Appendix K

Plan of Development / Detailed Proposed Action

K.1PLAN OF DEVELOPMENT/Detailed Proposed Action

K.1.1 Preconstruction Planning and Site Layout

Development activities proposed on fee and State of Wyoming surface lands would be approved by the Wyoming Oil & Gas Conservation Commission (WOGCC). The WOGCC permitting procedures require filing an APD with the WOGCC and obtaining an ROW from the surface owner.

The Operators would follow the procedures outlined below to gain approval for proposed activities on BLM-administered lands or minerals within the ARPA. The procedures described below are applicable to CBNG drilling and production activities (1,800-well program) and the deeper conventional natural gas drilling and production activities (200-well program) unless otherwise noted.

- Annual work plans for each developing or operational POD will be used instead of piecemeal individual APD filings. Each year on April 1, the Operators will submit to the BLM Rawlins Field Office comprehensive annual work plans for the following year, including APD packages and other appropriate permit application materials for the construction and development activities. The BLM, in conjunction with the Operators, will perform the usual on-site reviews and perform the other tasks necessary to prepare the program of work for site specific analysis under NEPA and permitting approval prior to the next drilling season. This procedure will allow for economies of scale with the NEPA process and provide a more comprehensive appraisal of the proposed action and their effects on the environment. This program should also reduce processing time for APDs. The Operators and the BLM will also assess and decide the method of analysis, including how the NEPA related work will be performed (either in-house or through third party contractors). Otherwise unplanned construction needs that arise during the course of the year and outside of the annual plan may be brought forward and proposed by operators and will be dealt with by the BLM appropriately, however the intent is to normally avoid individual APD submission and consideration.

  Annual work or site specific plans for developing or operational PODs will include geo-referenced information compatible with ArcMap that details pad and well locations; pipeline routes; water transfer stations; road locations (resource, collector or local); road construction techniques (including gravel type and source); wing ditch, water bar and culvert placement, any closed system livestock watering facilities, any potential fence modification or cattle guard installations, injection well locations; and any existing infrastructure (wells, roads, pipelines etc.) in the townships receiving new development.

- The proposed facilities would be staked by the Operators and inspected by an interdisciplinary team and/or an official from the BLM to ensure consistency with the approved RMP and oil and gas lease stipulations.

- More detailed descriptions of the proposed activity or construction plans would be submitted to the BLM by the Operators when required for the proposed development. The plans would address concerns that may exist concerning construction standards, required mitigation, etc. Negotiation of these plans between the Operators and the BLM, if necessary to resolve differences, would be based on field inspection findings and would take place either during or after the BLM onsite inspection. Submissions of maps will include the associated GIS geo-referenced information.

- The Operators and/or their contractors would revise APD/ROWs, as necessary, per negotiations with the BLM. The BLM would complete a project-specific environmental analysis that incorporates agreed upon construction and mitigation standards as detailed above. The BLM would then approve the annual proposal and attach the Conditions of Approval to the permit. The Operators must then commence the proposed activity within one year.

Following is a general discussion of proposed construction techniques to be used by the Operators. These construction techniques would be applicable to drill sites, pipelines, and access roads within the ARPA, and may vary between the well sites.

K.1.2 Construction and Drilling Phase

K.1.2.1 Access Road Construction

The road network within the ARPA is discussed in more detail in Chapter 3, Affected Environment. A typical roadway cross-section with width specifications is shown on Figure K-1.

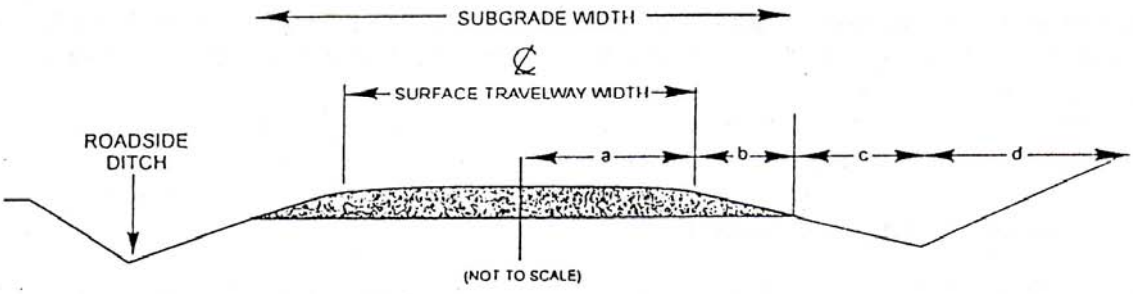
BLM Manual Section 9113 road classifications categorize ARPA roads into three separate classes:

1) Collector Roads. These roads normally provide primary access to large blocks of land and connect with or are extensions of a public road system such as WYO 789. Collector roads are two-lane and require application of the highest road standards. The predominant design speed is 30 to 50 mph depending on terrain and/or as determined by BLM, and the subgrade width is a minimum of 28 feet (24 feet full-surfaced travelway). A typical roadway cross-section with width specifications is shown in Figure K-1.

2) Local Roads. These are low volume roads providing the internal access network within an oil/gas field such as Carbon County Road 608. The design speed is 20-50 mph depending on terrain, and the sub grade width is normally 24 feet (20 feet full-surfaced travelway). Low volume roads in mountainous terrain may be single-lane roads with turnouts.

3) Resource Roads. These are normally spur roads that provide point access. Roads servicing individual oil/gas exploration and production locations fall within this classification. The road has a design speed of 15-30 mph and is constructed to a minimum subgrade of 16 feet (12 feet minimum full-surfaced travelway) with intervisible turnouts.

The Operators propose to construct required new access roads across public lands in accordance with BLM Manual 9113 standards. Roads would be located to minimize disturbances and maximize transportation efficiency. Roads would be closed and reclaimed by the Operators when they are no longer required for production operations, unless otherwise directed by the BLM.



	Minimum Subgrade Width (ft.)	Minimum Surfaced Travelway Width (ft)	a (ft)	b (ft)	c (ft)	d (ft)	Approximate Disturbance Width (ft)	Total ROW Width (ft)	Design Speed (mph)
Resource Road	16	12	6	2	4	8	40	50	15-30
Local Road	24	20	10	2	4	8	48	55	20-50
Collector Road	28	24	12	2	4	8	52	60	30-50

DIAGRAM OF TYPICAL TURNOUTS ON RESOURCE ROADS (PLAN VIEW)

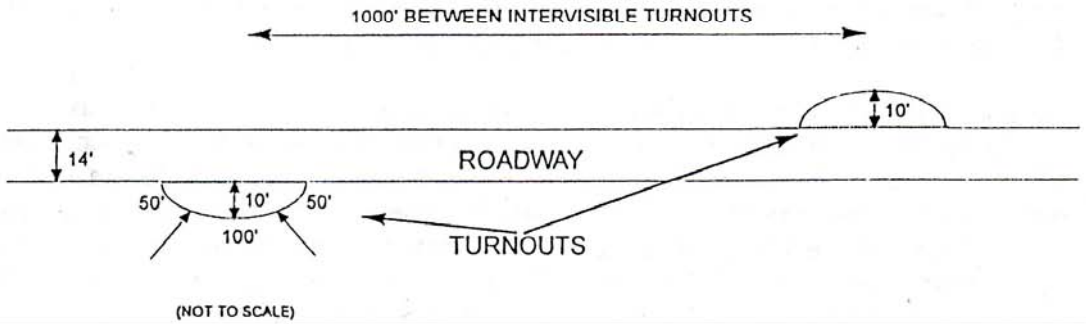


Figure K-1. Typical Roadway Cross-Section with Width Specifications

Based on onsite reviews, roads would be located to minimize disturbances and maximize transportation efficiency. The operators propose to construct access roads across public lands to wells in accordance with BLM Manual 9113 standards. New access roads would be designed and constructed to resource road standards to facilitate reclamation should the well be a dry hole. Roads located on private lands would be constructed in accordance with standards imposed by the private land owner. The number of roads would be limited to decrease potential impacts by discouraging development of looped roads and by accessing wells from short resource roads off the local roads. Roads would be closed and reclaimed by the operators when they are no longer required for production operations, unless otherwise directed by the BLM or private landowners. Roads would be designed to minimize disturbance and would be built and maintained as specified by the BLM to provide safe operating conditions at all times. Surface disturbance would be contained within the road ROW.

Construction equipment and techniques used by the operators would be to the standards found in the BLM Handbook (e.g., crown-and-ditch method). Should soft spots develop on the roadway during construction or drilling operations, they would be immediately covered with crushed rock or gravel. Where identified during on-site review by the BLM, problem areas on access roads to producing well sites would be graveled to a depth of 4 to 6 inches to reduce erosion and sedimentation. Graveling would be accomplished within a time period specified by BLM. Surfacing and base course materials would be obtained from existing, operational gravel pits located on fee or federal sources near the project area. Respreading of topsoil and windrowed vegetation to the side slopes of the newly constructed access roads and revegetation would begin the first appropriate season following the well going into production. Reclamation measures would be implemented the first operating season after well abandonment. The access road to an unproductive well site would be reclaimed upon abandonment of the well using stockpiled topsoil and a seed mixture contained in the approved APD/ROW.

In the event drilling is non-productive, all disturbed areas, including the well site and new access road, would be reclaimed to the approximate landform that existed prior to construction. Reclamation and site stabilization techniques would be applied as specified in the APD Surface Use Plan or the ROW Plan of Development (POD). If drilling is productive, all access roads to the well site would remain in place for well servicing activities (i.e., maintenance, improvements, etc.). Partial reclamation would be completed on segments of the well pad and access road ROW no longer needed.

Small drainage crossings on access routes within the project area would be either low water crossings or crossings using culverts. Low water crossings would be used in shallow channel crossings. Crossings of larger channels within the project area would consist of excavating an area approximately four feet deep under the travelway and filling it with rock and gravel to the level of the drainage bottom. Channel banks on either side of such crossings would be cut down to reduce grade where necessary. Culverts would be installed on smaller, steeper channel crossings. Topsoil would be saved before channel-crossing construction occurs. Also, the total area to be disturbed would be flagged on the ground before construction begins.

The Operators estimate that each proposed new well would require an average of 2,640 feet (1/2 mile) of new or upgraded road construction. They further estimate that approximately 0.5 miles of pipeline co-located in or adjacent to road beds will be required plus an additional 15 miles of larger sales pipeline running from the Muddy Mountain vicinity to the Brown Cow POD.

K.1.2.2 Well Pad Design and Construction

A graded well pad would be constructed at each well site using cut and fill construction techniques. Figure K-2 is a schematic drawing of a typical drill site layout. The dimensions of each well pad would be approximately 360 feet by 240 feet. Each well site would initially disturb an estimated 2 acres and be reclaimed to 1 acre after the cessation of drilling.

Generally, two temporary mud pits 50 feet wide by 10 feet deep by 50 feet long**,** constructed adjacent to each other and connected by a small overflow trench, would be excavated at each well and reclaimed after completion operations. Topsoil would be removed and stockpiled prior to excavating the pit as, required by BLM. The Operators estimate the reserve pits would be open from two to eight weeks to allow for evaporation of pit fluids which consists primarily of water. During this time, the pits would be fenced on all sides to prohibit wildlife and livestock from falling into the pit.

In the event drilling is non-productive at any given site, all disturbed areas associated with that site, including the well site and new access road, would be reclaimed to the approximate landform existing prior to construction. Reclamation and site stabilization techniques would be applied as specified in the Master Surface Use Plan (MSUP). If drilling is productive, all access roads to the well site would remain in place for well-servicing activities (i.e., maintenance, improvements, etc.). Interim reclamation would be completed on segments of the well pad and access road ROW that are no longer needed.

K.1.2.3 Drilling and Completion Operations

K.1.2.3.1 Coalbed Natural Gas

The natural gas and water injection wells would be drilled with conventional drilling rigs. Additional equipment and materials needed for drilling operations would be trucked to the well site. Water for use in drilling the wells would be obtained from existing wells completed in the coal seams of the Mesaverde. Approximately 700 barrels (29,400 gallons) of water would be needed for drilling each CBNG well. The actual water volume used in drilling operations would depend on the depth of the well and any losses that might occur during drilling. The proposed action would require an additional approximately 96,000 gallons (or 0.295 acre-feet) of water per well for cement preparation, well stimulation, and dust control. Based on existing hydrogeologic information, groundwater in the coal seams at the completion depths in the existing natural gas wells is hydraulically isolated from shallow groundwater and surface water resources.

Drilling mud would consist of native mud and bentonite. As down hole conditions dictate, small amounts of polymer additives and/or potassium chloride salts may be added for hole cleaning and clay stabilization. Drilling depths for the Mesaverde coals generally range from 250 feet to 6,000 feet and the producing formation would be exposed to the drill bore through perforations. The well control system would be designed to meet the conditions likely to be encountered in the hole and would be in conformance with BLM and State of Wyoming requirements. A completed CBNG well bore is shown in Figure K-3.

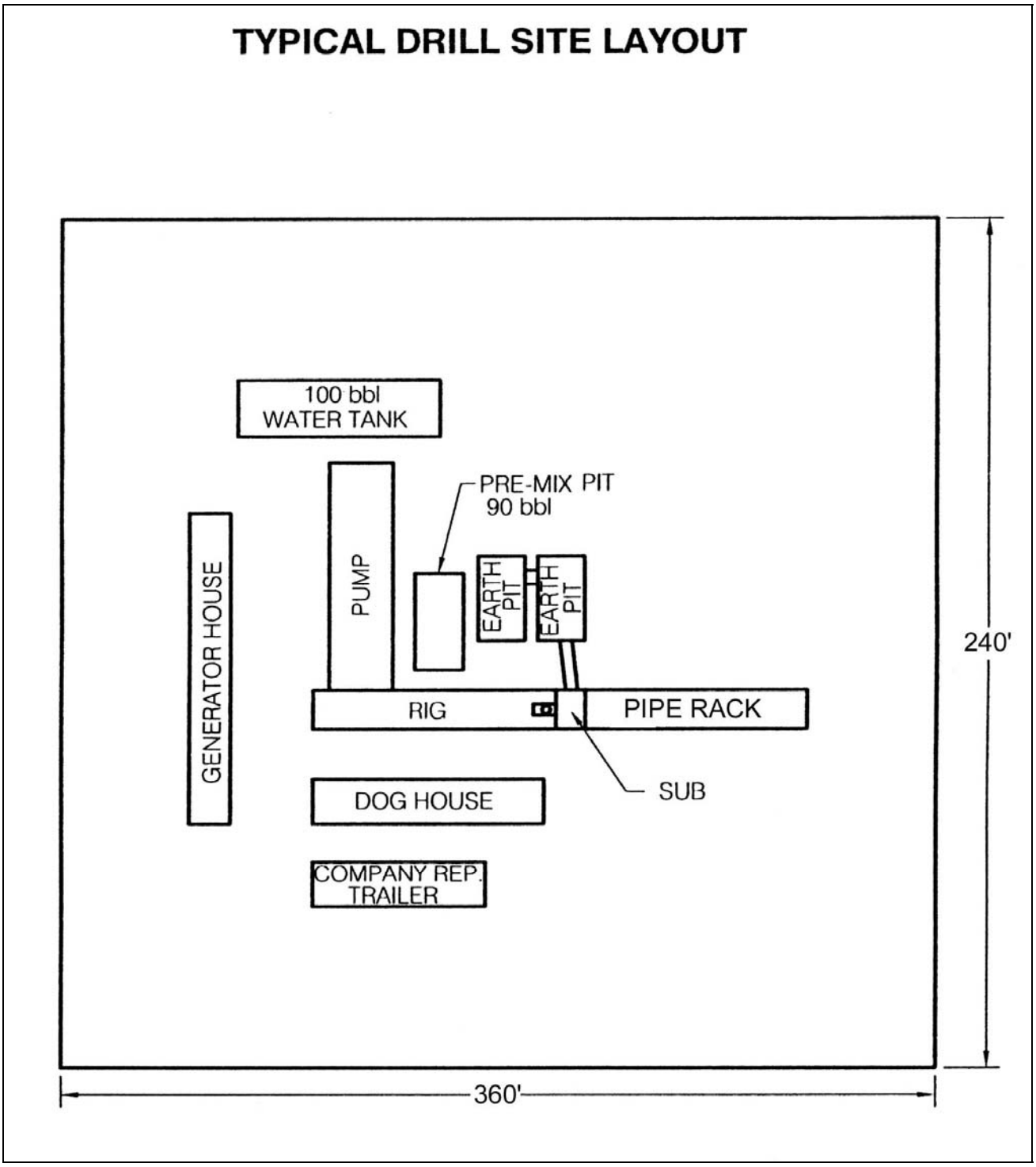


Figure K-2. Typical Drill Site Layout – Atlantic Rim Natural Gas Project

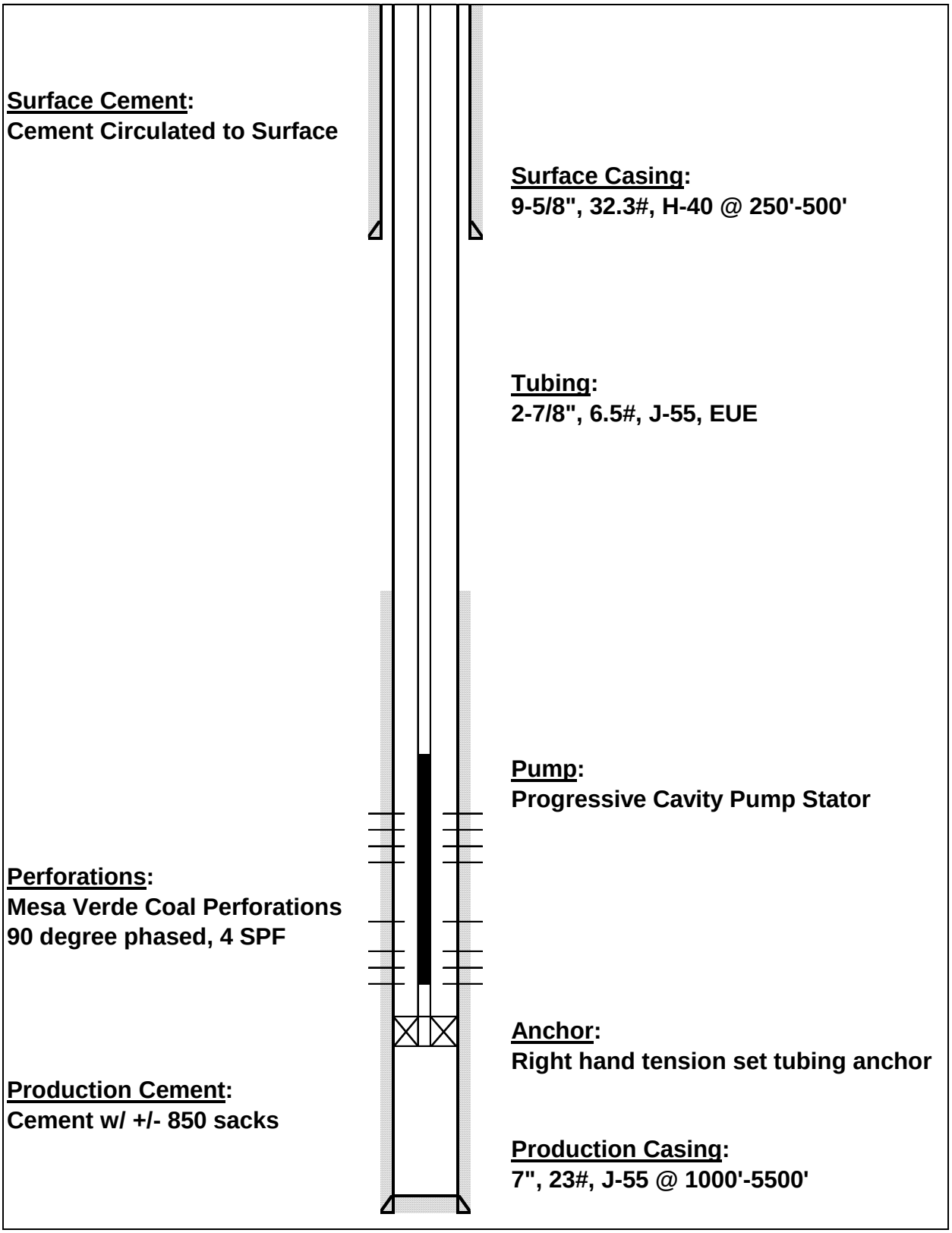


Figure K-3. Completed Conventional Well Bore – Atlantic Rim Natural Gas Project.

The drilling and completion operation for a well normally requires approximately ten to fifteen people at a time, including personnel for logging and cementing activities. Each well would be drilled within a period of seven to ten days. A well completion program may be initiated to stimulate production of gas and to determine gas and water production characteristics in preparation for production of gas from a drilled, cased, and cemented well. A mobile completion rig similar to the drill rig may be transported to the well site and used to complete each well. Completion operations are expected to average two to five days per well. Upon receiving applicable permits, CBNG may be flared or vented and water temporarily discharged and contained in the reserve pit or trucked to an alternate disposal site during the testing period. If determined to be productive, wells would be shut-in until pipelines and other production facilities are operational.

K.1.2.3.2 Deeper, Conventional Formations

Each gas drilling operation, for deeper conventional formations, would require transport of approximately 35 truckloads of drilling-related equipment and materials to facilitate the drilling operation. This number includes transportation of the drill rig, drill pipe, drilling fluid products, and related support equipment, but does not include the truck traffic required for re-supplying the operation (e.g., fuel, drilling fluid additives, etc.). Additional traffic would be variable, depending on the phases of the drilling operation, but should average eight or nine vehicles per day per drill site throughout the drilling operation, with substantially higher peaks during rig set-up and relocation and during certain completion activities. Total rig-up activities and installation of ancillary facilities would take approximately three days to complete.

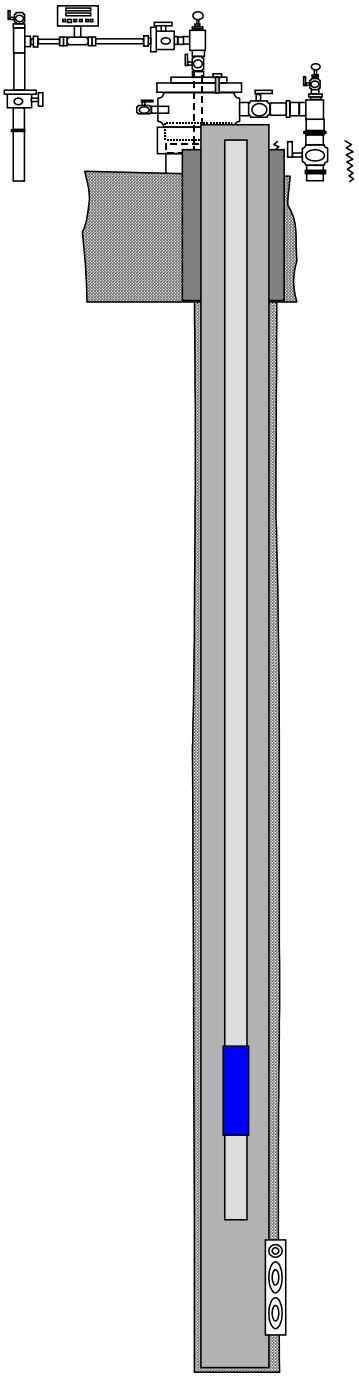
Drilling operations would be spread over the 20-year life of field development, with approximately 15 to 20 wells drilled each year. The number of wells drilled annually would depend on such factors as market prices, permit approval, and rig availability. Completion operations for each productive well would commence as soon as possible after the drilling rig moves off location.

The geologic formations to be tested for conventional natural gas production in the project area are the Mesaverde and Almond Formations. The drilling depth may vary from 500 down to 10,000 feet for a conventional well drilled requiring approximately 20 to 30 days to drill vertically, barring any major drilling problems. Figure K-4 shows a completed well bore for a conventional gas well.

Water, for drilling and service trailer use, would be obtained from State of Wyoming approved locations or local water source wells. Water requirements for drilling conventional wells average approximately 11,000 barrels (bbls) per well (462,000 gallons). The Operators intend to use freshwater-based mud for the majority of their drilling operations.

Well completion operations involve the placement and cementing of well casing and perforation, stimulation and testing of potentially productive zones. Well casing involves running steel casing pipe into the open borehole and cementing the pipe in place. Perforation, stimulation, and testing require large equipment to be transported and used at the well site, and flaring of produced gas. A typical cased well bore would consist of conductor pipe, surface casing, and production casing. Well completion operations involve the placement and cementing of well casing.

Well Name *Typical Conventional Well*
Field *Atlantic Rim*



Surface Casing

Size & Wt	*9-5/8" 36#*
Depth	*370'*
Cement:	*Volume sufficient to circulate cement to surface*
Drill Bit Size	*8-3/4"*
Drill Depth	*5,800'*

Production Casing

Size & Wt	*7" 23# or 5 1/2" 17# depending upon completion needs*
Depth	*5,800'*
Cement:	*Volume sufficient to isolate objective intervals*

Tubing

Size & Wt	*2-7/8" 6.5#*
Depth	*5,650'*
Packer	*Type and need determined by production conditions*

Pump

Type	*Type and need determined by production conditions*
Depth	*5,650'*

Perforated Interval

Length of interval and number of holes dependent upon thickness and number of prospective zones encountered

Figure K-4. Completed CBM Well Bore - Atlantic Rim Natural Gas Project.

Surface casing would be set at the start of drilling operations to prevent gas, oil, condensate, or water from migrating from formation to formation, to isolate producing zones, to isolate and protect surface formations and to attach pressure control equipment. Setting and cementing of production casing provides separation and isolation from abnormally pressured zones, usable water zones, and other mineral deposits. The well casing would be perforated in the productive interval to allow the flow of hydrocarbons to the surface. Approximately 10,000 barrels of water may be required in the completing and testing operations per conventional natural gas well. Most completions use a string of tubing that is inserted in the casing to the top of the perforated productive zone to allow gas, condensate, and water to flow to the surface where it is collected, measured, and contained. Completion operations typically last up to 60 days for deep tests.

K.1.2.3.3 Injection Wells

Drilling of the injection wells would be accomplished with the same equipment and personnel used to drill the CBNG wells. Depth of the injection wells is expected to range from 3,200 to 6,400 feet in the Hatfield, Cherokee, and/or Deep Creek sands formations. Drilling and completion of each injection well is expected to take approximately seven to 14 days and installation of surface equipment, holding tanks and pumping equipment, an additional 14 days. A schematic of a typical injection well is shown in Figure K-5.

K.1.3 Production Operations

K.1.3.1 Well Production Facilities

Wellhead facilities would be installed if the wells are productive. A weatherproof covering would be placed over some wellhead facilities and a small shed may need to be constructed over others. The type and amount of gas dictates the design variances. A down hole pump would be used to produce water from the cased and perforated pay intervals. The long-term surface disturbance at each productive well location where cut and fill construction techniques are used would encompass approximately 1 acre. Well site production facilities typically would be fenced or otherwise removed from existing uses. A typical production well site is shown in Figure K-6.

Pipeline trenches for well gathering lines are expected to disturb 15-foot wide corridors within the 30-foot wide temporary construction ROW, which would be reclaimed as soon as practical after construction is completed. The remaining 15 feet of the 30-foot ROW would be used to transport machinery, personnel, and equipment for the installation of flowlines and electrical lines, as well as to give working room for the machinery, personnel, and equipment during the installation process. Trenches would be constructed along the access roads wherever possible. Separate gathering lines would be buried in the trenches and would transport CBNG to the metering facility and compressor station and produced water to the injection wells.

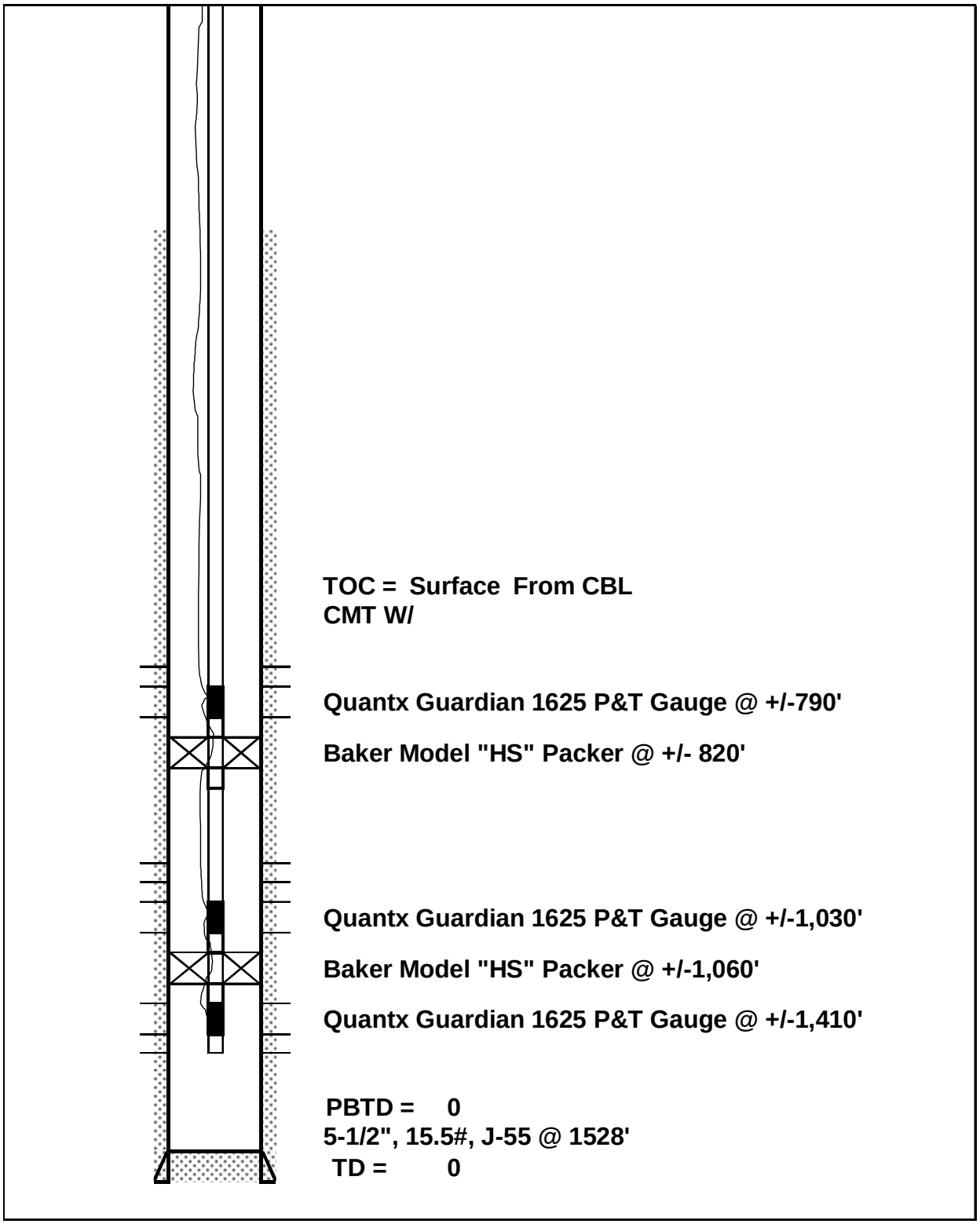


Figure K-5. Typical Pressure Monitoring Well Bore – Atlantic Rim Natural Gas Project.

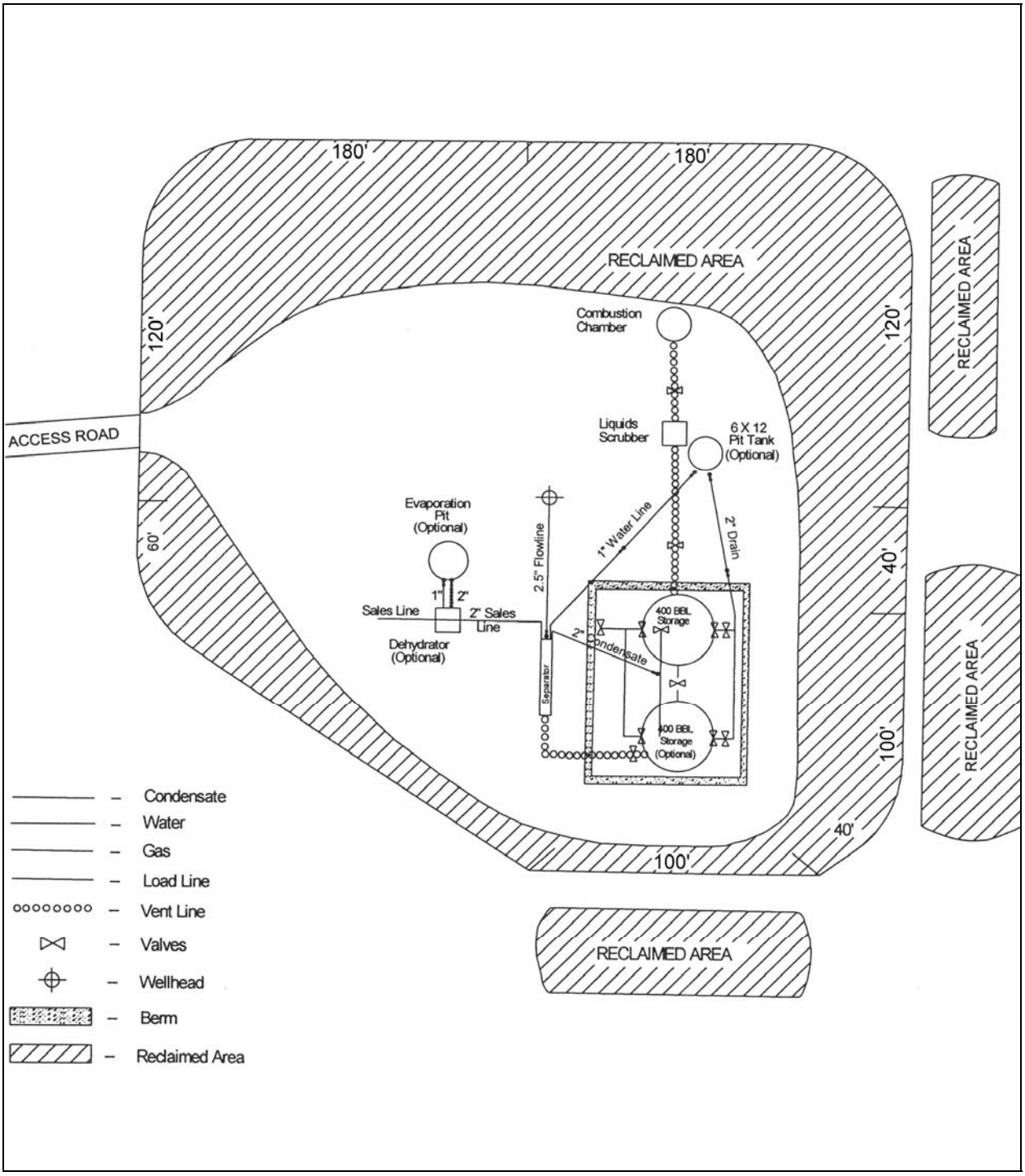


Figure K-6. Typical Conventional Production Well Site – Atlantic Rim Natural Gas Project.

At the conclusion of the Project, roads, culverts, cattle guards, pipelines, stock watering facilities, or other structures could be left in place for any beneficial use, as designated by the BLM. Water wells and produced water would be available to the BLM, if appropriations, diversion, and storage rights are obtained from the appropriate state agencies. All federally-owned lands containing disturbed areas or facilities that are no longer needed would be reclaimed.

K.1.3.2 Electric Power Generation and Power Lines

Electricity produced via generators at compressor sites would be used to power pumps during well development and to initiate and maintain production. Either natural gas engines or propane-fired engines would be used to run generators where the utility power capacity in the area is not sufficient. These gas/propane fired engines would be used on a temporary basis at individual wells until additional electric distribution lines can be installed with adequate electrical capacity. If booster or blower units are required on the wells, electrical motors or natural gas-fired reciprocating or micro turbine engines would power these units. Future compressors are anticipated to be powered by natural gas engines or electric motors. All distribution power lines (12.5 kV or lower) in the ARPA would be buried.

Introduction of electrical service may be proposed at a later if development activities demonstrate the economic feasibility of doing so in the future. To bring in electrical service to the area would require construction of many miles of above ground power lines, the construction of substations and interior lines to centralized POD facilities. The likelihood of this action ever occurring would depend on which areas produce enough gas, their geographic relationship to each other, and the available technology to deliver the power. At this time there isn't enough information to determine what such a proposal will look like, or where it will be located. Any powerline proposals for above ground electrical distribution would require an additional NEPA analysis, either in the form of an EIS or EA, depending at least in part on the nature and extent of the proposal.

K.1.3.3Pipelines

Three types of pipelines would be constructed as part of the proposed Project:

1. Gas-gathering pipeline systems (low pressure, from wellhead to Central Compressor Station).

2. Produced water-gathering pipeline systems (low pressure, from wellhead to centralized conditioning facilities or injection facilities).

3. Gas-delivery pipelines (high pressure, from compressor station to existing transmission pipelines).

Reclamation of pipeline corridors would occur as soon as practical after pipeline construction is complete.

K.1.3.3.1 Gas-Gathering Pipeline Systems

Gas-gathering and produced water-gathering pipelines would be placed together in the same trench/ditch when practical. Construction and installation of pipelines would occur immediately upon determination of the well's capability to produce. The pipeline ROW would typically follow access roads, except in a limited number of cases where topography dictates or as required by the BLM. Separate gathering lines would be used to transport gas to production facilities and/or compressor stations and produced water to central conditioning facilities and/or injection facilities. Gathering lines average 2,640 feet in length (per productive well) and 30 feet in width after construction.

K.1.3.3.2 Produced-Water Gathering System and Disposal Facilities

The outcome of the Atlantic Rim Project will depend, in part, on the economical disposal of water produced in association with dewatering of CBNG. Produced water would primarily be disposed of by injection into a suitable aquifer via injection well (anywhere in the ARPA).

Predictions for water disposal volumes indicate that a minimum of one water disposal facility would be needed for each POD (12 wells/POD) in the early stages of field development. A water disposal facility would initially consist of one re-injection well, four fiberglass storage tanks, pump station, and a dehydration unit. A CBNG well would initially produce approximately 800 barrels of water per day and steadily decline to 10 barrels per day in three years.

Produced water-gathering pipelines would be constructed along the well access road wherever feasible, from the wellhead to the central conditioning/storage facilities. The water lines would be placed together in the same trench/ditch as gas gathering lines wherever practical, and buried. Both, typical water conditioning facility and a water disposal facility are shown in Figure K-7.

Transfer pumping stations would be used during production operations to transfer produced water from the CBNG well(s) to the injection facilities or the water conditioning sites. The transfer pumping stations are needed in those areas where elevation differences require supplemental pumping to transfer the produced water. If transfer pumping stations are required, they would be identified in the individual APDs or MSUP. Each pumping station would contain a

400-barrel water tank, an inlet separation vessel, and a small centrifugal water pump. Each pumping station would consist of a pad area having approximate dimensions of 100 feet by 100 feet, and disturbing an estimated 0.2 acre. An approximate two-foot berm would be constructed around the perimeter of each pumping station area to contain any potential water spills. A small pump house would be constructed immediately outside the bermed area to house the centrifugal pump. A typical water transfer facility is shown in Figure K-8.

K.1.3.3.2.1 Surface Disposal

No surface disposal is proposed. Limited use of closed livestock and wildlife watering systems may occur, but will not be used to dispose of produced water.

K.1.3.3.2.2 Subsurface Disposal

Subsurface disposal of produced water would be used in the ARPA. Produced water from individual wells would be gathered and routed to centralized water handling and storage sites,

which would serve as central injection facilities (Figure K-7). The centralized facilities would be approved, as required, by the BLM, WOGCC, SEO, and WDEQ and would each be located offsetting injection or re-injection well(s). Facilities would location share wherever possible.

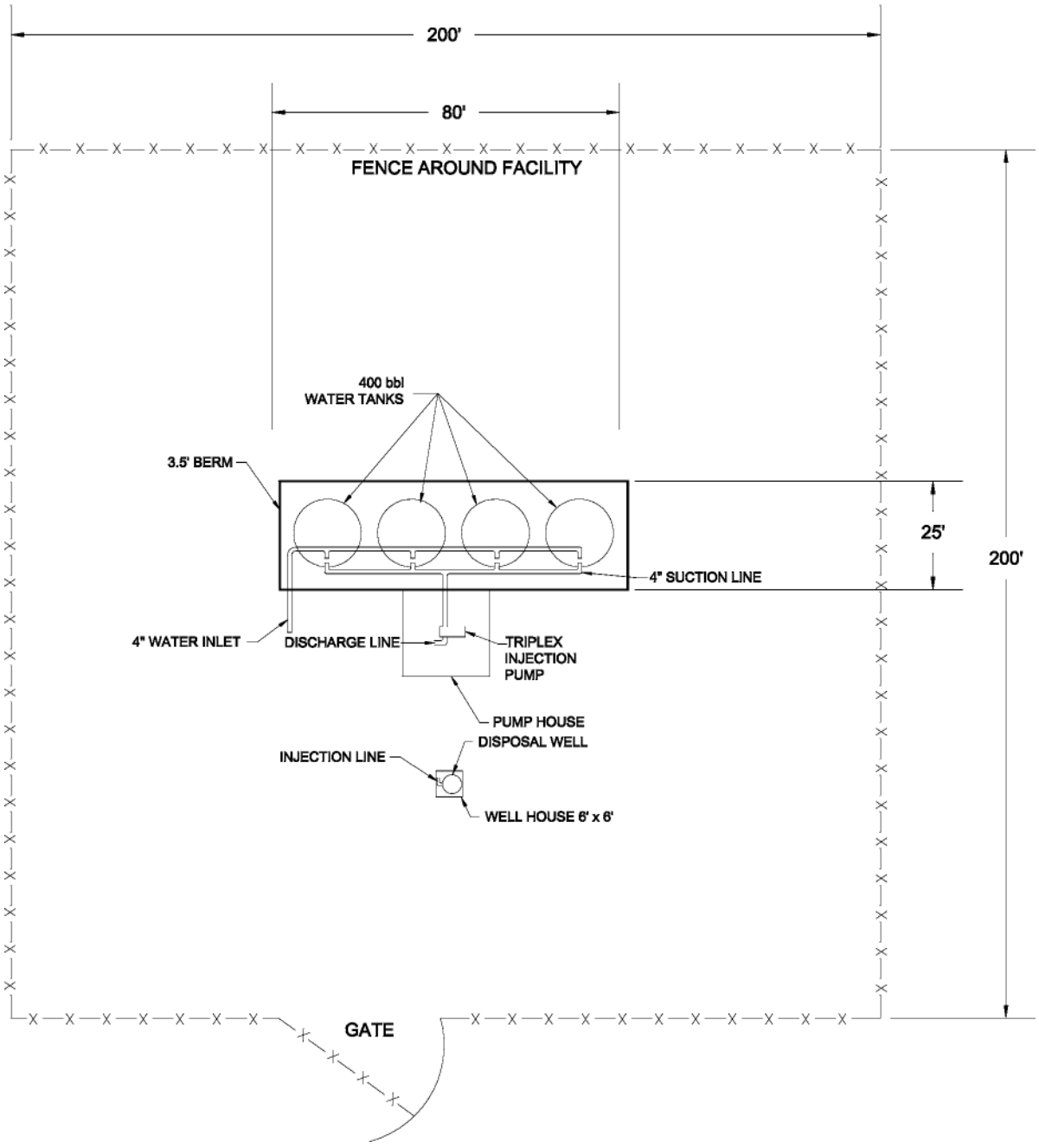


Figure K-7. Typical Water Conditioning and Disposal Facility – Atlantic Rim Natural Gas Project.

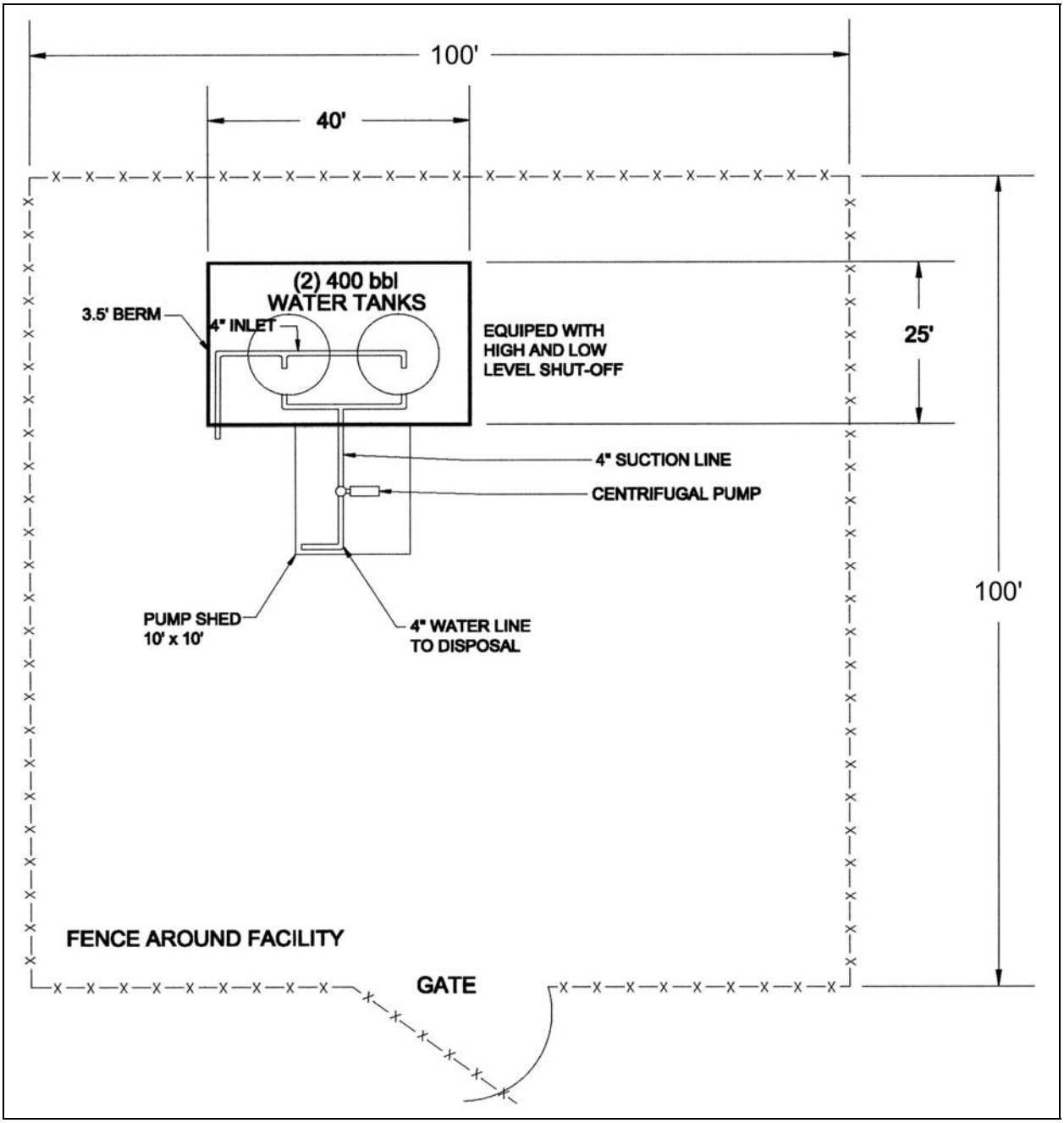


Figure K-8. Typical Water Transfer Facility – Atlantic Rim Natural Gas Project.

Formations targeted for injection of produced water are shown in Table K-1, based upon interim POD information.

Each deep injection well would have an approximate minimum injection capacity of 5,000 bbls/day and maximum injection capacity of 15,000 bbls/day. A predicted total project volume of produced water in the best success scenario for the proposed well development would be 250,000 to 450,000 bbls/day for approximately six to eight years. The volume of water would be on a consistent decline as the coal seam is dewatered. The above projections reflect water being produced during the exploration phase and water that could be produced if 2,000 wells were being dewatered simultaneously. 2,000 wells would result in approximately 166 injection wells.

Table K-1. Produced Water Injection Target Formations.

Formation	Depth Below Surface, Feet	POD Reference
Hatfield	5,965 to 6,335	Red Rim
Cherokee	5,965 to 6,335	Red Rim
Deep Creek Sandstone	5,965 to 6,335	Red Rim
Cherokee	3,200	Sun Dog, Brown Cow
Deep Creek Sandstone	3,400	Sun Dog, Brown Cow
Cherokee Sandstone	3,900 to 4,400	Blue Sky
Deep Creek Sandstone	4,200 to 4,700	Blue Sky

K.1.3.3.3 Gas-Delivery Pipelines and Compression

Produced natural gas under wellhead pressure would move through the low pressure gas gathering system to a compressor station. Typical gathering system line pressure is less than 100 pounds per square inch (psi). Gas arriving at the compressor station would be compressed from gathering line pressures up to higher pressures to facilitate gas delivery into a transmission pipeline.

Compression of the gas at a field compressor station would increase the pressure to an estimated 700 to 1,440 psi. The compressor station would have a pad size of 300 feet by 300 feet and would result in approximately 2.1 acres of site disturbance. All compressors are expected to be housed within structures. A typical compressor station is shown in Figure K-9.

Total compression needs for the Proposed Action would be 42,000 hp to 52,000 hp. The Operators estimate that a total of 61 compressor stations would be required for implementation of the Proposed Action. Engine make and model would vary due to compression requirements of the field gas. Initial compression is projected to be natural gas engine driven reciprocating compressor units meeting best available control technology (BACT) requirements of WDEQ-AQD. Each compressor station would also have a 1,206 hp natural gas fired generator (Cat 3516TA rich-burn with NSCR catalyst) for electric power production. Once electric power is available on-site compression would change over to electrically driven.

K.1.3.4 Ancillary Facilities

All wells, pipelines, and associated ancillary production facilities would be operated in a safe manner by the Operators, as set forth by standard industry operating guidelines and procedures. Routine maintenance of producing wells would be necessary to maximize performance and detect potential difficulties with gas production operations. Each well location would be visited about every other day to ensure operations are proceeding in an efficient and safe manner. The visits would include checking gauges, valves, fittings, and onsite storage of produced water. Routine onsite equipment maintenance would also be performed as necessary. Additionally, all roads and well locations would be regularly inspected and maintained to minimize erosion and assure safe operating conditions.

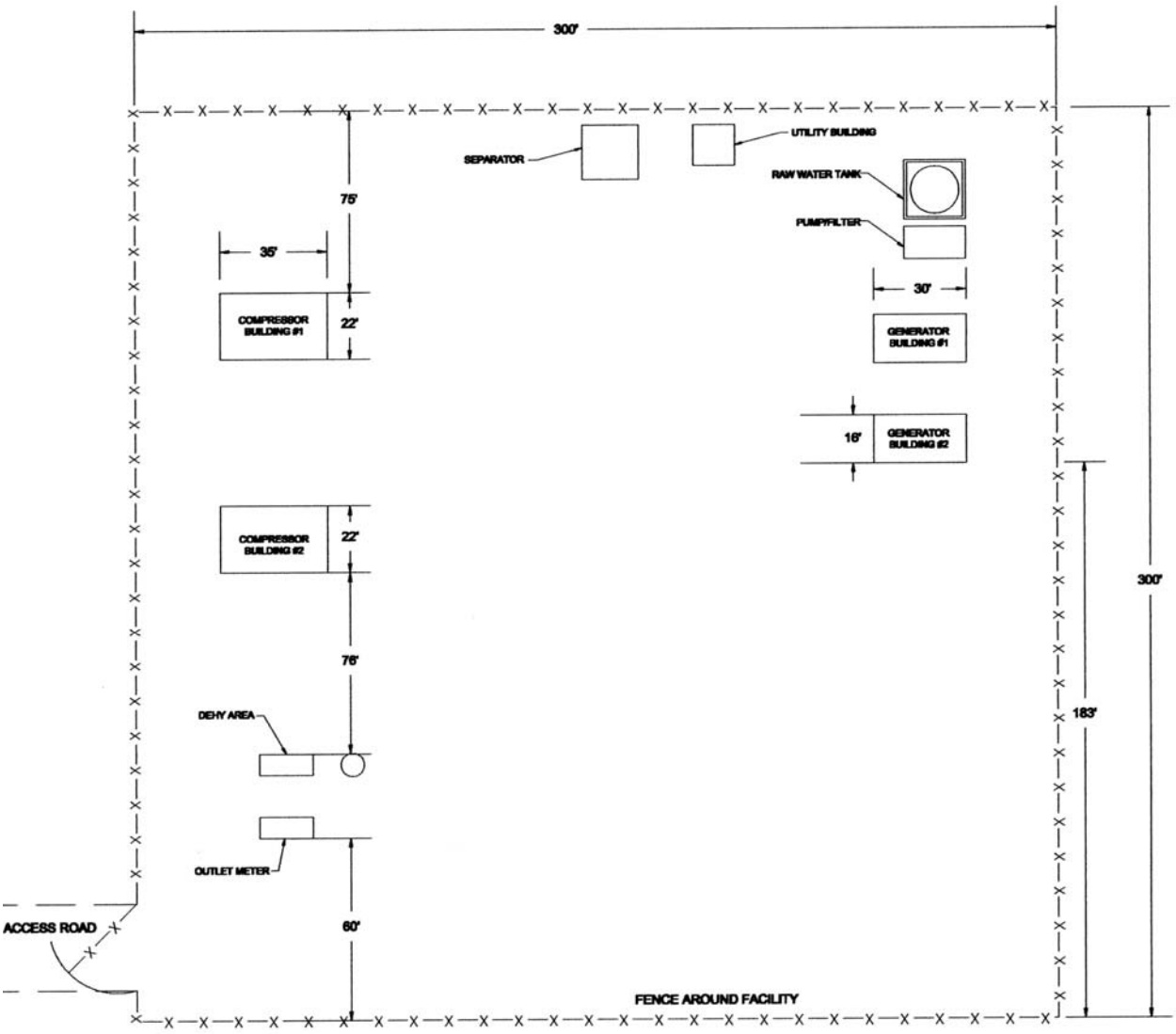


Figure K-9. Typical Compression Facility – Atlantic Rim Natural Gas Project.

K.1.3.5Traffic and Work Force Estimates

Estimated traffic requirements for drilling, completion, and field development operations are shown in Table K-2. The 'Trip Type' column lists the various service and supply vehicles that would travel to and from the well sites and production facilities. The 'Round-Trip Frequency' column lists the number of trips, both external (i.e., to/from the Project Area) and internal (within the Project Area). The figures provided in Table K-2 should be considered general estimates. Drilling and production activity levels may vary over time in response to weather and other factors.

Table K-2. Traffic Estimates.

Trip Type	Round-Trip Frequency	
Drilling (2 rigs, 2 crews/rig)	**External (to/from Project Area)**	**Internal (within Project Area)**
Rig supervisor	4/day	same
Rig crews	4/day	same
Engineers [a]	2/week	1/day/rig
Mechanics	4/week	same
Supply delivery [b]	1/week	2-4/day
Water truck [c]	3/week	2 round trips/day
Fuel trucks	4 round trips/well	same
Mud trucks [d]	1/week	2/day
Rig move [e]	8 trucks/well	8 trucks/well
Drill bit/tool delivery	2/ weeks	same
Completion		
Small rig/crew	1/day	same
Cement crew	2 trips/well	same
Consultant	1/day	same
Well loggers	3 trips/well	same
Gathering systems	2/day	same
Power systems	2/day	same
Compressor stations	2/day	same
Other field development	2/day	same
Testing and operations	2/day	same

Notes:

[a] Engineers travel to Project Area weekly and stay in a trailer at the Project Area during the week.

[b] Current plans are to establish a central supply area within a Project Area and deliver supplies on a weekly basis.

[c] Water trucks would deliver water to rigs from a location within the Project Area.

[d] Current plans are to establish a central mud location within a Project Area and deliver mud on a weekly basis.

[e] It would require eight trucks to move each rig to a Project Area. Upon completion of drilling in a Project Area, each rig would move to the next Project Area.

K.1.3.6 Site Restoration and Abandonment

The Operators propose to completely reclaim in the interim all disturbed areas not needed for production activities. Reclamation would generally include: 1) complete cleanup of the disturbed areas (drill sites, access roads, etc.), 2) restoration of the disturbed areas to the approximate ground contour that existed prior to construction, 3) replacement of topsoil over all disturbed areas, 4) ripping of disturbed areas to a depth of 12 to 18 inches, and 5) seeding of re-contoured areas with a BLM approved, certified weed-free, seed mixture.

Specific reclamation recommendations for use with the natural gas drilling and production operations within the project area are described in the Reclamation Plan (Appendix B). The final set of reclamation measures to be applied would be developed in the APD or ROW grant by each operator in consultation with the BLM and would be specific to each site and the conditions at that site.

K.1.3.7 Applicant Voluntarily Committed Measures

Following are applicant committed measures to avoid or mitigate resource or other land use impacts. An exception to a mitigation measure and/or design feature may be approved on a case-by-case basis when deemed appropriate by the BLM or in conjunction with the surface owner. An exception would be approved only after a thorough, site-specific analysis determined that the resource or land use for which the measure was put in place is not present or would not be significantly impacted. The Operators propose to implement resource-specific mitigation measures on all lands within the ARPA including federal, State and private (fee) surface ownership:

K.1.3.7.1 Preconstruction Planning and Design Measures

The Operators and the BLM would make on-site Interdisciplinary (ID) reviews of each proposed and staked facility site (e.g., well sites), new access road, access road reconstruction, and pipeline alignment projects so that site-specific recommendations and mitigation measures can be developed.

- New road construction and maintenance of existing roads in the ARPA would be accomplished in accordance with BLM Manual 9113 standards unless private landowners or the State of Wyoming specify otherwise on their lands.

- Consistent with the annual work planning described in section K.1.1, The Operators would prepare and submit an APD for each drill site on federal leases to the BLM for approval prior to initiation of construction. Also prior to construction, the Operators or their contractors would submit a Sundry Notice and/or ROW application for each pipeline and access road segment on federal leases. The APD would include a Surface Use Plan that would show the layout of the drill pad over the existing topography, dimensions of the pad, volumes and cross sections of cut and fill, location and dimensions of reserve pit, and access road egress and ingress. The APD, Sundry Notice, and/or ROW application plan would also itemize project administration, time frame, and responsible parties. In addition, a reclamation plan would be developed by the operators for each facility in consultation with the BLM. APD packages would be submitted annually on April 1, including GIS data specified in K.1.1, for planning and analysis for the upcoming work year.

K.1.3.7.2 Resource-Specific Requirements

Geology/Minerals

Mitigation measures presented in the Soils and Water Resources sections would avoid or minimize many of the potential impacts to the surface mineral resources. Protection of subsurface mineral resources from adverse impacts would be provided by the BLM and/or WOGCC casing and cementing policy.

Climate and Air Quality

- The Operators would not burn garbage or refuse at the drill sites or other facilities.
- When an air quality, soil loss, or safety problem is identified as a result of fugitive dust, immediate abatement would be initiated.

Soils and Water Resources

- Reduce the area of disturbance to the absolute minimum necessary for construction and production operations while providing for the safety of personnel. The Operators would prohibit off-road vehicle activity.
- Generally, buried pipelines would be located immediately adjacent to roads to avoid creating separate areas of disturbance and in order to reduce the total area of disturbance.
- The operators would avoid using frozen or saturated soils as construction material.
- The operators would minimize construction activities in areas of steep slopes and other sensitive soils, and apply special slope stabilizing structures if construction cannot be avoided in these areas.
- Design cut slopes in a manner that would allow retention of topsoil, surface treatment such as mulch, and subsequent revegetation.
- Selectively strip and salvage topsoil or the best suitable medium for plant growth from all disturbed areas on all well pads.
- Where possible, minimize disturbance to vegetated cuts and fills on existing roads that are improved.
- Install runoff and erosion control measures such as water bars, berms, and interceptor ditches if needed.
- Implement minor routing variations during access road layout to avoid steep slopes adjacent to ephemeral or intermittent drainage channels. Maintain a buffer strip of natural vegetation where possible (not including wetland vegetation) between all construction activities and ephemeral and intermittent drainage channels.

- Include adequate drainage control devices and measures in the road design (e.g., road berms and drainage ditches, diversion ditches, cross drains, culverts, out-sloping, and energy dissipaters) at sufficient intervals and intensities to adequately control and direct surface runoff above, below, and within the road environment to avoid erosive concentrated flows. In conjunction with surface runoff or drainage control measures, use erosion control devices and measures such as temporary barriers, ditch blocks, erosion stops, mattes, mulches, and vegetative covers. Implement a revegetation program as soon as possible to re-establish the soil protection afforded by a vegetal cover.

- Upon completion of construction activities, restore topography to near pre-existing contours at the well sites, along access roads and pipelines, and other facilities sites. Replace topsoil or suitable plant growth material over all disturbed surfaces, and apply fertilizer as needed, and seed.

- When feasible, limit construction of drainage crossings to no-flow periods or low-flow periods.

- Minimize the area of disturbance within ephemeral and intermittent drainage channel environments.

- Avoid construction of well sites, access roads, and pipelines within 500 feet of surface water and/or riparian areas. Exceptions to this would be granted by the BLM based on an environmental analysis and site-specific mitigation plans.

- Design channel crossings to minimize changes in channel geometry and subsequent changes in flow hydraulics.

- Construct channel crossings for buried pipelines such that the pipe is buried a minimum of four feet below the channel bottom.

- Regrade disturbed channel beds to the original geometric configuration with the same or very similar bed material.

- Case wells during drilling, and case and cement all wells in accordance with State, and/or Federal regulations to protect accessible high quality aquifers. High quality aquifers are aquifers with known water quality of 10,000 ppm TDS or less. Include well casing and welding of sufficient integrity to contain all fluids under high pressure during drilling and well completion. Further, wells would adhere to the appropriate BLM or WOGCC cementing policy.

- Reserve pits would be constructed so that a minimum of one-half of the total depth is below the original ground surface on the lowest point within the pit. To prevent seepage of fluids, drilling mud gel or poly liners would be used as needed to line reserve pits in areas where subsurface material would not contain fluids. Liners would be of sufficient strength and thickness to withstand normal installation and use. The liner would be impermeable (i.e., having a permeability of less than 10^{-7} cm/sec) and chemically compatible with all substances which may be put in the pit.
- Maintain 2 feet of freeboard on all reserve pits to ensure the reserve pits are not in danger of overflowing. Shut down drilling operations until the problem is corrected if leakage is found outside the pit.

- Extract hydrostatic test water used in conjunction with pipeline testing and all water used during construction activities from sources with sufficient quantities and through appropriation permits approved by the State of Wyoming.

- Discharge hydrostatic test water in a controlled manner onto an energy dissipator. The water is to be discharged onto undisturbed land that has vegetative cover, if possible, or into an established drainage channel. Prior to discharge, treat or filter the water to reduce pollutant levels or to settle out suspended particles if necessary. If discharged into an established drainage channel, the rate of discharge would not exceed the capacity of the channel to safely convey the increased flow. Coordinate all discharge to test water with the SEO and the BLM.

- Develop and implement a Storm Water Pollution Prevention Plan (SWPPP) for storm water runoff at drill sites as required per WDEQ storm water NPDES permit requirements.

- The Operators must coordinate with the Corps of Engineers (COE) to determine the specific Clean Water Act (CWA) Section 404 Permit requirements and conditions (including the potential requirement of compensatory mitigation) for each facility that occurs in Waters of the U.S. to prevent the occurrence of significant impact to such waters.

- Exercise precautions against pipeline breaks and other potential accidental discharges of toxic chemicals into adjacent streams. If liquid petroleum products storage capacity exceeds criteria contained in 40 CFR Part 112, a Spill Prevention Control and Countermeasures (SPCC) plan would be developed in accordance with 40 CFR Part 112.

- The project must comply with all applicable requirements of the CWA, including the requirement to obtain an WYPDES permit.

Vegetation and Wetlands

- Seed and stabilize disturbed areas with mixtures and treatment guidelines prescribed in the approved APD, ROW, or surface landowner requirements.

- Evaluate all project facility sites for occurrence and distribution of waters of the U.S., special aquatic sites, and jurisdictional wetlands. All project facilities would be located out of these sensitive areas. If complete avoidance is not possible, minimize impacts through modification and minor relocations. Coordinate activities that involve dredge or fill into wetlands with the COE.

- Conduct site-specific surveys for federally listed threatened and endangered (T&E) and candidate plant species prior to any surface disturbance in accordance with the Endangered Species Act.

Range Resources and Other Land Uses

- The Operators would coordinate with the affected livestock operators to ensure that livestock control structures remain functional during drilling and production operations.

Wildlife

- During reclamation, establish a variety of forage species that are useful to resident herbivores by specifying the seed mixes in the approved APD, ROW or surface landowner requirements.

- Discourage unnecessary off-site activities of operational personnel in the vicinity of the drill sites.

Visual Resources

- Paint all structures with non-reflective colors that blend with the adjacent landscape, except for structures that require safety coloration in accordance with Occupational Safety and Health Administration (OSHA) requirements.

Cultural Resources

- If a site is considered eligible for, or is already on the National Register of Historic Places (NRHP), avoidance is the preferred method for mitigating adverse effects to that property.

Socioeconomics

- Coordinate project activities with ranching operations to minimize conflicts involving livestock movement or other ranch operations. This would include scheduling of project activities to minimize potential disturbance of large-scale livestock movements. Establish effective and frequent communication with affected ranchers to monitor and correct problems and coordinate scheduling.

Health and Safety

- The operators will establish and maintain an appropriate safety program for the intended work which will comply with all applicable Federal, State and local regulations, including but not limited to, RCRA, SPCC, SARA, Hazardous Substance Management.

Table K-3. Types and Approximate Acreage of Surface Disturbance by Surface Ownership of the Proposed Action.

Proposed Action

Atlantic Rim Project Disturbance - Acres

	Life of Project Disturbance					Initial Disturbance			
Type	Federal	Private	State	Total		Federal	Private	State	Total
Coalbed NG	1,152	558	90	1,800		2,304	1,116	180	3,600
Conventional NG	333	161	26	520		564	273	44	882
Total Wellpad	1,485	719	116	2,320		2,868	1,389	224	4,482
Roads / Utilities*	2,327	1,127	182	3,636		6,206	3,006	485	9,697
Pipelines	0	0	0	0		93	45	7	145
Ancillary Facilities	182	88	14	285		947	458	74	1,479
Totals	3,994	1,935	312	6,241		10,114	4,899	790	15,803

Assumptions Used to Calculate the Proposed Action Distrubance Acreage

Assumptions	Amount	Unit
Acres / well pad Short Term -Coal Bed	2	Acres
Acres / well pad Long Term - Coal Bed	1	Acres
Acres disturbance / well pad Short Term -Conventional	4.41	Acres
Acres disturbance / well pad Long Term -Conventional	2.6	Acres
Drilling Success Rate	100	%
Miles / Well pad, avg*	0.5	Miles
Disturbance width, Roads & Utilities - initial	80	Feet
Disturbance Width, Roads & Utilities - LOP	30	Feet
Pipelines Outside Road Corridors	15	Miles

Assumptions	Amount	Unit
Coal Bed NG Wells	1800	Wells
Conventional NG Wells	200	Wells
Total Number of Wells Analyzed	2000	Wells
% Federal Development	64	%
% Private Development	31	%
% State of Wyoming Development	5	%
Ancillary Facilities - initial disturbance	1479	Acres
Ancillary Facilities - LOP disturbance	285	Acres

*well pad roads, collector roads and new arterial roads are considered in this figure.

Other than the asterisked number, all numbers (averages) used in the assumption chart are taken from actual field inspections conducted the summer of 2005 for both CBNG and conventional gas wells (BLM, 2005).