

Drilling and Production

A. Production Site

- Strive to centralize hydraulic fracturing operations.
- Consolidate well pads.
- Maximize the use of directional drilling which allows for a number of wells to be drilled from one well pad, thus reducing surface disturbances.
- Use alternative drilling practices such as "closed-loop", or pitless drilling which eliminates the need for earthen pits by storing drilling fluids in storage tanks.
- Maximize the use of remote monitoring of wells.
- State-of-the-art technologies (using for example coiled tubing rigs) should be considered wherever possible to reduce disturbance footprint for well pads.

B. Noxious Weed Management

- Map, minimize the occurrence, and prevent the spread of existing weed accumulations prior to development to more effectively target areas that will likely become issues after development.
- Control noxious and invasive plants that become established along roads, on well pads, or adjacent to other facilities.
- Control noxious weeds during the life of the well field.
- Clean and sanitize all equipment brought in from other regions to avoid weed transport. Cleaning and/or washing should be done at the initial point of transport rather than at the destination.

C. Roads & Transportation

- Coordinate well visits by using multi-function contractors.
- Transmit instrumentation readings from remote monitoring stations to reduce maintenance traffic.
- Install automated systems, including high tank alarms, emergency shut down and facilitate remote monitoring.
- Post speed limits on all access and maintenance roads to reduce wildlife collisions and limit dust; 0-40 mph is adequate in most cases.
- Coordinate employee transport, encourage carpooling or provide bus transport to work sites.
- Consider advantages of man camps in reducing travel related disturbance as well as the disadvantages of developing human concentrations in wildlife habitats.
- Prohibit or substantially limit traffic during high wildlife use hours (within 3 hours of sunrise and sunset) to the extent possible.
- Use pipelines to transport condensates off site, or install larger capacity storage tanks when frequent truck trips would impact habitat effectiveness.

D. Aquatic, Wetland, and Riparian Resources

- Control contaminants or pollutants and prevent them from entering streams, springs, stock waters and ground waters.
- No drilling activity or disturbance should occur within 300 feet of a riparian area, wetland, stream channel, or other water body extending from the outermost limit of

the riparian habitat.

- Surface discharges of water should meet CDPHE standards or otherwise assure the discharged water is of suitable quality for wildlife or livestock use.
- Ensure secondary containment is adequately sized and constructed of impermeable material.
- Consider constructing berms around well pad perimeters to retain fluids.
- All pipeline crossings of a watercourse should be protected against surface disturbances and damage to the pipeline, which could result in a spill event.
- Any stream crossing of a pipeline should be protected by installation of automatic shutoff valves.
- Any pipeline crossing of a perennial stream should be done by boring underneath the stream rather than trenching
- Pipeline crossings can be installed through ephemeral streams by trenching.
- Use appropriate size riprap to stabilize stream banks and place riprap from the channel bottom to the top of the normal high water line on the bank at all stream crossings or other design recommended by CDOW.
- Locate and construct all structures crossing intermittent and perennial streams such that they do not decrease channel stability or increase water velocity.
- Avoid stripping riparian canopy or stream bank vegetation if possible. It is preferable to crush or shear streamside woody vegetation rather than completely remove it.
- Any site where vegetation is stripped during installation of stream crossings should be re-vegetated immediately after the crossing is completed.
- Staging, refueling, and storage areas should not be located in riparian zones or on flood plains.
- Keep all chemicals, solvents and fuels at least 300 feet away from streams and riparian areas.
- Ensure secondary containment is at least 110% capacity of the largest tank, integrity is intact, and contains impermeable materials on the sides as well as below.
- During pipeline construction avoid discharging hydrostatic test waters into streams. These waters could cause alterations of stream channels, increased sediment loads and introduction of potentially toxic chemicals or invasive species into drainages
 - (i) Release hydrostatic waters first into a temporary, sediment retention basin if the concentration of total suspended solids is significantly higher than in the receiving water. Dewater temporary sedimentation basins in a manner that prevents erosion.
 - (iii) Locate pipelines that parallel drainages, outside the 100-year floodplain.
 - (iv) Construct pipeline crossings at right angles to all riparian corridors and streams to minimize the area of disturbance.
- Use the minimum practical width for rights-of-way where pipelines cross riparian areas and streams.
- In-stream activity restrictions may be necessary to protect fish spawning habitat in certain streams. These restrictions will be identified in Section 404 permits issued by the U.S. Army Corps of Engineers (COE). CDOW encourages contacting aquatic biologists for advice regarding appropriate practices and design

considerations when planning in-stream activities.

E. Environmental Mitigations

- Hire environmental specialists to develop, implement and maintain an environmental mitigation and monitoring program.
- Consult with CDOW/BLM/USFS/NRCS on wildlife habitat enhancement projects, reclamation planning, noxious weed control, riparian habitat restoration, grazing management, and geographic area-specific seed mixes.
- Reduce air quality impacts by use of combustors, electric equipment, and by eliminating flaring.
- Utilize vapor recovery systems and other mechanisms to control odors and reduce air quality impacts.

F. Wildlife Recreation

- Partner with resource agencies and local user groups to identify and improve existing and potential outdoor recreation activities in areas of production and development.
- Locate above-ground facilities for the smallest visual evidence, paint an appropriate color.
- Leave a screen of trees around well pads in wooded areas.
- Place seasonal restrictions on construction activities at times when public use of lands is at its highest (e.g. big game hunting seasons).

G. Food and Waste Management

- Mandate the use of wildlife-proof trash cans.
- Build fully fenced and enclosed trash collection points and keep gates closed at all times leading into the facility.
- Immediately address employee feeding of wildlife.

H. Personnel Management/Education

- Encourage employees to car pool or use formalized transportation mechanisms to reduce trips to and from work sites.
- Establish frequent employee education and training programs to increase awareness of the various kinds of impacts, effects and consequences of poaching and roadkills. Supply information about Colorado wildlife laws, licensing and residency requirements, outdoor recreation opportunities, the values of wildlife species to the ecosystem and the State of Colorado and activity periods during which wildlife are most active.
- Employees should be instructed to avoid walking away from vehicles or facilities into view of wildlife, especially during winter months and reproductive (courtship, nesting) seasons,
- Employees should not be allowed to carry any weapons or firearms while on the job or riding in company vehicles.