will not provide greater prairie chicken habitat.
- Restore appropriate native shrub species to disturbed sites.
- Do not use non-native grasses or shrubs in greater prairie chicken habitat reclamation.
- Reclamation of breeding habitat should include a substantially higher percentage of forbs than other areas.
- Utilize native and select non-native forbs and legumes in seed mixes as they are a vital component of brood-rearing habitat. Dryland adapted varieties of alfalfa and yellow sweet clover should be the primary non-native forbs used.

GUNNISON AND GREATER SAGE-GROUSE

- Consult with CDOW at the earliest stage of development to review detailed maps of Gunnison or greater sage-grouse seasonal habitats and to help select development sites.
- Identify seasonal habitats and migratory patterns of sage-grouse. Map all seasonal habitats using CDOW habitat selection models as they become available.
- Conduct comprehensive development planning that provides a clear point of reference in evaluating, avoiding, and mitigating large scale and cumulative impacts.
- No surface occupancy within 0.6 mile of any known Gunnison or greater sage-grouse lek.
- Avoid oil and gas operations within 4 miles of any known Gunnison or greater sage-grouse lek, and within mapped Gunnison or greater sage-grouse breeding, summer, and winter habitat outside the 4 mile buffer. Select sites for development that will not disturb suitable nest cover or brood-rearing habitats within 4 miles of an active lek, or within identified nesting and brood-rearing habitats outside the 4-mile perimeter.
- Where oil and gas activities must occur within 4 miles of Gunnison or greater sage-grouse leks or within other mapped Gunnison or greater sage-grouse breeding or summer habitat, conduct these activities outside the period between March 1 and June 30.
- Where oil and gas activities must occur within mapped Gunnison or greater sage-grouse winter habitat, conduct these activities outside the period between December 1 and March 15.
- Restrict well site visitations to portions of the day between 9:00 a.m. and 4:00 p.m. during the lekking season (March 1 to May 15).
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Avoid surface facility density in excess of 10 well pads per 10-square mile area (one well pad per section) in Gunnison or greater sage-grouse breeding and summer habitat (within 4 miles of active leks).

- When surface density of oil and gas facilities exceeds 1 well pad/section, initiate a Comprehensive Development Plan (CDP) that includes recommendations for off-site and compensatory mitigation actions.
- Phase and concentrate all development activities, so that large areas of undisturbed habitat for wildlife remain and thorough reclamation occurs immediately after development and before moving to new sites. Development should progress at a pace commensurate with reclamation success.
- Avoid core areas as outlined in the Greater Sage-Grouse Statewide Plan, available from CDOW to ensure sage-grouse persistence and retain Gunnison sage-grouse core areas to ensure Gunnison sage-grouse persistence
- Implement the species appropriate Infrastructure Layout and Drilling and Production Operations Wildlife Protection Measures found in Section II B. and Section II D. of this document.
- Minimize surface disturbance and fragmentation of Gunnison or greater sage-grouse habitat through use of the smallest facility footprints possible, use of multiple well pads, clustering of roads and pipelines, and the widest possible spacing of surface facilities.
- Locate facilities in vegetation types other than sagebrush to avoid impacts to sage-grouse breeding and wintering habitat.
- Use drill mats to prevent habitat loss or disturbance and reduce reclamation costs.
- When compressor stations must be sited within 4 miles of Gunnison or greater sage-grouse active and inactive (within last 10 years) lek sites, locate compressor stations farther than 0.6 mile (3,200 feet) from sage-grouse lek sites. Use noise reduction equipment on compressors and other development and production equipment.
- Use topographical features to provide visual concealment of facilities from known lek locations and as a noise suppressant.
- Muffle or otherwise control exhaust noise from pump jacks and compressors so that operational noise will not exceed 49 dB measured at 30 feet from the source.
- Design tanks and other facilities with structures such that they do not provide perches or nest substrates for raptors, crows and ravens.
- Install raptor perch deterrents on equipment, fences, cross arms and pole tops in Gunnison or greater sage-grouse habitat.
- Remove all unnecessary infrastructure.
- Utilize a central generator to feed the entire field via underground electrical lines.
- Where feasible, bury new power lines and retrofit existing power lines by burying them or installing perch guards to prevent their use as raptor perches.
- Design wastewater pits to minimize retention of stagnant surface water.
- Treat waste water pits and any associated pit containing water that provides a medium for breeding mosquitos with Bti (*Bacillus thuringiensis v. israelensis*) or take other effective action to control mosquito larvae that may spread West Nile Virus to wildlife, especially grouse.
- In consultation with CDOW, replace any permanently impacted, disturbed, or altered Gunnison or greater sage-grouse seasonal habitats by enhancing marginal sagebrush steppe communities (big sagebrush and related communities) and grasslands within or immediately adjacent to mapped seasonal Gunnison or greater sage-grouse habitat.
- Implement the species appropriate reclamation guidelines found in Section II G. of this document.
- Use early and effective reclamation techniques, including an aggressive interim reclamation program, to return habitat to use by Gunnison or greater sage-grouse as quickly as possible.

- Reclaim/restore Gunnison or greater sage-grouse habitats with native grasses, forbs, and shrubs conducive to optimal Gunnison or greater sage-grouse habitat and other wildlife appropriate to the ecological site.
- Use high diversity (10 species or more) reclamation seed mixes in Gunnison or greater sage-grouse habitat.
- Use approved CP-4D (Gunnison or greater sage-grouse) seed mixes, based on soil type, precipitation, and elevation, available from Farm Service Agency or Natural Resources Conservation Service, or other seed mixes approved by CDOW.
- Avoid aggressive non-native grasses in Gunnison or greater sage-grouse habitat reclamation.
- Restore disturbed sagebrush sites with the appropriate sagebrush species or subspecies on disturbed sagebrush sites. Use locally collected seed for reseeding where possible.
- Reclaim mapped summer habitat with a substantially higher percentage of forbs (> 15 percent cover post establishment) than used in other areas.
- Utilize native and select non-native forbs and legumes in seed mixes as they are a vital component of brood-rearing habitat.

KIT FOX

- Survey for kit fox den sites in appropriate habitats before development and avoid surface disturbance within 0.25 mile of den sites while young are den dependent (Feb 1 to May 1).
- Gate single-purpose roads and restrict general public access to reduce traffic disruptions to wildlife.
- Close and immediately reclaim all roads that are redundant, not used regularly, or have been abandoned to the maximum extent possible to minimize disturbance and habitat fragmentation.
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Utilize native vegetation for reclamation within kit fox overall range.
- Restrict use of pesticides for rodent control in kit fox overall range to prevent reduction of kit fox food supplies and secondary toxicity.
- Limit or restrict artificial water sources within kit fox overall range to prevent the spread of competitive predators into kit fox habitat.

LEAST TERN

- No surface occupancy within 300 feet of the high water mark of mapped least tern nesting habitat usually occurring on bare sandy shorelines of reservoirs, islands in reservoirs, or sand bars along major rivers in eastern Colorado.
- No surface disturbance to least tern foraging areas during the nesting season (April 1 to July 31) to include shallow water areas in lakes, ponds, and river backwater areas within 0.5 mile of known least tern production areas.

LESSER PRAIRIE CHICKEN

- Consult with CDOW at the earliest stage of development to review detailed maps of lesser prairie chicken seasonal habitats and to help select development sites.
- Conduct comprehensive development planning that provides a clear point of reference in evaluating, avoiding, and mitigating large scale and cumulative impacts.
- No surface occupancy within 0.6 mile of any active or inactive (within past 10 years) lesser prairie chicken leks.
- Avoid oil and gas operations within 2.2 miles of active leks and within lesser prairie chicken nesting and early brood-rearing habitat outside the 2.2 mile buffer. Select sites for

development that will not disturb suitable nest cover or brood-rearing habitats within 2.2 miles of an active lek, or within identified nesting and brood-rearing habitats outside the 2.2 mile perimeter.

- Where oil and gas activities must occur within 2.2 miles of active leks, conduct these activities outside the period between March 15 and June 15.
- Restrict well site visitations to portions of the day between 9:00 a.m. and 4:00 p.m. during the lekking season (March 15 to June 15).
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Avoid surface facility density in excess of 10 well pads per 10-square mile area (one well pad per section) in lesser prairie chicken nesting and early brood-rearing habitat (within 2.2 miles of active leks).
- When surface density of oil and gas facilities exceeds 1 well pad/section, initiate a Comprehensive Development Plan (CDP) that includes recommendations for off-site and compensatory mitigation actions.
- Phase and concentrate all development activities, so that large areas of undisturbed habitat for wildlife remain and thorough reclamation occurs immediately after development and before moving to new sites. Development should progress at a pace commensurate with reclamation success.
- Implement the species appropriate Infrastructure Layout and Drilling and Production Operations Wildlife Protection Measures found in Section II B. and Section II D. of this document.
- Locate compressor stations at least 2.2 miles away from lesser prairie chicken active and historic (within last 10 years) lek sites. When compressor stations must be sited within 2.2 miles of lesser prairie chicken active and historic (within last 10 years) lek sites, locate compressor stations farther than 0.6 mile (3,200 feet) from lesser prairie chicken lek sites.
- Use topographical features to provide visual concealment of facilities from known lek locations and as a noise suppressant.
- Muffle or otherwise control exhaust noise from pump jacks and compressors so that operational noise will not exceed 49 dB measured at 30 feet from the source.
- Utilize a central generator to feed the entire field via underground electrical lines.
- Design tanks and other facilities with structures such that they do not provide perches or nest substrates for raptors, crows and ravens.
- Install raptor perch deterrents on equipment, fences, cross arms and pole tops in lesser prairie-chicken habitat.
- Bury new power lines and retrofit existing power lines by burying them or installing perch guards to prevent their use as raptor perches.
- Design wastewater pits to minimize retention of stagnant surface water.
- Treat waste water pits and any associated pit containing water that provides a medium for breeding mosquitos with Bti (*Bacillus thuringiensis v. israelensis*) or take other effective action to control mosquito larvae that may spread West Nile Virus to wildlife, especially grouse.
- Use early and effective reclamation techniques, including an aggressive interim reclamation program to return habitat to use by lesser prairie-chicken as quickly as possible.
- In consultation with CDOW, replace any permanently impacted, disturbed, or altered sand sagebrush habitat within identified nesting and brood rearing range through enhancement of existing or marginal sand sagebrush habitat or reclamation of altered or converted habitat within or immediately adjacent to mapped nesting or brood rearing habitat.
- Implement the species appropriate reclamation guidelines found in Section II G. of this document.

- When reclaiming breeding habitat, include a substantially higher percentage of forbs than used in other areas.
- Reclaim lesser prairie chicken habitats with native grasses including switchgrass, big bluestem, little bluestem, sand bluestem, yellow Indian grass, and prairie sandreed.
- Do not plant buffalo grass, blue grama and sideoats grama in lesser prairie chicken habitat as they will eventually dominate the resulting stand and will not provide lesser prairie chicken habitat.
- Restore appropriate native shrub species to disturbed sites.
- Do not use aggressive non-native grasses or shrubs in lesser prairie chicken habitat reclamation.
- Utilize native and select non-native forbs and legumes in seed mixes as they are a vital component of brood-rearing habitat. Dry land adapted varieties of alfalfa and yellow sweet clover should be the primary non-native forb species used.

LYNX

- Consult with DOW regarding lynx use of the development area.
- Avoid locating facilities within lynx breeding habitat (spruce-fir forest south of Interstate 70 above 9,000 feet in elevation and with slopes greater than 25%).
- Prior to development, establish baseline vegetation condition and inventory and to provide a basis for post-development habitat restoration.
- Identify, avoid, and protect vegetation used by snowshoe hare.
- Apply stipulations during programmatic planning stage for oil and gas that limit occupancy, control surface use or control timing of activities in lynx habitats.
- On projects where over-the-snow access is required, restrict use to designated routes.
- Minimize snow compaction when authorizing and monitoring developments.
- Utilize remote monitoring of sites that are located in lynx habitat, to reduce disturbance from well visitation.
- Restrict public access on single purpose roads during project activities.
- Close and immediately reclaim all roads that are redundant, not used regularly, or have been abandoned to the maximum extent possible to minimize disturbance and habitat fragmentation.
- Report all lynx sightings to DOW.
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Minimize traffic in occupied lynx habitat between 3:00 p.m. and 7:00 a.m.
- Reclaim newly constructed pipelines immediately following construction and do not allow any motorized vehicles access to pipeline (i.e., install barriers, boulders etc).
- Encourage developers to pipe produced water to a central site for transport, in order to reduce truck traffic to each well pad site.
- Minimize upgrading of roads used to access oil/gas developments or transmission pipelines in lynx habitat or linkage areas.
- Develop a reclamation plan (e.g. road reclamation and vegetation rehabilitation) for abandoned well sites to restore suitable habitat for lynx.

MOUNTAIN PLOVER

- Survey suitable nesting habitat within the known range of mountain plover that is proposed for development during the appropriate season. Flag active nests and apply the seasonal restriction described below.
- No surface occupancy within 300 feet of active mountain plover nest sites until young are hatched and independent of nest.

PIPING PLOVER

- No surface occupancy within 300 feet of the high water mark of mapped piping plover nesting habitat usually occurring on sandy open shorelines of reservoirs and lakes, or islands in reservoirs or lakes in eastern Colorado.
- No surface disturbance to piping plover foraging areas during the nesting season (April 1 to July 31) to include shallow water areas along exposed beach substrates associated with lakes, ponds, and beaches, and dry, barren sandbars along backwater river areas with abundant macro-invertebrate and insect populations within 0.5 mile of known piping plover production areas.

PLAINS SHARP-TAILED GROUSE

- Consult with CDOW at the earliest stage of development to review detailed maps of plains sharp-tailed grouse seasonal habitats and to help select development sites.
- Conduct comprehensive development planning that provides a clear point of reference in evaluating, avoiding, and mitigating large scale and cumulative impacts.
- No surface occupancy within 0.4 mile of any known plains sharp-tailed grouse lek.
- Avoid oil and gas operations within 1.25 miles of any known plains sharp-tailed grouse lek, and within mapped plains sharp-tailed grouse breeding or summer habitat outside the 1.25 mile buffer. Select sites for development that will not disturb suitable nest cover or brood-rearing habitats within 1.25 miles of an active lek, or within identified nesting and brood-rearing habitats outside the 1.25 mile perimeter.
- Where oil and gas activities must occur within 1.25 miles of plains sharp-tailed grouse leks or within other mapped plains sharp-tailed grouse breeding or summer habitat, conduct these activities outside the period between March 1 and June 30.
- Restrict well site visitations to portions of the day between 9:00 a.m. and 4:00 p.m. during the lekking season (March 1 to June 1).
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Avoid surface facility density in excess of 10 well pads per 10-square mile area (one well pad per section) in plains sharp-tailed grouse breeding and summer habitat (within 1.25 miles of active leks).
- When surface density of oil and gas facilities exceeds 1 well pad/section, initiate a Comprehensive Development Plan (CDP) that includes recommendations for off-site and compensatory mitigation actions.
- Phase and concentrate all development activities, so that large areas of undisturbed habitat for wildlife remain and thorough reclamation occurs immediately after development and before moving to new sites. Development should progress at a pace commensurate with reclamation success.
- Retain core habitat areas and limit disturbance to ensure plains sharp-tailed grouse survival.
- Implement the species appropriate Infrastructure Layout and Drilling and Production Operations Wildlife Protection Measures found in Section II B. and Section II D. of this document.
- Minimize surface disturbance and fragmentation of plains sharp-tailed grouse habitat through use of the smallest facility footprints possible, use of multiple well pads, clustering of roads and pipelines, and the widest possible spacing of surface facilities.
- When compressor stations must be sited within 1.25 miles of plains sharp-tailed grouse active and inactive (within last 10 years) lek sites, locate compressor stations no closer than 2500 feet from the lek.

- Use noise reduction equipment on compressors and other development and production equipment.
- Use topographical features to provide visual concealment of facilities from known lek locations and as a noise suppressant.
- Muffle or otherwise control exhaust noise from pump jacks and compressors so that operational noise will not exceed 49 dB measured at 30 feet from the source.
- Design tanks and other facilities with structures such that they do not provide perches or nest substrates for raptors, crows and ravens.
- Install raptor perch deterrents on equipment, fences, cross arms and pole tops in plains sharp-tailed grouse habitat.
- Utilize a central generator to feed the entire field via underground electrical lines.
- Bury new power lines and retrofit existing power lines by burying them or installing perch guards to prevent their use as raptor perches.
- Design wastewater pits to minimize retention of stagnant surface water.
- Treat waste water pits and any associated pit containing water that provides a medium for breeding mosquitos with Bti (*Bacillus thuringiensis v. israelensis*) or take other effective action to control mosquito larvae that may spread West Nile Virus to wildlife, especially grouse.
- In consultation with CDOW, replace any permanently impacted, disturbed, or altered plains sharp-tailed grouse habitat within identified nesting and brood rearing range through enhancement of existing or marginal plains sharp-tailed grouse habitat or reclamation of altered or converted habitat within or immediately adjacent to mapped nesting or brood rearing habitat.
- Implement the species appropriate reclamation guidelines found in Section II G. of this document.
- Use early and effective reclamation techniques, including an aggressive interim reclamation program to return habitat to use by plains sharp-tailed grouse as quickly as possible.
- Reclaim/restore plains sharp-tailed grouse habitats with native grasses and forbs conducive to optimal plains sharp-tailed grouse habitat and other wildlife appropriate to the ecological site.
- Use approved CP-4D (plains sharp-tailed grouse) seed mixes, based on soil type, available from Farm Service Agency or Natural Resources Conservation Service, or other seed mixes approved by CDOW.
- Do not use aggressive non-native grasses in plains sharp-tailed grouse habitat reclamation.
- Establish a small percentage (i.e., less than 5% cover) of adapted native shrubs listed in the Farm Service Agency and Natural Resources Conservation Service's CP-4D plains sharp-tailed grouse seed mixes on disturbed sites.
- Reclaim brood rearing areas with a substantially higher percentage of forbs than other areas.
- Utilize native and select non-native forbs and legumes in seed mixes as they are a vital component of brood-rearing habitat. Suitable species include those forbs approved by the Farm Service Agency and the Natural Resources Conservation Service's CP-4D seed mixes for CRP. Dryland adapted varieties of alfalfa and yellow sweet clover should be the primary non-native forb species used.

PRAIRIE DOGS (White-Tailed & Gunnison's)

- Survey for active and inactive prairie dog colonies within development areas prior to development.
- Avoid construction on or in prairie dog colonies wherever possible.

- Where oil and gas activities must occur on or in white-tailed or Gunnison's prairie dog colonies, conduct these activities outside the period between March 1 and June 15.
- Avoid surface facility density in excess of 10 well pads per 10-square mile area (one well pad per section) in White-tailed and Gunnison's Prairie Dog Management Emphasis Areas that will be described in the Colorado Statewide Implementation Plan for the species.
- When surface density of oil and gas facilities exceeds 1 well pad/section, initiate a Comprehensive Development Plan (CDP) that includes recommendations for off-site and compensatory mitigation actions.
- Manage oil and gas activities within prairie dog colonies to minimize impacts to attributes that maintain the functional integrity of the prairie dog colony (e.g., vegetation, soils, burrow systems, etc.).
- Minimize road development and close roads to recreational use.
- Promptly reclaim disturbed areas within prairie dog colonies with native grasses and forbs appropriate to the ecological site.
- Aggressively control non-native and invasive weeds, particularly cheatgrass, in reclamation areas within prairie dog habitat.
- Install raptor perch deterrents on equipment, fences, cross arms and pole tops in prairie dog habitat.

PREBLE'S MEADOW JUMPING MOUSE

- No surface occupancy within 300 feet either side of centerline along streams of known or potentially occupied habitat along the northern Front Range from the Colorado Wyoming state line through northern El Paso County.
- Consult with the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers when permitting any permanent or temporary activity within known or potentially occupied habitat Preble's meadow jumping mouse habitat.

PRONGHORN ANTELOPE

- Avoid surface disturbance to and construction activities within pronghorn winter concentration areas west of I-25 from January 1 through March 31.
- Identify critical habitat types and adjust development sites to avoid these areas.
- Gate single-purpose roads to reduce traffic disruptions to wildlife.
- Close and immediately reclaim all roads that are redundant, not used regularly, or have been abandoned to the maximum extent possible to minimize disturbance and habitat fragmentation.
- Limit fence construction in pronghorn habitat. Use CDOW recommended pronghorn fence designs.
- Prior to development, establish baseline vegetation condition and inventory to provide a basis for post-development habitat restoration.
- Avoid aggressive non-native grasses and shrubs in pronghorn habitat restoration.
- Reclaim pronghorn habitats with native shrubs, grasses, and forbs appropriate to the ecological site disturbed.
- Restore appropriate sagebrush species or subspecies on disturbed sagebrush sites. Use locally collected seed for reseeding where possible. Sagebrush is less important in pronghorn reclamation on the eastern plains than it is in western Colorado (west of I-25).

RAPTORS

General Raptor Mitigation Measures

- Prior to ground disturbing activities, determine either through consultation with CDOW or surveys the locations of raptor nesting and roosting sites.
- Provide raptor survey data for incorporation into the CDOW raptor database.
- Consult with and implement CDOW recommendations regarding raptor protection measures including seasonal timing restrictions and recommended buffer zones.
- Avoid disturbance of raptor nesting habitat during the breeding season (variable by species--January 1 to July 15).
- Avoid impacts to raptor roost sites during the wintering period (variable by species--November 15 to April 1).
- Survey any suitable habitat (cliffs, large trees, snags) within 1 mile of a proposed project site for raptor nests. Where raptor nests are found, site the project to provide a suitable buffer zone, and/or place sufficient seasonal limitations on construction activity to protect the nest site.
- Bury utility lines in defined areas with high collision risk for birds.
- Implement recommendations from both *"Suggested Practices for Avian Protection on Power Lines, the State of the Art in 2006"* and the *"Avian Protection Plan (APP) Guidelines"* (2005) for proper design and retrofit considerations for powerlines and poles to minimize raptor electrocution. These documents can be ordered at the Edison Electric Institute web site (www.eei.org) or can be downloaded at the Avian Power Line Interaction Committee web site (www.aplic.org).

Bald Eagle

- No surface occupancy (beyond that which historically occurred in the area) within 0.25 mile of any active or historic bald eagle nest site.
- No human disturbance or construction activity within 0.5 mile of any active bald eagle nest from November 15 to July 31. Activity within 0.5 mile of bald eagle nest sites would be best conducted between August 15 and October 15.
- No surface occupancy or construction within 0.25 mile of any active bald eagle winter night roost site, where there is no direct line of sight to the roost, between December 1 and February 28 and within 0.5 mile of any active bald eagle winter night roost site, where there is a direct line of sight to the roost, between December 1 and February 28.
- No human disturbance within 0.5 mile of any active bald eagle winter roost site from November 15 to March 15 except for periodic visits such as oil maintenance and monitoring. Maintenance and monitoring work within the buffer zone after development should be restricted to the period between 10:00 a.m. and 2:00 p.m.
- No human disturbance within any mapped winter concentration areas between November 15 and March 15.

Ferruginous Hawk

- No surface occupancy (beyond that which historically occurred in the area) within 0.5 mile of active nest sites and associated alternate nests.
- No human encroachment or construction activity within 0.5 mile of any active ferruginous hawk nest or alternate nest site from February 1 to July 15.

Golden Eagle

- No surface occupancy (beyond that which historically occurred in the area) within 0.25 mile of any active golden eagle nest site.

- No human encroachment or construction activity within 0.5 mile of any active golden eagle nest from December 15 to July 15.

Mexican Spotted Owl

- No surface occupancy (beyond that which historically occurred in the area) within designated Mexican spotted owl protected activity centers (PAC's) without USFWS consultation.
- No surface disturbance between March 1 to August 31 within and adjacent to Mexican spotted owl protected activity centers (PAC's) without USFWS consultation.

Osprey

- No surface occupancy (beyond that which historically occurred in the area) within 0.25 mile of any active osprey nest site.
- No human encroachment or construction activity within 0.25 mile of any active osprey nest from April 1 to August 31.

Peregrine Falcon

- No surface occupancy (beyond that which historically occurred in the area) within 0.5 mile of any active or historic peregrine falcon nest site.
- No human encroachment or construction activity within 0.5 mile of any active peregrine falcon nest site from March 15 to July 31.

Burrowing Owl

- Adhere to recommended survey protocol and actions to protect nesting Burrowing Owls (e.g. survey active and inactive prairie dog colonies for presence of Burrowing Owls when construction will occur between March 1 and October 31).
- Conduct surface disturbance within 300 feet of any active burrowing owl nest site outside the period between March 1 and August 15.

RIVER OTTER

- Avoid or limit the use of pesticides, herbicides, and fertilizers within the flood plain in occupied river otter habitat.
- Minimize disturbance of riparian vegetation adjacent to waterways (i.e., within 300 feet) of occupied river otter habitat.
- Minimize road development within 300 feet of occupied river otter habitat, especially the creation of new stream or river crossings (bridges) in occupied river otter habitat.
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Provide information on sightings of live or dead river otters for incorporation into the CDOW river otter sightings database. Sighting forms are located at:
<http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/Mammals/RiverOtterObservation.htm>

SOUTHWEST WILLOW FLYCATCHER

- Survey for active nest sites during the breeding season within southwest willow flycatcher overall range.
- No Surface Occupancy within 300 feet of southwest willow flycatcher nest sites.
- No surface disturbance or removal of riparian habitat within 300 feet from stream edge within potential southwest willow flycatcher habitat

- Restrict activities May 15 to August 1 in potential southwest willow flycatcher habitat.

SWIFT FOX

- Survey for swift fox den sites and avoid surface disturbance within 0.25 mile while young are den dependent (March 15 to June 15).
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Utilize native vegetation for reclamation within swift fox overall range
- Restrict use of pesticides for rodent control in swift fox overall range.

WESTERN BOREAL TOAD

- No Surface Occupancy within 0.5 mile of known breeding sites.
- Consult with CDOW prior to any surface disturbance or construction activities within 600 feet of any documented western boreal toad field sighting or production area.

AQUATIC SPECIES/AMPHIBIANS

- Consult with CDOW or collect baseline aquatic species and macro-invertebrate inventory data both pre and post development.
- Conduct two pass population estimations for streams potentially affected. Report species composition, length-frequency and individual weights.
- Collect water samples to monitor water quality before, during and after occupation and document data and changes.
- No surface disturbance within 300 feet of any designated Gold Medal water.
- Design stream crossings to minimize the total number of crossings and so that crossings are at or as near to 90 degrees to the direction of stream flow.
- Construct stream crossings “in the dry” and avoid impacts to trout during spawning and hatching periods.
- Restrict trucks from crossing streams and utilize appropriate and effective culverts that don’t preclude upstream movement of fish.
- Avoid using low water crossings.
- Control erosion and sedimentation, and manage storm water runoff; reclaim sites as quickly as possible to restore vegetation.
- Control weeds along riparian corridors and manage livestock grazing to maintain riparian corridor health.
- Consider fencing riparian areas.
- Avoid changes to water quality and quantity.
- Repair incised channels where excessive erosion and sedimentation is occurring.
- Consider directional boring of pipeline crossings of perennial streams.
- Replace non-native riparian vegetation such as tamarisk and Russian olive with appropriate native plantings such as cottonwood or willow.
- Protect groundwater, riparian areas and wetlands by installing impermeable barriers beneath fluid pits.
- When working in designated Gold Medal waters, 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:
 - Remove all mud and debris from equipment and spray/soak equipment with a 1:15 solution of disinfection solution containing the following ingredients:

- Dialkyl dimethyl ammonium chloride, 5-10% by weight;
 - Alkyl dimethyl benzyl ammonium chloride, 5-10% by weight;
 - Nonyl phenol ethoxylate, 5-10% by weight;
 - Sodium sesquicarbonate, 1-5%;
 - Ethyl alcohol, 1-5%; and
 - Tetrasodium ethylene diaminetetraacetate, 1-5%
 - 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
 - Spray/soak equipment with water greater than 140 degrees Fahrenheit for at least 10 minutes.
 - Sanitize water suction hoses and water transportation tanks (using methods described above) and discard rinse water at an appropriately permitted disposal facility.
- Avoid stream channel disturbances during fish spawning seasons. Fish spawn at specific times of the year. The eggs incubate in the gravel until the yolk sac is absorbed and the larval fish can swim up through the gravel and into the main body of water. Eggs incubating in the redds can be smothered by the excessive deposition of sediment, and further affected by fungal spores carried in the sediment. Adults can be affected by the same fungal species with high mortality rates. Fish spawning dates and incubation times vary by elevation and temperatures, but in general the following intervals will apply in Colorado:
 - Rainbow trout: March 1 - June 15
 - Brown trout: October 1 – May 1
 - Brook trout: August 15 – May 1
 - Cutthroat trout: June 1 – September 1
 - Bluehead sucker: May 1 – July 15
 - Flannelmouth sucker: April 1 – July 1
 - Roundtail chub: May 15 – July 15

ATTACHMENT C

HEXPROTECT COVER

Hexprotect Cover

Advanced Water Treatment Technologies
Engineered for a lifetime

Wind resistant hexagonal tile cover.

AWTT INC. Hexprotect cover system is the result of intense and extensive research leading to a product which fulfills demands of an affordable and wind resistant floating cover for liquids.

This innovative hexagonal floating cover offers highly effective solutions to problematic liquid storage systems such as municipal and industrial wastewater, treatment processing plants, metal and petrochemical plants, leachate ponds, airports, raw water reservoirs and other applications for heat retention, photosynthesis prevention and or a wildlife deterrent.

The Hexprotect system ensures coverage of up to 99%. The resulting thermal insulation barrier combines the insulation factor of the air held in each tile with the poor heat conductivity of plastic. While the small air pockets between the tiles are not sealed, they also contribute to this insulation system, which dramatically reduces heat loss and light transfer. The cover also reduces liquid loss through evaporation and prevents odor problems.

The Hexprotect tile barrier, contrary to standard covers, does not represent an obstacle to static, moving or dipping equipment. The tiles can be easily pushed aside and the cover reforms itself as the basin and obstacles change configuration, as in a clarifier.

In fact, the tiles will keep up with liquid level, rising, lowering and restacking themselves as needed.

Hexprotect is also an effective wildlife deterrent. When entirely covered, the body of water becomes unattractive to waterfowl and other wildlife such as deer. They simply don't recognize it as water. Compared to netting, Hexprotect is not sensitive to ice or snow damage and do not require any kind of support.

Hexprotect is produced with high quality high density polyethylene. The expected life time is 25 years.

Technical Data:

Diagonal measure:	220 mm
Weight dry:	172 g
Weight installed:	455g
Height:	60 mm
No. per m2:	32
No. per square foot:	3



Hexprotect features:

- Quick and simple to install
- Up to 99% surface coverage
- Decrease liquid loss by evaporation by up to 95%
- Decrease emission by up to 95%
- Heating cost reduced by up to 85%
- Wind resistant up to 75 mph

Hexprotect added benefits :

- Deters waterfowl from landing on covered waters
- Each tile is made of long lasting, UV resistant, high quality HDPE
- Allow movement of equipment through liquid. Unlimited and easy access to the liquid.
- Adjust to the variation of the liquid level by spreading & stacking
- Naturally Self arrange and interlock on the liquid surface
- Fast and Effective solution to odor problems
- Virtually maintenance free
- Cannot tear like conventional membrane cover
- Reduces penetration of UV rays: prohibit growth of algae and clogging weeds.
- Aeration can be installed underneath the Hexprotect
- Reduce chemical consumption.
- Unaffected by rain water
- Life expectancy of 25 years



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Visit us on the web:
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Hexprotect™ AQUA: technical data

Wind resistant

Product Info

Hexprotect™ technical data

Hexprotect™ tiles are made of virgin or recycled, high density polyethylene HDPE (FDA (3) and NSF approved HDPE resins available for special applications). The cover self ballasts, increasing its weight more than 260%, making it suitable for high wind applications. The proprietary features and manufacturing process ensures the cover floats with slightly more than 50% of its shell above water. Compared to other hexagonal tile covers, the Hexprotect cover is often cheaper to ship and offers improved wind resistance. Installation remains extremely simple, and simply consists of unloading the product directly onto the liquid.

Description	Water ballasted hexagonal tile
Construction	100% HDPE shell
Diameter	220 mm
Average total weight (dry)	400g
Average total weight (installed)	400g
Number per sq. ft	3
Number per square meter	32
Wind resistant (up to) (1)	209 km/h (130 MPH)
Operating temperature range (1)	-50°C / + 80 °C
Projected Life Expectancy	25+ years

Resin & Ballast Properties (1)(2)

Shell Material	High Density Blow Molding polyethylene
Melt Flow Index (190°C/2.16 kg)	0.35
Density	0.955
Melting Point, °F	264
Tensile Strength (PSI)	4000
Elongation at Break, %	600
Flexure Modulus (PSI)	200,000
Ballast Filler	Drinking water

(1) Data developed under laboratory conditions.

(2) Some of the data listed was determined on compression molded specimens and may, therefore, vary from specimen taken from molded articles.

(3) Complies with FDA 21 CFR § 177.1520, Para. (c) 2.1 and 2.

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Testimonials

'Thanks for the communication and for keeping everything on schedule. [...] Your scheduling, production, shipping and communication have been a welcome change from how everything else has gone'. Mike

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