# APPENDIX F:
# REVISED DRAFT DEQ ENVIRONMENTAL SPECIFICATIONS

# Draft DEQ Environmental Specifications

The following specifications have been developed by the DEQ for projects receiving a Certificate of Compliance and would become conditions to the Certificate of Compliance if it is approved.

**CONTENTS**

**DEFINITIONS**

ACCESS EASEMENT: Any land area over which the OWNER has received an easement or other permission from a LANDOWNER allowing travel to and from the project. Access easements may or may not include access roads.

ACCESS ROAD: Any travel course which is constructed by substantial recontouring of land and which is intended to permit passage by most four-wheeled vehicles.

BEGINNING OF CONSTRUCTION: Any project-related earthmoving or removal of vegetation (except for clearing of survey lines).

BOND: Performance bond to guarantee successful reclamation and revegetation of the project as allowed under 75-20-302(2),MCA

CERTIFICATE: Certificate of Compliance issued by the Department of Environmental Quality.

CONTRACTOR: Constructors of the Facility (agent of owner)

FWP: Montana Fish, Wildlife and Parks

DNRC: Montana Department of Natural Resources and Conservation

DOT: Montana Department of Transportation

DEQ: Montana Department of Environmental Quality

LANDOWNER: The owner of private property or the managing agency for public lands.

OWNER: The owner(s) of the facility, or the owner's agent.

SENSITIVE AREA: Area which exhibits environmental characteristics that may make it susceptible to impact from construction of a transmission facility. The extent of these areas is defined for each project but may include any of the areas listed in Circular MFSA-2 Sections 3.2(1)(d) and 3.4(1).

SHPO: State Historic Preservation Office

STATE INSPECTOR: DEQ employee or DEQ designee with the responsibility for monitoring the OWNER's and contractor's compliance with terms and conditions of the Certificate of Compliance issued for a project.

## INTRODUCTION

The purpose of these specifications is to ensure mitigation of potential environmental impacts during the construction, operation and maintenance of a transmission facility.

For non-exempt facilities, the Montana Major Facility Siting Act supersedes all state and local environmental permit requirements except for those dealing with air and water quality, public health and safety, water appropriations and diversions, and easements across state lands (75-20-103 and 401, MCA). A major purpose of these conditions is to ensure that the intent of the laws which are superseded is met, even though the procedures of applying for and obtaining permits from various state agencies are not. As specified later in this document, the STATE INSPECTOR will have the responsibility for arranging reviews and inspections by other state agencies, which would otherwise have been done through a permit application process.

Appendices A through Q refer to the site-specific concerns and areas that apply for a specific project. These addenda, as needed, will be prepared by DEQ working in consultation with the OWNER prior to the start of construction.

## 0.0 GENERAL SPECIFICATIONS

### 0.1. SCOPE

These specifications apply to all lands affected by the project. Where the LANDOWNER requests practices other than those listed in these specifications, the OWNER may authorize such a change provided that the STATE INSPECTOR is notified in writing of the change and that the change would not be in violation of: (1) the intent of any state law which is superseded by the Montana Major Facility Siting Act; (2) the Certificate; (3) any conditions imposed by DEQ; (4) DEQ's finding of minimum adverse impact; or (5) the regulations in ARM 17.20.1901 and 17.20.1902.

### 0.2. ENVIRONMENTAL PROTECTION

The OWNER shall conduct all operations in a manner to protect the quality of the environment and to reduce impacts to the greatest extent practical.

### 0.3. CONTRACT DOCUMENTS

These specifications shall be part of or incorporated into the contract documents; therefore, the OWNER and the OWNER'S agents shall be held responsible for adherence to these specifications in performing the work

### 0.4. BRIEFING OF EMPLOYEES

The OWNER shall ensure that the CONTRACTOR and all field supervisors are provided with a copy of these specifications and informed of which sections are applicable to specific procedures. It is the responsibility of the OWNER, its CONTRACTOR and the CONTRACTOR's Construction Supervisors to ensure that the intent of these measures is met. Supervisors shall inform all employees on the applicable environmental constraints spelled out herein prior to and during construction. Site-specific measures spelled out in the appendices attached hereto shall be incorporated into the design and construction specifications or other appropriate contract document.

**0.5. COMPLIANCE WITH REGULATIONS**

All project-related activities of the OWNER shall comply with all applicable local, state, and federal laws, regulations, and requirements.

**0.6. LIMITS OF LIABILITY**

The OWNER is not responsible for correction of environmental damage or destruction of property caused by negligent acts of DEQ employees during construction monitoring activities.

**0.7. DESIGNATION OF SENSITIVE AREAS**

DEQ, in its evaluation of the project, has designated certain areas along the right-of-way or access roads as SENSITIVE AREAS. The OWNER shall take all reasonable actions to avoid adverse impacts in these SENSITIVE AREAS and adopt the measures in Appendix A.

**0.8. PERFORMANCE BOND**

To ensure compliance with these specifications, the OWNER shall submit to the State of Montana or its authorized agent a BOND or BONDS pertaining specifically to the restoration and revegetation of the right-of-way and adjacent land damaged during construction. Post-construction monitoring by DEQ will determine compliance with these specifications and other mitigating measures included herein. At the time cleanup and restoration are complete, and revegetation is progressing satisfactorily, the OWNER shall be released from its obligation for restoration. At the time the OWNER is released, a portion of this BOND or a separate BOND shall be established by the OWNER and submitted to the State of Montana or its authorized agent. This BOND shall be held for five years or until monitoring by DEQ indicates that reclamation, weed control, and road closures have been adequate. The amount and bonding mechanisms for this section shall be specified by DEQ and agreed to by the OWNER under provisions established by 17.20.1902(9) as specified in Appendix B and attached. Proof of bond shall be submitted to DEQ two weeks prior to the start of construction.

**0.9. DESIGNATION OF STRUCTURES**

Each structure for the project shall be designated by a unique number on plan and profile maps, and a shape file, route, or geodatabase showing line, structure, and access locations submitted to DEQ. References to specific poles or towers in Appendices A through Q shall use these numbers. If this information is not available because the survey is not complete, station numbers or mileposts shall indicate locations along the centerline. Station numbers or mileposts of all angle points shall be designated on plan and profile maps.

**0.10. ACCESS**

When easements for construction access are obtained for construction personnel, provision will be made by the OWNER to ensure that DEQ personnel or contractors will be allowed access to the right-of-way and to any off-right-of-way access roads used for construction during the term of the CERTIFICATE. Liability for damage caused by providing such access for the STATE INSPECTOR shall be limited by section 0.6 LIMITS OF LIABILITY.

**0.11. DESIGNATION OF STATE INSPECTOR**

DEQ shall designate a STATE INSPECTOR or INSPECTORS to monitor the OWNER'S compliance with these specifications and any other project–specific mitigation measures adopted by DEQ as provided in ARM 17.20.1901 through 17.20.1902. The STATE INSPECTOR shall be the OWNER's liaison with the State of Montana on construction, post-construction, and reclamation activities. All communications regarding the project shall be directed to the STATE INSPECTOR. The name of the STATE INSPECTOR can be obtained by contacting the Bureau Chief of the Environmental Management Bureau, Permitting and Compliance Division, Department of Environmental Quality, or the Bureau Chief's successor (see Appendix P).

**1.0. PRE-CONSTRUCTION PLANNING AND COORDINATION**

**1.1. PLANNING**

**1.1.1**. Planning of all stages of construction and maintenance activities is essential to ensure that construction-related impacts will be kept to a minimum. The CONTRACTOR and OWNER shall, to the extent possible, plan the timing of construction, construction and maintenance access and requirements, location of special use sites, and other details before the commencement of construction.

**1.1.2.** Preferably thirty days, but at least fifteen days before the start of construction, the OWNER shall submit plan and profile map(s) and an electronic equivalent acceptable to the STATE INSPECTOR depicting the location of the centerline and of all construction access roads, maintenance access roads, structures, clearing backlines, and, if known, special use sites. The scale of the map for special use sites shall be 1:24,000 or larger.

**1.1.3.** If special use sites are not known at the time of submission of the plan and profile, the following information shall be submitted no later than five days prior to the start of construction. The location of special use sites including staging sites, pulling sites, batch plant sites, splicing sites, borrow pits, and storage or other buildings shall be plotted on one of the following and submitted to DEQ: ortho-photomosaics of a scale 1:24,000 or larger, or available USGS 7.5′ plan and profile maps of a scale 1:24,000 or larger, or an electronic equivalent acceptable to the STATE INSPECTOR.

**1.1.4.** Changes or updates to the information submitted in 1.1.2 and 1.1.3 shall be submitted to DEQ as they become available. In no case shall a change be submitted less than five (5) working days prior to its anticipated date of construction. Changes in these locations prior to construction where designated SENSITIVE AREAS are affected must be submitted to DEQ seven (7) working days before construction and approved by the STATE INSPECTOR prior to construction.

**1.1.5.** Long-term maintenance routes to all points on the line should be planned before construction begins. Where known, new construction access roads intended to be maintained for permanent use shall be differentiated from temporary access roads on the maps required under 1.1.2 above.

## 1.2. PRE-CONSTRUCTION CONFERENCE

**1.2.1.** At least one week before commencement of any construction activities, the OWNER shall schedule a pre-construction conference. The STATE INSPECTOR shall be notified of the date and location for this meeting. One of the purposes of this conference shall be to brief the CONTRACTOR and land management agencies regarding the content of these specifications and other DEQ approved mitigating measures, and to make all parties aware of the roles of the STATE INSPECTOR and of the federal inspectors (if any).

**1.2.2.** The OWNER's representative, the CONTRACTOR's representative, the STATE INSPECTOR, and representatives of affected state and federal agencies who have land management or permit and easement responsibilities shall be invited to attend the pre-construction conference.

## 1.3. PUBLIC CONTACT

**1.3.1.** Written notification by the OWNER's field representative or the CONTRACTOR shall be given to local public officials in each affected community prior to the beginning of construction to provide information on the temporary increase in population, when the increase is expected, and where the workers will be stationed. If local officials require further information, the OWNER shall hold meetings to discuss potential temporary changes. Officials contacted shall include the county commissioners, city administrators, and law enforcement officials. It is also suggested that local fire departments, emergency service providers, and a representative of the Chamber of Commerce be contacted.

**1.3.2.** The OWNER shall negotiate with the LANDOWNER in determining the best location for access easements and the need for gates.

**1.3.3.** The OWNER shall contact local government officials, or the managing agency, as appropriate, regarding implementation of required traffic safety measures.

## 1.4. HISTORICAL AND ARCHAEOLOGICAL SURVEY

**1.4.1**. The OWNER must develop and carry out a plan submitted to the State Historic Preservation Office (SHPO) that includes steps which have been and will be taken to identify, evaluate, and avoid or mitigate damage to cultural resources affected by the project. The plan (Appendix I) shall include: (1) actions taken to identify cultural resources during initial intensive survey work; (2) an evaluation of the significance of the identified sites and likely impacts caused by the project; (3) recommended treatments or measures to avoid or mitigate damage to known cultural sites; (4) steps to be taken in the event other sites are identified after approval of the plan; and (5) provisions for monitoring construction to protect cultural resources. Except for monitoring, all steps of the plan must be carried out prior to the start of construction. The requirements for this plan should not be construed to exempt or alter compliance by the OWNER or managing agency with 36 CFR 800. This plan must be filed with SHPO.

## 2.0 CONSTRUCTION

### 2.1. GENERAL

**2.1.1.** The preservation of the natural landscape contours and environmental features shall be an important consideration in the location of all construction facilities, including roads, storage areas, and buildings. Construction of these facilities shall be planned and conducted so as to minimize destruction, scarring, or defacing of the natural vegetation and landscape. Any necessary earthmoving shall be planned and designed to be as compatible as possible with natural landforms.

**2.1.2.** Temporary construction sites and staging areas shall be the minimum size necessary to perform the work. Such areas shall be located where most environmentally compatible, considering slope, fragile soils or vegetation, and risk of erosion. After construction, these areas shall be restored as specified in Section 3.0 of these specifications unless the STATE INSPECTOR authorizes a specific exemption in writing.

**2.1.3.** All work areas shall be maintained in a neat, clean, and sanitary condition at all items. Trash or construction debris (in addition to solid wastes described in section 2.14) shall be regularly removed during the construction, restoration, and reclamation periods.

**2.1.4.** In areas where mixing of soil horizons would lead to a significant reduction in soil productivity, increased difficulty in establishing permanent vegetation, or an increase in weeds, mixing of soil horizons shall be avoided insofar as possible. This may be done by removing and stockpiling topsoil, where practical, so that it may be spread over subsoil during site restoration. Known areas where stockpiling of topsoil is required are listed in Appendix L. Prior to construction the STATE INSPECTOR may designate other areas.

**2.1.5.** Vegetation such as trees, plants, shrubs, and grass on or adjacent to the right-of-way which do not interfere with the performance of construction work or operation of the line itself shall be preserved.

**2.1.6.** The OWNER shall take all necessary actions to avoid adverse impacts to SENSITIVE AREAS listed in Appendix A. The STATE INSPECTOR shall be notified two working days in advance of initial clearing or construction activity in these areas. The OWNER shall mark or flag the clearing backlines and limits of disturbance in certain SENSITIVE AREAS as indicated in Appendix A. All construction activities must be conducted within this marked area.

**2.1.7.** The OWNER shall either acquire appropriate land rights or provide compensation for damage for the land area that will be disturbed by construction. The width of the area disturbed by construction shall not exceed a reasonable distance from the centerline as necessary to perform the work. For this project, work should be contained within the area specified in Appendix C.

**2.1.8**. Flow in a stream course may not be permanently diverted. If temporary diversion is necessary, flow will be restored before a major runoff season or the next spawning season, as determined by the STATE INSPECTOR in consultation with the managing agency.

**2.2. CONSTRUCTION MONITORING**

**2.2.1.** The STATE INSPECTOR is responsible for implementing the monitoring plan required by ARM 17.20.1902. The plan specifies the type of monitoring data and activities required, and terms and schedules of monitoring data collection, and assigns responsibilities for data collection, inspection reporting, and other monitoring activities. It is attached as Appendix Q.

**2.2.2.** The STATE INSPECTOR, the OWNER, and the OWNER'S agents will attempt to rely upon a cooperative working relationship to reconcile potential problems relating to construction in SENSITIVE AREAS and compliance with these specifications. When construction activities would cause excessive environmental impacts due to seasonal field conditions or damage to sensitive features, the STATE INSPECTOR will discuss possible mitigating measures or minor construction rescheduling to avoid these impacts with the OWNER. The STATE INSPECTOR will be prepared to provide the OWNER with written documentation of the reasons for the modifications within 24 hours of their imposition.

**2.2.3**. The STATE INSPECTOR may require mitigating measures or procedures at some sites beyond those listed in Appendix A in order to minimize environmental damage due to unique circumstances that arise during construction, such as unanticipated discovery of a cultural site. The STATE INSPECTOR will follow procedures described in the monitoring plan when such situations arise.

**2.2.4.** In the event that the STATE INSPECTOR shows reasonable cause that compliance with these specifications is not being achieved, DEQ would take corrective action as described in 75-20-408, MCA.

**2.3. TIMING OF CONSTRUCTION**

**2.3.1.** Construction and motorized travel may be restricted or prohibited at certain times of the year in certain areas. Exemptions to these timing restrictions may be granted by DEQ in writing if the OWNER can clearly demonstrate that no environmental impacts will occur as a result. These areas, listed in Appendix D, include areas deemed as SENSITIVE AREAS.

**2.3.2.** In order to prevent rutting and excessive damage to vegetation, construction will not take place during periods of high soil moisture when construction vehicles will cause severe rutting.

**2.4. PUBLIC SAFETY**

**2.4.1.** All construction activities shall be done in compliance with existing health and safety laws.

**2.4.2.** Requirements for aeronautical hazard marking shall be determined by the OWNER in consultation with the Montana Aeronautical Division, the FAA, and DEQ. These requirements are listed in Appendix E. Where required, aeronautical hazard markings shall be installed at the time the wires are strung, according to the specifications listed in Appendix E.

**2.4.3.** Noise levels shall not exceed established DEQ standards as a result of operation of the facility and associated facilities. For electric transmission facilities, the average annual noise levels, as expressed by an A-weighted day-night scale (Ldn) will not exceed 50 decibels at the edge of the right-of-way in residential and subdivided areas unless the affected LANDOWNER waives this condition.

**2.4.4.** The facility shall be designed, constructed, and operated to adhere to the National Electric Safety Code regarding transmission lines.

**2.4.5.** The electric field at the edge of the right-of-way will not exceed 1 kilovolt per meter measured 1 meter above the ground in residential or subdivided areas unless the affected LANDOWNER waives this condition, and the electric field at road crossings under the facility will not exceed 7 kilovolts per meter measured 1 meter above the ground.

**2.5. PROTECTION OF PROPERTY**

**2.5.1.** Construction operations shall not take place over or upon the right-of-way of any railroad, public road, public trail, or other public property until negotiations and/or necessary approvals have been completed with the managing agency. Roads and trails will be protected and kept open for public use. Where it is necessary to cross a trail with access roads, the trail corridor will be restored. Adequate signing and/or blazes will be established so the user can find the route. All roads and trails designated by government agencies as needed for fire protection or other purposes shall be kept free of logs, brush, and debris resulting from operations under this agreement. Any such road or trail damaged by project construction or maintenance shall be promptly restored to its original condition.

**2.5.2.** Reasonable precautions shall be taken to protect, in place, all public land monuments and private property corners or boundary markers. If any such land markers or monuments are destroyed, the marker shall be reestablished and referenced in accordance with the procedures outlined in the "Manual of Instruction for the Survey of the Public Land of the United States" or, in the case of private property, the specifications of the county engineer. Reestablishment of survey markers will be at the expense of the OWNER

**2.5.3.** Construction shall be conducted so as to prevent any damage to existing real property including but not limited to transmission lines, distribution lines, telephone lines, railroads, ditches, and public roads crossed. If such property is damaged by operations under this agreement, the OWNER shall repair such damage immediately to a reasonably satisfactory condition in consultation with the property owner.

**2.5.4.** In areas with livestock, the OWNER shall make a reasonable effort to comply with the reasonable requests of LANDOWNERs regarding measures to control livestock. Unless requested by a LANDOWNER, care shall be taken to ensure that all gates are closed after entry or exit. The LANDOWNER shall be compensated for any losses to personal property due to construction or maintenance activities. Gates shall be inspected and repaired when necessary during construction and missing padlocks shall be replaced. The OWNER shall ensure that gates are not left open at night or during periods of no construction activity unless the LANDOWNER makes other requests. Any fencing or gates cut, removed, damaged, or destroyed by the OWNER shall immediately be replaced with new materials. Fences installed shall be of the same height and general type as a nearby fence on the same property, and shall be stretched tight with a fence stretcher before stapling or securing to the fence post. Temporary gates shall be of sufficiently high quality to withstand repeated opening and closing during construction, to the satisfaction of the LANDOWNER.

**2.5.5.** The CONTRACTOR must notify the OWNER, the STATE INSPECTOR, and, if possible, the affected LANDOWNER within two working days of damage to land, crops, property, or irrigation facilities, contamination or degradation of water, or livestock injury caused by the OWNER's construction activities, and the OWNER shall reasonably restore any damaged resource or property or provide reasonable compensation to the affected party.

**2.5.6.** Pole holes and anchor holes must be covered or fenced in any fields, pastures, or ranges being used for livestock grazing or where a LANDOWNER's requests can be reasonably accommodated.

**2.5.7.** When requested by the LANDOWNER, all fences crossed by permanent access roads shall be provided with a gate. All fences to be crossed by access roads shall be braced before the fence is cut. Fences not to be gated should be restrung temporarily during construction and restrung permanently within 30 days following construction, subject to the reasonable desires of the LANDOWNER.

**2.5.8.** Where new access roads cross fence lines, the OWNER shall make reasonable effort to accommodate the LANDOWNER's wishes on gate location and width.

**2.5.9.** Any breaching of natural barriers to livestock movement by construction activities will require fencing sufficient to control livestock.

**2.6. TRAFFIC CONTROL**

**2.6.1.** At least 30 days before any construction within or over any state or federal highway right-of-way or paved secondary highway maintained by DOT, the OWNER will notify the appropriate DOT field office to review the proposed occupancy and to obtain appropriate permits and authorizations. The OWNER must supply DEQ with documentation that this consultation has occurred. This documentation should include any measures recommended by DOT and to what extent the OWNER has agreed to comply with these measures. In the event that recommendations or regulations were not followed, a statement as to why the OWNER chose not to follow them should be included. If there is a disagreement, DEQ will resolve the matter.

**2.6.2.** In areas where project construction creates a hazard, traffic will be controlled according to the applicable DOT regulations. Safety signs advising motorists of construction equipment shall be placed on major state highways, as recommended by DOT. The installation of proper road signing will be the responsibility of the OWNER.

**2.6.3.** The managing agency shall be notified, as soon as practicable, when it is necessary to close public roads to public travel for short periods to provide safety during construction.

**2.6.4.** Construction vehicles and equipment will be operated at speeds safe for existing road and traffic conditions.

**2.6.5.** Traffic delays will be restricted on primary access routes, as determined by DOT or the managing agency.

**2.6.6.** Access for fire and emergency vehicles will be provided for at all times.

**2.6.7.** Public travel through and use of active construction areas shall be limited at the discretion of the managing agency.

## 2.7. ACCESS ROADS AND VEHICLE MOVEMENT

**2.7.1.** Construction of new roads shall be the minimum reasonably required to construct and maintain the facility. State, county, and other existing roads shall be used for construction access wherever possible. Access roads intended to be permanent should be initially designed as such. The location of access roads and towers shall be established in consultation with affected LANDOWNERs, and LANDOWNER concerns shall be accommodated where reasonably possible and not in contradiction to these specifications or other DEQ conditions.

**2.7.2**. All new roads, both temporary and permanent, shall be constructed with the minimum possible clearing and soil disturbance to minimize erosion, as specified in Section 2.11 of these specifications.

**2.7.3**. Where practical, all roads shall be initially designed to accommodate one-way travel of the largest piece of equipment that will be required to use them; road width shall be no wider than necessary.

**2.7.4.** Roads shall be located in the right-of-way insofar as possible. Travel outside the right-of-way to enable traffic to avoid cables and conductors during conductor-stringing shall be kept to the minimum possible. Road crossings of the right-of-way should be near support structures.

**2.7.5.** Where practical, temporary roads shall be constructed on the most level land available. Where temporary roads cross flat land they shall not be graded or bladed unless necessary, but will be flagged or otherwise marked to show their location and to prevent travel off the roadway.

**2.7.6.** In order to minimize soil disturbance and erosion potential, no cutting and filling for access road construction shall be allowed in areas of up to 5 percent sideslope. In areas of over 5 percent sideslope, road building that may be required shall conform to a 4 percent outslope. The roads shall be constructed to prevent channeling of runoff, and shoulders or berms that would channel runoff shall be avoided.

**2.7.7.** The OWNER will maintain all permanent access roads, including drainage facilities, which are constructed for use during the period of construction. In the event that a road would be left in place, the OWNER and LANDOWNER may enter into agreements regarding maintenance for erosion control following construction.

**2.7.8**. Any damage to existing private roads, including rutting, resulting from project construction or maintenance shall be repaired and restored to a condition as good or better than original as soon as possible. Repair and restoration of roads should be accomplished during and following construction as necessary to reduce erosion.

**2.7.9**. All permanent access road surfaces, including those under construction, will be prepared with the necessary erosion control practices as determined by the STATE INSPECTOR or the managing agency prior to the onset of winter.

**2.7.10**. Any necessary snow removal shall be done in a manner to preserve and protect roads, signs, and culverts, to ensure safe and efficient transportation, and to prevent excessive erosion damage to roads, streams, and adjacent land.

**2.7.11.** At the conclusion of line construction, final maintenance will be performed on all existing private roads used for construction access by the CONTRACTOR. These roads will be returned to a condition as good or better than when construction began.

**2.7.12.** At least 30 days prior to construction of a new access road approach intersecting a state or federal highway, or of any structure encroaching upon a highway right-of-way, the OWNER shall submit to DOT a plan and profile map showing the location of the proposed construction. At least five days prior to construction, the OWNER shall provide the STATE INSPECTOR written documentation of this consultation and actions to be taken by the OWNER as provided in 2.6.1.

**2.8. EQUIPMENT OPERATION**

**2.8.1.** During construction, unauthorized cross-country travel and the development of roads other than those approved shall be prohibited. The OWNER shall be liable for any damage, destruction, or disruption of private property and land caused by his construction personnel and equipment as a result of unauthorized cross-country travel and/or road development.

**2.8.2.** To prevent excessive soil damage in areas where a graded roadway has not been constructed, the limits and locations of access for construction equipment and vehicles shall be clearly marked or specified at each new site before any equipment is moved to the site. Construction foremen and personnel should be well versed in recognizing these markers and shall understand the restriction on equipment movement that is involved.

**2.8.3**. Dust control measures shall be implemented on access roads where required by the managing agency or where dust would pose a nuisance to residents. Construction activities and travel shall be conducted to minimize dust. Water, straw, wood chips, dust palliative, gravel, combinations of these, or similar control measures may be used. Oil or similar petroleum-derivatives shall not be used.

**2.8.4.** Work crew foremen shall be qualified and experienced in the type of work being accomplished by the crew they are supervising. Earthmoving equipment shall be operated only by qualified, experienced personnel. Correction of environmental damage resulting from operation of equipment will be the responsibility of the OWNER. Repair of damage to a condition reasonably satisfactory to the LANDOWNER, managing agency, or if necessary, DEQ, is required.

**2.8.5.** Sock lines will be strung using methods that minimize disturbance of soils and vegetation.

**2.8.6**. Following construction in areas designated by the local weed control board or STATE INSPECTOR as a noxious weed area the CONTRACTOR shall thoroughly clean all vehicles and equipment to remove weed parts and seeds immediately prior to leaving the area.

**2.9. RIGHT-OF-WAY CLEARING AND SITE PREPARATION**

**2.9.1**. The STATE INSPECTOR shall be notified at least ten days prior to any timber clearing. The STATE INSPECTOR shall be responsible for notifying the DNRC Forestry Division.

**2.9.2**. During clearing of survey lines or the right-of-way, shrubs shall be preserved to the greatest extent possible. Shrub removal shall be limited to crushing where necessary. Plants may be cut off at ground level, leaving roots undisturbed so that they may re-sprout.

**2.9.3.** Right-of-way clearing shall be kept to the minimum necessary to meet the requirements of the National Electric Safety Code. Trees to be saved within the clearing backlines and danger trees located outside the clearing backlines shall be marked. Clearing backlines in SENSITIVE AREAS will be indicated on plan and profile maps. All snags and old growth trees that do not endanger the line or maintenance equipment shall be preserved. In designated SENSITIVE AREAS, the STATE INSPECTOR shall approve clearing boundaries prior to clearing.

**2.9.4**. In no case should the entire nominal width of the right-of-way be cleared of trees up to the edge, unless approved by the STATE INSPECTOR and the LANDOWNER. Clearing should instead produce a "feathered edge" right-of-way configuration, where only specified hazard trees and those that interfere with construction or conductor clearance are removed. In areas where there is potential for long, tunnel views of transmission lines or access roads as identified in Appendix A, care shall be taken to screen the lines from view. For areas identified in Appendix A, a separating screen of vegetation shall be retained where the right-of-way parallels or crosses highways and rivers.

**2.9.5.** During construction, care will be taken to avoid damage to small trees and shrubs on the right-of-way that do not interfere with the clearing requirements under 2.9.3. and would not grow to create a hazard over a ten-year period.

**2.9.6**. Soil disturbance and earth moving will be kept to a minimum.

**2.9.7.** The OWNER shall be held liable for any unauthorized cutting, injury or destruction to timber whether such timber is on or off the right-of-way.

**2.9.8.** Unless otherwise requested by the LANDOWNER or managing agency, felling shall be directional in order to minimize damage to remaining trees. Maximum stump height shall be no more than 12 inches on the uphill side or 1/3 the tree diameter whichever is greater. Trees will not be pushed or pulled over. Stumps will not be removed unless they conflict with a structure, anchor, or roadway.

**2.9.9.** Special logging, clearing, or excavation techniques may be required in certain highly sensitive or fragile areas, as listed in Appendix A.

**2.9.10**. Crane landings shall be constructed on level ground unless extreme conditions (such as slope, soft, or marshy ground) make other construction necessary. In areas where more than one crane landing per tower site would be built, the STATE INSPECTOR will be notified at least 5 days prior to the beginning of construction at those sites.

**2.9.11.** No motorized travel on, scarification of, or displacement of talus slopes shall be allowed except where approved by the STATE INSPECTOR and LANDOWNER.

**2.9.12.** To avoid unnecessary ground disturbance, grounding wires or counterpoise should be placed or buried in disturbed areas whenever possible.

**2.9.13.** Slash resulting from project clearing that may be washed out by high water the following spring shall be removed and piled outside the floodplain before runoff. Instream slash resulting from project clearing must be removed within 24 hours.

**2.9.14.** Streamside trees will be felled away from streams rather than into or across streams.

## 2.10. GROUNDING

Grounding of fences, buildings, and other structures on and adjacent to the right-of-way shall be done according to the specifications of the National Electric Safety Code and any other specifications listed in Appendix G.

## 2.11. EROSION AND SEDIMENT CONTROL

**2.11.1.** Clearing and grubbing for roads and rights-of-way and excavations for stream crossings shall be carefully controlled to minimize silt or other water pollution downstream from the rights-of-way. At a minimum, erosion control measures described in the OWNER's Storm Water Control Plan shall be implemented. Sediment retention basins will be installed as required by the STATE INSPECTOR or managing agency.

**2.11.2.** Roads shall cross drainage bottoms at sharp or nearly right angles and level with the stream bed whenever possible. Temporary bridges, fords, culverts, or other structures will be installed to avoid stream bank damage.

**2.11.3.** Under no circumstances shall stream bed materials be removed for use as backfill, embankments, road surfacing, or for other construction purposes.

**2.11.4.** No excavations shall be allowed on any river or perennial stream channels or floodways at locations likely to cause detrimental erosion or offer a new channel to the river or stream at times of flooding.

**2.11.5.** Installation of transmission line structures, culverts, bridges, or other structures in or within 250 feet of perennial streams along with clearing on stream beds and banks will be done as specified by the STATE INSPECTOR following on-site inspections by DEQ, with the certificate holder, FWP, and local conservation districts invited to attend. All culverts shall be installed with the culvert inlet and outlet at natural stream grade or ground level.

**2.11.6.** Construction of transmission line structures, access roads, bridges, fill slopes, culverts, or impoundments, or channel changes within the high-water mark of any perennial stream, lake, or pond, requires consultation with FWP and the local conservation district and application of applicable water quality standards. Within 15 days prior to the start of construction, the OWNER shall submit written documentation that consultation has occurred. Included in this documentation should be the recommendation of the agencies consulted and the actions that OWNER expects to take to completely implement them.

**2.11.7.** No blasting shall be allowed in streams. Blasting may be allowed near streams if precautions are taken to protect the stream from debris and from entry of nitrates or other contaminants into the stream.

**2.11.8.** The OWNER shall maintain private roads while using them. All ruts made by machinery shall be filled or graded to prevent channeling. In addition, the OWNER must take measures to prevent the occurrence of erosion caused by wind or water during and after use of these roads. Some erosion-preventive measures include but are not limited to, installing or using cross-logs, drain ditches, water bars, and wind erosion inhibitors such as water, straw, gravel, or combinations of these. Erosion control shall be accomplished as described in the Montana Pollution Discharge Elimination System (MPDES) General Permit for Storm Water Discharges Associated with Construction Activity.

**2.11.9.** The OWNER shall prevent material from being deposited in any watercourse or stream channel. Where necessary, measures such as hauling of fill material, construction of temporary barriers, or other approved methods shall be used to keep excavated materials and other extraneous materials out of watercourses. Any such materials entering watercourses shall be removed immediately.

**2.11.10**. The OWNER shall be responsible for the stability of all embankments created during construction. Embankments and backfills shall contain no stream sediments, frozen material, large roots, sod, or other materials that may reduce their stability.

**2.11.11.** Culverts, arch bridges, or other stream crossing structures shall be installed at all permanent crossings of flowing or dry watercourses where fill is likely to wash out during the life of the road. Culvert or bridge installation is prohibited in areas of important fish spawning beds identified by FWP and during specified fish spawning seasons on less sensitive streams or rivers. All culverts shall be large enough to handle approximately 15-year floods. Culvert size shall be determined by standard procedures taking into account the variations in vegetation and climatic zones in Montana, the amount of fill, and the drainage area above the crossing, and shall be approved as specified in 2.11.6. All culverts shall be installed at the time of road construction and maintained for the life of the project. The areas where stream-crossing measures must be taken are listed in Appendix H.

**2.11.12.** No fill material other than that necessary for road construction shall be piled within the high water zone of streams where floods can transport it directly into the stream. Excess floatable debris shall be removed from areas immediately above crossings to prevent obstruction of culverts or bridges during periods of high water.

**2.11.13.** No skidding of logs or driving of vehicles across a perennial watercourse shall be allowed, except via authorized construction roads.

**2.11.14.** No perennial watercourses shall be permanently blocked or diverted.

**2.11.15.** Skidding with tractors shall not be permitted within 100 feet of streams containing flowing water except in places designated in advance, and in no event shall skid roads be located on these stream courses. Skid trails shall be located high enough out of draws, swales, and valley bottoms to permit diversion of runoff water to natural undisturbed forest ground cover.

**2.11.16.** Construction methods shall prevent accidental spillage of solid matter, contaminants, debris, petroleum products, and other objectionable pollutants and wastes into watercourses, lakes, and underground water sources. Secondary containment catchment basins capable of containing the maximum accidental spill shall be installed at areas where fuel, chemicals or oil are stored. Any accidental spills of such materials shall be cleaned up immediately.

**2.11.17.** To reduce the amount of sediment entering streams, a strip of undisturbed vegetation will be provided between areas of disturbance (road construction or tower construction) and stream courses, and around first order or larger streams that have a well-defined stream course or aquatic or riparian vegetation, unless otherwise required by the LANDOWNER. Buffer strip width is measured from the high water line of a channel and will be determined by the STATE INSPECTOR and managing agency. When braided streams with more than one discernible channel (ephemeral or permanent) are encountered, the high water line of the outermost channel shall be used. In the event that vegetation cannot be left undisturbed, structural sediment containment, approved by the STATE INSPECTOR, must be substituted before soil-disturbing activity commences.

**2.11.18.** When no longer needed, all temporary structures or fill installed to aid stream crossing shall be removed and the course of the stream reestablished to prevent future erosion.

**2.11.19.** All temporary dams built on the right-of-way shall be removed after line construction unless otherwise approved by the STATE INSPECTOR. Dams allowed to remain shall be upgraded to permanent structures and shall be provided with spillways or culverts, a continuous sod cover on their tops, and downstream slopes meeting dam safety standards. Spillways may be protected against erosion with riprap or equivalent means.

**2.11.20.** Damage resulting from erosion or other causes shall be repaired after completion of grading and before revegetation is begun.

**2.11.21.** Point discharge of water will be dispersed in a manner to avoid erosion or sedimentation of streams as required in DEQ permits.

**2.11.22.** Riprap or other erosion control activities will be planned based on possible downstream consequences of activity, and installed during the low flow season if possible.

**2.11.23.** Water used in embankment material processing, aggregate processing, concrete curing, foundation and concrete lift cleanup, and other wastewater processes shall not be discharged into surface waters without a valid discharge permit from DEQ.

## 2.12. ARCHAEOLOGICAL, HISTORICAL AND PALEONTOLOGICAL RESOURCES

**2.12.1.** All construction activities shall be conducted so as to prevent damage to significant archaeological, historical, or paleontological resources, in accordance with the requirements of 1.4.1 and Appendix I.

**2.12.2.** Any relics, artifacts, fossils or other items of historical, paleontological, or archaeological value shall be preserved in a manner acceptable to both the LANDOWNER and the State Historic Preservation Officer. If any such items are discovered during construction, SHPO shall be notified immediately. Work that could disturb the materials or surrounding area must cease until the site can be properly evaluated by a qualified archaeologist (either employed by the

OWNER, managing agency or representing SHPO) and recommendations made by that person based on the Historic Preservation Plan outlined in Appendix I (but in no case more than 10 days). For significant sites, the OWNER must follow recommendations of SHPO.

**2.12.3.** The OWNER shall conform to treatments recommended for cultural resources by either SHPO or the Advisory Council on Historic Preservation (ACHP).

**2.13. PREVENTION AND CONTROL OF FIRES**

**2.13.1.** Burning, fire prevention, and fire control shall comply with the burning plan and fire plan in Appendix J. These plans shall meet the requirements of the managing agency and/or the fire control agencies having jurisdiction. The STATE INSPECTOR shall be invited to attend all meetings with these agencies to discuss or prepare these plans. The STATE INSPECTOR, in turn, shall notify DNRC of all such meetings.

**2.13.2.** The OWNER shall direct the CONTRACTOR to comply with regulations of any county, town, state or governing municipality having jurisdiction regarding fire laws and regulations.

**2.13.3.** Blasting caps, powder, and other explosives shall be stored only in approved areas and containers and always separate from each other.

**2.13.4**. The OWNER shall direct the CONTRACTOR to properly store and handle combustible material that could create objectionable smoke, odors, or fumes. The OWNER shall direct the CONTRACTOR not to burn refuse such as trash, rags, tires, plastics, or other debris, except as permitted by the county, town, state, or governing municipality having jurisdiction.

**2.14. WASTE DISPOSAL**

**2.14.1.** The OWNER shall direct the CONTRACTOR to use licensed solid waste disposal sites. Inert materials (Group III wastes) may be disposed of at licensed Class III landfill sites; mixed refuse (Group II wastes) must be disposed of at licensed Class II landfill sites.

**2.14.2.** Emptied pesticide containers or other chemical containers must be triple rinsed to render them acceptable for disposal in Class II landfills or for scrap recycling pursuant to ARM 17.54.201 for treatment or disposal. Pesticide residue and pesticide containers shall be disposed of in accordance with ARM 17.30.637.

**2.14.3**. All waste materials constituting a hazardous waste defined in ARM 16.44.303, and wastes containing any concentration of polychlorinated biphenyls must be transported to an approved designated hazardous waste management facility (as defined in ARM 17.53.201) for treatment or disposal.

**2.14.4.** All used oil shall be hauled away and recycled or disposed of in a licensed Class II landfill authorized to accept liquid wastes or in accordance with 2.14.2 and 2.14.3 above. There shall be no intentional release of crankcase oil or other toxic substances into streams or soil. In the event of an accidental spill into a waterway, the substances will be cleaned up and the STATE INSPECTOR will be contacted immediately. Any spill of refined petroleum products greater than 25 gallons must be reported to the State at Disaster and Emergency Services at 406-841-03911.

**2.14.5.** Sewage shall not be discharged into streams or streambeds. The OWNER shall direct the CONTRACTOR to provide refuse containers and sanitary chemical toilets, convenient to all principal points of operation. These facilities shall comply with applicable federal, state, and local health laws and regulations. A septic tank pump licensed by the State shall service these facilities.

**2.14.6.** In order to reduce fire hazard, small trees and brush cut during construction should be chipped, burned, and/or scattered. Slash 3 inches in diameter or greater may be scattered in quantities of up to 15 tons/acre unless otherwise requested by the LANDOWNER. Tops, limbs and brush less than 3 inches in diameter and 3 feet in length may be left in quantities less than 3 tons per acre except on cropland and residential land or where otherwise specified by the LANDOWNER. In certain cases the STATE INSPECTOR will authorize chipping and scattering of tops, limbs and brush in excess of 3 tons per acre as an erosion control measure. Merchantable timber should be decked and removed at the direction of the LANDOWNER or managing agency

**2.14.7.** Refuse burning shall require the prior approval of the LANDOWNER and a Montana Open Burning Permit must be obtained from DEQ. Any burning of wastes shall comply with section 2.13 of these specifications.

**2.15. SPECIAL MEASURES**

**2.15.1.** Poles with a low reflectivity constant should be used to reduce potential for visual contrast.

**2.15.2.** At river crossings, strategic placement of structures should be done both as a means to screen views of the transmission line and right-of-way and to minimize the need for vegetative clearing. Crossings of rivers should be designed to avoid diagonal crossings.

**3.0 POST-CONSTRUCTION CLEANUP AND RECLAMATION**

**3.1. CLEANUP**

**3.1.1**. All litter resulting from construction is to be removed from the right-of-way and along access roads leading to the right-of-way. Such litter shall be legally disposed of as soon as possible, but in no case later than 60 days following completion of wire clipping. If requested by the LANDOWNER, the OWNER shall provide for removal of any additional construction-related debris discovered after this initial cleanup.

**3.1.2.** Insofar as practical, all signs of temporary construction facilities such as haul roads, work areas, buildings, foundations or temporary structures, soil stockpiles, excess or waste materials, or any other vestiges of construction shall be removed and the areas restored to as natural a condition as practical, in consultation with the LANDOWNER.

**3.2. RESTORATION, RECLAMATION, AND REVEGETATION**

**3.2.1** Restoration, reclamation, and revegetation of the right-of-way, access roads, crane pads, splicing or stringing sites, borrow sites, gravel fill, stone, or aggregate excavation, or any other disturbance shall be in accordance with the reclamation and revegetation plan (Appendix K). The OWNER may choose to develop this plan in consultation with appropriate land management agencies as part of easement negotiations. In this case, the OWNER shall provide written documentation of consultation with those agencies and a copy of the agreed-to plan. This plan and any conditions to the Certificate approved by DEQ shall be attached as Appendix K.

**3.2.2**. Scarring or damage to any landscape feature listed in Appendix A shall be restored as nearly as practical to its original condition. Bare areas created by construction activities will be reseeded in compliance with Appendices K and L to prevent soil erosion.

**3.2.3.** After construction is complete, and in cooperation with the LANDOWNER, temporary roads shall be closed.

**3.2.4.** In agricultural areas where soil has been compacted by movement of construction equipment and unless otherwise specified by the LANDOWNER, the OWNER shall direct the CONTRACTOR to rip the soil deep enough to restore productivity, or if complete restoration is not possible, the OWNER shall compensate the LANDOWNER for lost productivity.

**3.2.5.** Earth next to access roads that cross streams shall be replaced at slopes less than the normal angle of repose for the soil type involved.

**3.2.6.** All drainage channels shall be restored to a gradient and width that will prevent accelerated gully erosion.

**3.2.6.** Drive-through dips, open-top box culverts, waterbars, or cross drains shall be added to roads at the proper spacing and angle as necessary to prevent erosion.

**3.2.7.** Interrupted drainage systems shall be restored.

**3.2.8.** Sidecasting of waste materials may be allowed on slopes over 40 percent after approval by the LANDOWNER, however, this will not be allowed within the buffer strip established for stream courses, in areas of high or extreme soil instability, or in other SENSITIVE AREAS identified in Appendix A. Surplus materials shall be hauled to LANDOWNER-approved sites in such areas.

**3.2.9.** Seeding prescriptions to be used in revegetation, requirements for hydroseeding, fertilizing, and mulching, as jointly determined by representatives of the OWNER, DEQ, and other involved state and federal agencies, are specified in Appendix L.

**3.2.10.** Piling and windrowing of material for burning shall use methods that will prevent significant amounts of soil from being included in the material to be burned and minimize destruction of ground cover. Non-mechanized methods are recommended if necessary to minimize soil erosion and vegetation disturbance. Piles shall be located so as to minimize danger to timber and damage to ground cover when burned.

**3.2.11.** During restoration in areas where topsoil has been stockpiled, the site will be graded to near natural contours and the topsoil will be replaced on the surface.

**3.2.12.** Excavated material not suitable or required for backfill shall be evenly filled back onto the cleared area prior to spreading any stockpiled soil. Large rocks and boulders uncovered during excavation and not buried in the backfill will be disposed of as approved by the STATE INSPECTOR and/or LANDOWNER.

**3.2.13.** Application rates and timing of seeds and fertilizer, and purity and germination rates of seed mixtures, shall be as determined in consultation with DEQ. Reseeding shall be done at the first appropriate opportunity after construction ends.

**3.2.14.** Where appropriate, hydro seeding, drilling, or other appropriate methods shall be used to aid revegetation. Mulching with straw, wood chips, or other means shall be used where necessary. Areas requiring such treatment are listed in Appendix L.

**3.2.15.** All temporary roads shall be obliterated and reclaimed (with the concurrence of the LANDOWNER), as specified in Appendix M. All temporary roadways shall be graded and scarified as specified to permit the growth of vegetation and to discourage traffic. Permanent unsurfaced roadbeds not open to public use will be revegetated as soon after use as possible unless specified otherwise by the LANDOWNER.

**3.3. MONITORING**

**3.3.1.** Upon notice by the OWNER, the STATE INSPECTOR will schedule initial post-construction field inspections following cleanup and road closure. Follow-up visits will be scheduled as required to monitor the effectiveness of erosion controls, reseeding measures, and the right-of-way management plan (Appendix N). The STATE INSPECTOR will contact the LANDOWNER for post-construction access and to determine LANDOWNER satisfaction with the OWNER's restoration measures.

**3.3.2.** The STATE INSPECTOR shall document observations for inclusion in monitoring reports regarding bond release or the success of mitigating measures required by DEQ.

**3.3.2.** Failure of the OWNER to adequately reclaim all disturbed areas in accordance with section 3.2 and ARM 17.20.1902(10) shall be cause for forfeiture of the reclamation BOND(s) or penalties described in Section 0.3. Success of revegetation shall be based on criteria specified in ARM 17.20.1902(10). Failure of the OWNER to achieve adequate revegetation of disturbed areas may be cause for forfeiture of the revegetation BOND(s) or penalties described in Section 0.3.

**4.0. OPERATION AND MAINTENANCE**

**4.1. RIGHT-OF-WAY MANAGEMENT AND ROAD MAINTENANCE**

**4.1.1.** Maintenance of the right-of-way and permanent access roads shall be as specified in the right-of-way management plan (Appendix N). This plan shall provide for the protection of SENSITIVE AREAS identified prior to and during construction as well as control of erosion on permanent access roads.

**4.1.2.** Vegetation that has been saved through the construction process and which does not pose a hazard or potential hazard to the transmission line, particularly that of value to fish and wildlife as specified in Appendix A, shall be allowed to grow on the right-of-way.

**4.1.3.** Vegetative cover adjacent to the transmission line in areas other than cropland shall be maintained in cooperation with the LANDOWNER.

**4.1.4.** Grass cover, water bars, cross drains, the proper slope, and other agreed to measures shall be maintained on permanent access roads and service roads in order to prevent soil erosion.

**4.2. MAINTENANCE INSPECTIONS**

**4.2.1.** The OWNER shall have responsibility to correct soil erosion, noxious weed, or revegetation problems on the right-of-way or access roads as they become known. Appropriate corrective action will be taken where necessary. The OWNER, through agreement with the LANDOWNER or managing agency, may provide a mechanism to identify and correct such problems but the OWNER is responsible for correcting these problems.

**4.2.2.** Operation and maintenance inspections using ground vehicles shall be timed so that routine maintenance will be done when access roads are firm, dry, or frozen, wherever possible. Maintenance vegetative clearing shall be done according to criteria spelled out in Appendix N.

**4.3. CORRECTION OF LANDOWNER PROBLEMS**

**4.3.1.** When the facility causes interference with radio, TV, or other stationary communication systems after the facility is operating, the OWNER will correct the interference with mechanical corrections to facility hardware, or antennas, or will install remote antennas or repeater stations, or will use other reasonable means to correct the problem.

**4.3.2.** The OWNER will respond to complaints of interference by investigating complaints to determine the origin of the interference. If the interference is not caused by the facility, the OWNER shall so inform the person bringing the complaint. The OWNER shall provide the STATE INSPECTOR with documentation of the evidence regarding the source of the interference if the person brings the complaint to the STATE INSPECTOR or DEQ.

**4.4. HERBICIDES AND WEED CONTROL**

**4.4.1.** Weed control, including any application of herbicides in the right-of-way, will be done by applicators currently licensed in Montana and in accordance with recommendations of the Montana Department of Agriculture, and in accordance with the right-of-way maintenance plan in Appendix N.

**4.4.2.** Herbicides will not be used in certain areas identified by DEQ and FWP, as listed in Appendix O or as requested by the LANDOWNER.

**4.4.3.** Proper herbicide application methods will be used to keep drift and nontarget damage to a minimum.

**4.4.4.** Herbicides must be applied according to label specifications and in accordance with 4.4.1 above. Only herbicides registered in compliance with applicable federal and state laws may be applied.

**4.4.5.** Herbicides shall not be sprayed during heavy rains or threat of heavy rains. Vegetation buffer zones shall be left along all identifiable stream channels. Herbicides shall not be used in any public water supply watershed identified by DEQ.

**4.4.6.** In areas disturbed by the transmission line, the OWNER will cooperate with LANDOWNERs in control of noxious weeds as designated by the weed control board having jurisdiction in the county crossed by the line.

**4.4.6.** The OWNER shall notify the STATE INSPECTOR in writing 30 days prior to any broadcast or aerial spraying of herbicides. The notice shall provide details as to the time, place, and justification for such spraying. DEQ, FWP, and the Montana Department of Agriculture shall have the opportunity to inspect the portion of the right-of-way or access roads before, during, and after spraying.

**4.4.7.** During the second and third growing seasons following the completion of restoration and reseeding, the OWNER and STATE INSPECTOR shall inspect the right-of-way and access roads for newly established stands of noxious weeds. The county weed control supervisor shall be invited to attend this inspection. In the event that stands of weeds are encountered, the OWNER shall take appropriate control measures.

**4.5. MONITORING**

**4.5.1.** DEQ may continue to monitor operation and maintenance activities for the life of the project in order to ensure compliance with the specifications in this section (see Appendix Q).

**4.5.2.** The OWNER will be responsible to DEQ for the term of the reclamation BOND (Section 0.8). Following BOND release, the OWNER will report to individual LANDOWNERs and managing agencies except as specified in conditions to the certificate.

**4.5.3.** Upon reasonable complaint from an affected LANDOWNER or managing agency, DEQ may require the OWNER to fund additional monitoring efforts to resolve problems that develop after release of the BONDs. Such efforts would be limited to determining compliance with these specifications and other conditions of the Certificate.

**5.0 ABANDONMENT**

When the transmission line is no longer used or useful, structures including poles, guy wires, and footings; conductors; and ground wires shall be removed and disturbed areas reclaimed using methods outlined in Appendix K.

# APPENDICES

## APPENDIX A: SENSITIVE AREAS FOR THE MATL TRANSMISSION LINE PROJECT

The following sensitive areas have been identified where special measures would be implemented to reduce impacts:

### Land Use/Infrastructure

To minimize impacts to farming, DEQ could require the use of monopoles in the following sensitive areas to reduce impacts associated with crossing of farmland where routing around this farmland would be difficult, where the proposed transmission line would closely parallel an existing power line, and near substations where transmission lines converge:

Alternative 2 between mileposts 0 and 1.13, 1.35 and 1.85; irrigated cropland between mileposts 69.58 and 69.79, 69.81 and 70.72, 85.32 and 85.46; local routing options where the line would diagonally cross crop and CRP land; Belgian Hill Local Routing Option (1.56 miles), and 54.9 miles of land where the line would diagonally cross crop and CRP land.

Alternative 3 between mileposts 0.79 and 2.32.

Alternative 4 on all crop and CRP lands plus crop and CRP lands along the following local routing options: the selected Diamond Valley Local Routing Option (South, Middle, or North), Teton River Crossing, Belgian Hill Local Routing Option (1.0 mile), Bullhead Coulee South, and Bullhead Coulee North.

### Geological/Soils

**Black Horse Lake**

Alternatives 2 and 3 at milepost 4.35 to 4.52 the alignment would be widened an additional 500 feet further south to allow flexibility in pole placement that would avoid an area occasionally flooded by Black Horse Lake.

**Teton River Crossing Area**

Precision mapping for unstable soils would be conducted along the alignment between the milepost markers identified below:

Alternative 2 between mileposts 35.3 and 35.8, 36.2 and 36.6, 36.9 and 37.4, and between mileposts 38 and 40

Alternative 3 between mileposts 32.3 and 32.7, 33.08 and 33.47, and between mileposts 33.8 and 34.0 (where a landslide is crossed)

Alternative 4 between mileposts 36.18 and 36.7, 37.27 and 37.55, 37.9 and 38.4, and between mileposts 39.08 and 41.15

On Alternative 2 the alignment would be narrowed south of the river to avoid a landslide and north of the river would be widened by an additional 250 feet north of the centerline between mileposts 38 and 40 to avoid areas of slope instability in this area. A similar measure would be applied should Alternative 4 be selected.

**Dry Fork of Marias River Crossing**

Alternative 4 between mileposts 69.8 and 70.2, 70.5 and 70.8, 71.1 and 71.4, 71.65 and 72.8, 73.7 and 73.75, 75.1 and 75.7, 76.1 and 76.4, 77.05 and 77.4, 77.7 and 78.05, 80.15 and 81.15, 81.35 and 81.9:

The alignment would be widened to 1000 feet except on cultivated land to allow flexibility in pole placement should new cultural resource sites be encountered. Precision mapping for unstable soils should be conducted along the alignment between the milepost markers identified above. Structures and roads would be located to avoid unstable slopes. If cultural resource sites are encountered and the alignment moved, additional mapping of unstable soils would be required.

**Marias River Crossing Area**

Alternative 2 between mileposts 88.75 and 88.82, 89.1 and 89.4, 89.8 and 90.0, 90.35 and 90.72

Alternative 3 between mileposts 84.3 and 84.65, 84.78 and 84.95, 85.4 and 85.8

Alternative 4 between mileposts 95.2 and 97.1:

Precision mapping for unstable soils must be conducted along the alignment between the milepost markers identified above.

**Wildlife**

On the selected alternative, areas of native vegetation that have not been surveyed for grouse leks would be surveyed prior to construction. Construction would not occur during the breeding season from April to Mid-June within 2 miles of active leks. Anti - perching devices would be installed and maintained on structures within 2 miles of leks.

Overhead ground wires would be marked in the following areas within 2 miles of leks to reduce the potential for avian collisions with the transmission line:

Alternative 2 between mileposts 85.7 and 92

Alternative 3 between mileposts 81 and 87

Alternative 4 between mileposts 9.5 and 10.5 and 95.5 and 101.5

Overhead ground wires near wetlands would be marked to reduce the potential for collisions after inspection and field verification of the need for marking by FWP and FWS biologists.

**Cultural Resources**

Cultural resource surveys would be completed along unsurveyed areas with a high probability of discovering new sites. If cultural resource sites are discovered, structure locations and access routes would be modified to avoid sensitive features or the site recorded.

A professional archeologist would observe construction in high probability areas listed below during pole placement. If cultural resources are discovered during excavation, construction would be temporarily halted while the OWNER completes recovery of artifacts. Artifacts are the property of the LANDOWNER.

**Wetlands**

MATL would delineate wetlands within 500 feet of the alignment of the approved alternative for the portion through Teton County where wetlands have not been mapped by the USFWS.

Alternative 2 between mileposts 23 and 35

Alternative 3 between mileposts 17 and 42

Alternative 4 between mileposts 23 and 48

**Vegetation**

MATL would avoid placing roads and poles in designated 100 year floodplains.

Additional areas for monitoring or for application of mitigation measures may be identified following the pre-construction monitoring trip by the State Inspector or the Inspector's designee.

## APPENDIX B: PERFORMANCE BOND SPECIFICATIONS

Construction and reclamation bonds shall be used to ensure performance with these specifications. Bond amounts are as follows:

Construction bond:

Reclamation bond:

Bonds shall be held and released as provided in ARM 17.20.1902 (6) and (9)- (12).

## Appendix C: Variations In Right-of-Way Width

See Appendix A for variations in right-of way widths.

DEQ does not recommend specific widths for construction easements. In accordance with the specifications, construction activities shall be contained in the minimum area necessary for safe and prudent construction.

DEQ does not recommend specific variations in right-of-way widths beyond those required to meet the National Electric Safety Code for electric transmission line operations and those necessary to meet standards established in ARM 17.20.1607(2).

## Appendix D: Areas Where Construction Timing Restrictions Apply

Except for those areas described in Appendix A, no restrictions in the timing of construction are recommended, beyond those considered necessary on the basis of on-site inspections of stream crossings required in Section 2.11.6 of these specifications and in other sections of these specifications, or as negotiated by LANDOWNERs in individual easement agreements.

## Appendix E: Aeronautical Hazard Markings

For all alternatives, the OWNER would install FAA-recommended aerial markers for aviation safety, as well as at crossings of the Conoco pipeline and crossings of the Cenex pipeline.

For all alternatives, the OWNER would install FAA-recommended aerial markers to make the line more visible to low flying aircraft at crossings of Interstate 15 and U.S. Highways 87 and 2. Marker balls would also be placed at all river crossings.

## Appendix F: Noxious Weed Areas

Presence of noxious weed areas will be determined during a joint inspection by the OWNER, affected weed control boards, and LANDOWNERs. Weeds will be controlled as directed by county Noxious Weed Control programs, state law, and these Environmental Specifications.

## Appendix G: Grounding Specifications

Power lines, fences, and pipelines shall be grounded in accordance with the National Electrical Safety Code. The OWNER shall ensure that operation of the transmission line does not interfere with operation of cathodic protection systems of any pipelines crossed or paralleled.

## Appendix H: Culvert and Bridge Requirements

It does not appear that new culverts or bridges will be needed during construction. In the event a culvert or bridge is needed, it shall be installed to the standards set forth in Section 2.11.11 of the specifications and following review of the proposed installation by the STATE INSPECTOR. The STATE INSPECTOR may require site specific measures to reduce impacts.

## Appendix I: Historic Preservation Plan

The OWNER, in consultation with SHPO, shall develop a plan for identification and treatment of historical or archaeological sites affected by construction. Copies of these plans shall be part of this Appendix. The plan shall identify proposed treatments to be employed to avoid, mitigate or offset project effects on cultural resource sites or culturally significant tribal resources as agreed to by SHPO.

## Appendix J: Burning Plan and Fire Plan

The need for a detailed burning or fire plan is not anticipated for this project. In the event that burning is required prior to or during construction, such burning shall occur in accordance with Sections 0.5, 2.13, and 2.14 of the specifications.

## Appendix K: Reclamation and Revegetation Plan

At least 30 days prior to the start of construction, a reclamation and revegetation plan must be developed and submitted to DEQ for approval. This plan must, at a minimum, specify seeding mixtures, rates, seeding methods and timing of seeding. It must address LANDOWNER wishes, and satisfy requirements of the MPDES General Permit for Storm Water Discharges Associated with Construction Activity and ARM 17.20.1902(10).

The reclamation and revegetation plans must be structured to comply with ARM 17.20.1902 (6) and (9)-(12).

## Appendix L: Areas Where Stockpiling of Topsoil, Hydro Seeding, Fertilizing, or Mulching is Required

At each area where cut and fill would be necessary to construct a road or crane pad, the OWNER shall salvage and stockpile topsoil, and spread the topsoil over disturbed areas following construction to increase re-vegetation success.

## Appendix M: Roads to be Closed and/or Obliterated

If permanent roads are necessary for construction or maintenance of the project, the OWNER shall close or obliterate the roads during decommissioning as requested by the LANDOWNER.

### Appendix N: Right-of-Way Management Plan

DEQ does not recommend a specific right-of-way management plan. To the extent possible, all maintenance and operation activities shall be performed to comply with the requirements of the environmental specifications.

### Appendix O: Watersheds and Other Areas Where Herbicides are Prohibited

DEQ does not recommend any areas or watersheds where herbicide use is prohibited. Herbicide use shall conform to all applicable local, state, and federal restrictions.

### Appendix P: Name and Address of State Inspector

| STATE INSPECTOR | OWNER'S LIAISON |
| --- | --- |
| Environmental Science Specialist<br>Montana Dept of Environmental Quality<br>P.O. Box 200901<br>1520 East Sixth Avenue<br>Helena, Montana 59620-0901<br>(406) 444-_____ | |

### Appendix Q: Monitoring Plan

The STATE INSPECTOR is responsible for implementing this monitoring plan required by 75-20-303(b) and (c), MCA, and for reporting whether terms of the Certificate of Compliance and Environmental Specifications are being met, along with any conditions in the Stormwater Discharge permit and state land easements. The STATE INSPECTOR may identify additional mitigating measures in order to minimize environmental damage due to unique circumstances that arise during construction. These measures will be presented in writing to the OWNER's Liaison who will see that such measures are implemented in a timely manner.

Within 60 days of the completion of construction the STATE INSPECTOR shall review the project area for adequate cleanup, restoration of compacted soils, any necessary earthwork, and repair of damaged property. The STATE INSPECTOR shall notify the OWNER of additional construction cleanup and restoration of disturbed areas. Once the area is restored and revegetated, the bond or bonds shall be released as indicated in ARM 17.20.1902(6) and (9)-(12).

In the growing season following construction the STATE INSPECTOR will determine the adequacy of erosion controls, check for successful seed germination, and determine in conjunction with county weed supervisors areas where weed control would be necessary.

After one and five complete growing seasons following construction, the STATE INSPECTOR will determine whether revegetation efforts have been sufficient to meet the requirements of Appendix K of these Environmental Specifications. If revegetation is not adequate to meet the requirements of Appendix K, the STATE INSPECTOR shall determine whether it is in the best interest of the State to seize the BOND or BONDs and reclaim and revegetate remaining disturbed areas or to continue to monitor these areas. The STATE INSPECTOR shall respond to complaints from citizens for the life of the project.

When violations of the Certificate are identified, the STATE INSPECTOR shall report the violation in writing to the OWNER, who shall immediately take corrective action. If violations continue, penalties described in 75-20-408, MCA may be imposed.

# APPENDIX H:
# LAND USE TYPES BY MILEPOST

The following tables provide a breakdown of land uses along the alignments analyzed in the EIS. Mile posts run from south to north. The analysis was done with GIS based on photo interpretation of the land uses.

| TABLE H- 1<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.827 | 0.827 | **Non-Irrigated** |
| 0.827 | 0.865 | 0.038 | **ROW** |
| 0.865 | 1.142 | 0.277 | **Non-Irrigated** |
| 1.142 | 1.179 | 0.036 | **Riparian** |
| 1.179 | 1.358 | 0.180 | **Rangeland/Native** |
| 1.358 | 1.836 | 0.477 | **Non-Irrigated** |
| 1.836 | 2.800 | 0.964 | **ROW** |
| 2.800 | 3.770 | 0.971 | **Non-Irrigated** |
| 3.770 | 3.798 | 0.028 | **ROW** |
| 3.798 | 3.930 | 0.132 | **Rangeland/Native** |
| 3.930 | 4.471 | 0.541 | **Non-Irrigated** |
| 4.471 | 5.000 | 0.528 | **Rangeland/Native** |
| 5.000 | 5.044 | 0.044 | **ROW** |
| 5.044 | 5.490 | 0.446 | **Rangeland/Native** |
| 5.490 | 5.503 | 0.014 | **ROW** |
| 5.503 | 5.647 | 0.144 | **Rangeland/Native** |
| 5.647 | 5.654 | 0.007 | **ROW** |
| 5.654 | 5.756 | 0.102 | **Rangeland/Native** |
| 5.756 | 5.769 | 0.013 | **ROW** |
| 5.769 | 6.140 | 0.371 | **Rangeland/Native** |
| 6.140 | 6.450 | 0.310 | **Non-Irrigated** |
| 6.450 | 6.922 | 0.472 | **Rangeland/Native** |
| 6.922 | 11.329 | 4.406 | **Non-Irrigated** |
| 11.329 | 11.358 | 0.029 | **ROW** |
| 11.358 | 15.098 | 3.740 | **Non-Irrigated** |
| 15.098 | 15.125 | 0.027 | **Rangeland/Native** |
| 15.125 | 15.503 | 0.378 | **Non-Irrigated** |
| 15.503 | 15.508 | 0.005 | **ROW** |
| 15.508 | 15.960 | 0.451 | **Non-Irrigated** |
| 15.960 | 15.962 | 0.003 | **ROW** |
| 15.962 | 16.720 | 0.758 | **Non-Irrigated** |
| 16.720 | 16.725 | 0.005 | **ROW** |
| 16.725 | 17.639 | 0.914 | **Non-Irrigated** |
| 17.639 | 17.799 | 0.160 | **Rangeland/Native** |
| 17.799 | 18.197 | 0.398 | **Non-Irrigated** |
| 18.197 | 18.625 | 0.428 | **Rangeland/Native** |
| 18.625 | 18.637 | 0.012 | **ROW** |
| 18.637 | 19.550 | 0.913 | **Rangeland/Native** |
| 19.550 | 19.569 | 0.019 | **ROW** |
| 19.569 | 19.644 | 0.075 | **Rangeland/Native** |

**TABLE H- 1**
**LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2**

| Mile Post Begin | Mile Post End | Distance (Miles)[1] | Land Use |
|---|---|---|---|
| 19.644 | 19.730 | 0.085 | **Non-Irrigated** |
| 19.730 | 19.741 | 0.011 | **ROW** |
| 19.741 | 21.662 | 1.921 | **Rangeland/Native** |
| 21.662 | 22.034 | 0.372 | **Non-Irrigated** |
| 22.034 | 22.050 | 0.016 | **ROW** |
| 22.050 | 22.585 | 0.536 | **Non-Irrigated** |
| 22.585 | 23.329 | 0.744 | **Rangeland/Native** |
| 23.329 | 23.347 | 0.018 | **ROW** |
| 23.347 | 23.824 | 0.477 | **Rangeland/Native** |
| 23.824 | 24.340 | 0.516 | **Non-Irrigated** |
| 24.340 | 24.348 | 0.009 | **ROW** |
| 24.348 | 25.338 | 0.990 | **Non-Irrigated** |
| 25.338 | 25.406 | 0.067 | **Rangeland/Native** |
| 25.406 | 25.784 | 0.378 | **Non-Irrigated** |
| 25.784 | 25.881 | 0.097 | **Rangeland/Native** |
| 25.881 | 27.750 | 1.869 | **Non-Irrigated** |
| 27.750 | 27.774 | 0.025 | **ROW** |
| 27.774 | 28.710 | 0.936 | **Non-Irrigated** |
| 28.710 | 28.738 | 0.028 | **Riparian** |
| 28.738 | 29.656 | 0.918 | **Non-Irrigated** |
| 29.656 | 29.703 | 0.047 | **Rangeland/Native** |
| 29.703 | 29.752 | 0.048 | **Non-Irrigated** |
| 29.752 | 29.789 | 0.037 | **ROW** |
| 29.789 | 29.975 | 0.186 | **Non-Irrigated** |
| 29.975 | 30.072 | 0.097 | **Rangeland/Native** |
| 30.072 | 30.498 | 0.427 | **Non-Irrigated** |
| 30.498 | 30.561 | 0.063 | **Rangeland/Native** |
| 30.561 | 31.442 | 0.881 | **Non-Irrigated** |
| 31.442 | 31.476 | 0.034 | **Rangeland/Native** |
| 31.476 | 31.492 | 0.016 | **Riparian** |
| 31.492 | 31.528 | 0.037 | **Rangeland/Native** |
| 31.528 | 31.719 | 0.191 | **Non-Irrigated** |
| 31.719 | 31.729 | 0.010 | **ROW** |
| 31.729 | 31.750 | 0.020 | **Non-Irrigated** |
| 31.750 | 31.756 | 0.007 | **ROW** |
| 31.756 | 31.934 | 0.178 | **Non-Irrigated** |
| 31.934 | 31.954 | 0.020 | **Rangeland/Native** |
| 31.954 | 33.588 | 1.634 | **Non-Irrigated** |
| 33.588 | 33.754 | 0.166 | **Riparian** |
| 33.754 | 34.135 | 0.381 | **Non-Irrigated** |
| 34.135 | 34.152 | 0.017 | **ROW** |
| 34.152 | 35.342 | 1.190 | **Non-Irrigated** |
| 35.342 | 35.562 | 0.220 | **Rangeland/Native** |
| 35.562 | 35.594 | 0.031 | **Riparian** |

| TABLE H- 1<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 35.594 | 35.678 | 0.084 | **Rangeland/Native** |
| 35.678 | 35.838 | 0.160 | **Non-Irrigated** |
| 35.838 | 35.848 | 0.011 | **Rangeland/Native** |
| 35.848 | 36.097 | 0.249 | **Non-Irrigated** |
| 36.097 | 36.102 | 0.005 | **ROW** |
| 36.102 | 36.339 | 0.237 | **Non-Irrigated** |
| 36.339 | 36.388 | 0.049 | **Rangeland/Native** |
| 36.388 | 36.395 | 0.007 | **Riparian** |
| 36.395 | 36.561 | 0.166 | **Rangeland/Native** |
| 36.561 | 37.023 | 0.463 | **Non-Irrigated** |
| 37.023 | 37.237 | 0.214 | **Rangeland/Native** |
| 37.237 | 37.339 | 0.102 | **Non-Irrigated** |
| 37.339 | 37.369 | 0.030 | **Rangeland/Native** |
| 37.369 | 37.443 | 0.074 | **Riparian** |
| 37.443 | 37.452 | 0.010 | **Rangeland/Native** |
| 37.452 | 37.985 | 0.532 | **Non-Irrigated** |
| 37.985 | 38.335 | 0.350 | **Rangeland/Native** |
| 38.335 | 38.620 | 0.286 | **Non-Irrigated** |
| 38.620 | 39.053 | 0.432 | **Rangeland/Native** |
| 39.053 | 39.208 | 0.155 | **Non-Irrigated** |
| 39.208 | 39.275 | 0.067 | **Rangeland/Native** |
| 39.275 | 39.522 | 0.247 | **Non-Irrigated** |
| 39.522 | 39.838 | 0.317 | **Rangeland/Native** |
| 39.838 | 40.866 | 1.028 | **Non-Irrigated** |
| 40.866 | 40.881 | 0.015 | **ROW** |
| 40.881 | 41.158 | 0.277 | **Non-Irrigated** |
| 41.158 | 41.173 | 0.015 | **ROW** |
| 41.173 | 45.128 | 3.954 | **Non-Irrigated** |
| 45.128 | 45.141 | 0.013 | **ROW** |
| 45.141 | 45.250 | 0.109 | **Non-Irrigated** |
| 45.250 | 45.269 | 0.019 | **ROW** |
| 45.269 | 47.518 | 2.249 | **Non-Irrigated** |
| 47.518 | 47.543 | 0.025 | **Riparian** |
| 47.543 | 48.056 | 0.513 | **Non-Irrigated** |
| 48.056 | 48.142 | 0.087 | **Rangeland/Native** |
| 48.142 | 48.451 | 0.309 | **Non-Irrigated** |
| 48.451 | 48.465 | 0.013 | **Riparian** |
| 48.465 | 48.476 | 0.011 | **ROW** |
| 48.476 | 48.490 | 0.014 | **Riparian** |
| 48.490 | 48.499 | 0.009 | **ROW** |
| 48.499 | 49.161 | 0.662 | **Non-Irrigated** |
| 49.161 | 49.173 | 0.012 | **ROW** |
| 49.173 | 50.864 | 1.691 | **Non-Irrigated** |
| 50.864 | 50.885 | 0.020 | **ROW** |

| TABLE H- 1<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 50.885 | 51.120 | 0.235 | **Non-Irrigated** |
| 51.120 | 51.170 | 0.051 | **Riparian** |
| 51.170 | 51.759 | 0.589 | **Non-Irrigated** |
| 51.759 | 51.833 | 0.074 | **Rangeland/Native** |
| 51.833 | 52.229 | 0.396 | **Non-Irrigated** |
| 52.229 | 52.249 | 0.020 | **ROW** |
| 52.249 | 52.748 | 0.499 | **Non-Irrigated** |
| 52.748 | 52.820 | 0.071 | **Rangeland/Native** |
| 52.820 | 52.883 | 0.064 | **ROW** |
| 52.883 | 53.043 | 0.160 | **Rangeland/Native** |
| 53.043 | 53.331 | 0.288 | **Non-Irrigated** |
| 53.331 | 53.723 | 0.392 | **Rangeland/Native** |
| 53.723 | 53.774 | 0.051 | **Non-Irrigated** |
| 53.774 | 53.803 | 0.028 | **Rangeland/Native** |
| 53.803 | 53.870 | 0.068 | **Non-Irrigated** |
| 53.870 | 53.912 | 0.042 | **Riparian** |
| 53.912 | 53.936 | 0.024 | **Non-Irrigated** |
| 53.936 | 53.983 | 0.046 | **Riparian** |
| 53.983 | 55.399 | 1.416 | **Non-Irrigated** |
| 55.399 | 55.425 | 0.026 | **ROW** |
| 55.425 | 55.906 | 0.481 | **Non-Irrigated** |
| 55.906 | 56.305 | 0.399 | **Rangeland/Native** |
| 56.305 | 56.347 | 0.042 | **ROW** |
| 56.347 | 56.536 | 0.189 | **Non-Irrigated** |
| 56.536 | 56.815 | 0.279 | **Rangeland/Native** |
| 56.815 | 56.857 | 0.042 | **Non-Irrigated** |
| 56.857 | 56.988 | 0.131 | **Rangeland/Native** |
| 56.988 | 57.355 | 0.367 | **Non-Irrigated** |
| 57.355 | 57.548 | 0.192 | **Rangeland/Native** |
| 57.548 | 57.669 | 0.121 | **Non-Irrigated** |
| 57.669 | 57.791 | 0.122 | **Rangeland/Native** |
| 57.791 | 57.833 | 0.042 | **ROW** |
| 57.833 | 57.898 | 0.065 | **Non-Irrigated** |
| 57.898 | 57.998 | 0.100 | **Rangeland/Native** |
| 57.998 | 58.032 | 0.033 | **Non-Irrigated** |
| 58.032 | 58.147 | 0.115 | **Rangeland/Native** |
| 58.147 | 58.437 | 0.290 | **Non-Irrigated** |
| 58.437 | 58.455 | 0.019 | **Rangeland/Native** |
| 58.455 | 58.470 | 0.015 | **ROW** |
| 58.470 | 58.547 | 0.077 | **Rangeland/Native** |
| 58.547 | 58.764 | 0.217 | **Non-Irrigated** |
| 58.764 | 58.800 | 0.036 | **Rangeland/Native** |
| 58.800 | 59.819 | 1.019 | **Non-Irrigated** |
| 59.819 | 59.840 | 0.021 | **ROW** |

| TABLE H- 1<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 59.840 | 60.607 | 0.767 | **Non-Irrigated** |
| 60.607 | 60.642 | 0.036 | **ROW** |
| 60.642 | 60.779 | 0.136 | **Non-Irrigated** |
| 60.779 | 60.925 | 0.146 | **Rangeland/Native** |
| 60.925 | 61.538 | 0.614 | **Non-Irrigated** |
| 61.538 | 61.559 | 0.021 | **ROW** |
| 61.559 | 62.296 | 0.737 | **Non-Irrigated** |
| 62.296 | 62.317 | 0.021 | **Rangeland/Native** |
| 62.317 | 62.334 | 0.018 | **Riparian** |
| 62.334 | 62.385 | 0.051 | **Rangeland/Native** |
| 62.385 | 62.928 | 0.543 | **Non-Irrigated** |
| 62.928 | 62.939 | 0.011 | **ROW** |
| 62.939 | 63.747 | 0.808 | **Non-Irrigated** |
| 63.747 | 63.759 | 0.011 | **ROW** |
| 63.759 | 64.042 | 0.284 | **Non-Irrigated** |
| 64.042 | 64.052 | 0.010 | **ROW** |
| 64.052 | 64.316 | 0.264 | **Non-Irrigated** |
| 64.316 | 65.448 | 1.132 | **Rangeland/Native** |
| 65.448 | 65.991 | 0.543 | **Non-Irrigated** |
| 65.991 | 66.025 | 0.034 | **ROW** |
| 66.025 | 66.431 | 0.405 | **Non-Irrigated** |
| 66.431 | 66.989 | 0.558 | **Rangeland/Native** |
| 66.989 | 67.469 | 0.480 | **Non-Irrigated** |
| 67.469 | 67.478 | 0.008 | **ROW** |
| 67.478 | 68.135 | 0.658 | **Non-Irrigated** |
| 68.135 | 68.150 | 0.014 | **Water** |
| 68.150 | 69.55 | 1.400 | **Non-Irrigated** |
| 69.550 | 69.565 | 0.015 | **Rangeland/Native** |
| 69.565 | 69.582 | 0.016 | **ROW** |
| 69.582 | 69.796 | 0.214 | **Irrigated** |
| 69.796 | 69.820 | 0.024 | **ROW** |
| 69.820 | 70.181 | 0.361 | **Irrigated** |
| 70.181 | 70.188 | 0.007 | **Water** |
| 70.188 | 70.727 | 0.538 | **Irrigated** |
| 70.727 | 70.741 | 0.015 | **Water** |
| 70.741 | 71.569 | 0.828 | **Non-Irrigated** |
| 71.569 | 71.581 | 0.013 | **ROW** |
| 71.581 | 71.980 | 0.398 | **Non-Irrigated** |
| 71.980 | 72.002 | 0.022 | **Riparian** |
| 72.002 | 72.660 | 0.658 | **Non-Irrigated** |
| 72.660 | 72.681 | 0.021 | **Riparian** |
| 72.681 | 72.694 | 0.013 | **Rangeland/Native** |
| 72.694 | 72.702 | 0.007 | **ROW** |
| 72.702 | 72.784 | 0.082 | **Rangeland/Native** |

| TABLE H- 1<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 72.784 | 72.808 | 0.025 | **Riparian** |
| 72.808 | 72.899 | 0.090 | **Rangeland/Native** |
| 72.899 | 73.148 | 0.249 | **Non-Irrigated** |
| 73.148 | 73.319 | 0.171 | **Irrigated** |
| 73.319 | 73.559 | 0.240 | **Rangeland/Native** |
| 73.559 | 73.576 | 0.017 | **Water** |
| 73.576 | 73.661 | 0.085 | **Rangeland/Native** |
| 73.661 | 73.700 | 0.039 | **ROW** |
| 73.700 | 73.897 | 0.197 | **Non-Irrigated** |
| 73.897 | 74.221 | 0.325 | **Rangeland/Native** |
| 74.221 | 74.917 | 0.695 | **Non-Irrigated** |
| 74.917 | 74.934 | 0.017 | **Rangeland/Native** |
| 74.934 | 75.789 | 0.855 | **Non-Irrigated** |
| 75.789 | 75.847 | 0.058 | **Rangeland/Native** |
| 75.847 | 76.590 | 0.743 | **Non-Irrigated** |
| 76.590 | 76.665 | 0.076 | **Rangeland/Native** |
| 76.665 | 76.868 | 0.203 | **Non-Irrigated** |
| 76.868 | 77.015 | 0.147 | **Rangeland/Native** |
| 77.015 | 77.045 | 0.030 | **Non-Irrigated** |
| 77.045 | 77.195 | 0.150 | **Rangeland/Native** |
| 77.195 | 77.289 | 0.094 | **Non-Irrigated** |
| 77.289 | 77.665 | 0.376 | **Rangeland/Native** |
| 77.665 | 77.740 | 0.075 | **Non-Irrigated** |
| 77.740 | 77.805 | 0.065 | **Rangeland/Native** |
| 77.805 | 77.866 | 0.061 | **Non-Irrigated** |
| 77.866 | 77.936 | 0.069 | **Rangeland/Native** |
| 77.936 | 77.979 | 0.043 | **Non-Irrigated** |
| 77.979 | 78.000 | 0.021 | **Rangeland/Native** |
| 78.000 | 78.065 | 0.065 | **Non-Irrigated** |
| 78.065 | 78.258 | 0.193 | **Rangeland/Native** |
| 78.258 | 78.371 | 0.113 | **Non-Irrigated** |
| 78.371 | 79.505 | 1.134 | **Rangeland/Native** |
| 79.505 | 79.746 | 0.242 | **Non-Irrigated** |
| 79.746 | 79.786 | 0.040 | **Rangeland/Native** |
| 79.786 | 79.794 | 0.008 | **Riparian** |
| 79.794 | 80.203 | 0.409 | **Non-Irrigated** |
| 80.203 | 80.894 | 0.692 | **Rangeland/Native** |
| 80.894 | 80.911 | 0.016 | **ROW** |
| 80.911 | 80.960 | 0.049 | **Rangeland/Native** |
| 80.960 | 80.968 | 0.009 | **ROW** |
| 80.968 | 81.189 | 0.221 | **Rangeland/Native** |
| 81.189 | 81.200 | 0.011 | **Riparian** |
| 81.200 | 81.340 | 0.140 | **Rangeland/Native** |
| 81.340 | 81.513 | 0.173 | **Non-Irrigated** |

| TABLE H- 1<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 81.513 | 81.521 | 0.008 | **ROW** |
| 81.521 | 81.616 | 0.095 | **Non-Irrigated** |
| 81.616 | 81.624 | 0.008 | **Water** |
| 81.624 | 82.402 | 0.778 | **Non-Irrigated** |
| 82.402 | 82.424 | 0.022 | **Rangeland/Native** |
| 82.424 | 82.737 | 0.313 | **Non-Irrigated** |
| 82.737 | 82.808 | 0.071 | **Rangeland/Native** |
| 82.808 | 83.089 | 0.281 | **Non-Irrigated** |
| 83.089 | 83.094 | 0.005 | **ROW** |
| 83.094 | 84.288 | 1.195 | **Non-Irrigated** |
| 84.288 | 84.446 | 0.158 | **Rangeland/Native** |
| 84.446 | 84.468 | 0.022 | **Non-Irrigated** |
| 84.468 | 84.649 | 0.181 | **Rangeland/Native** |
| 84.649 | 84.802 | 0.154 | **Non-Irrigated** |
| 84.802 | 84.916 | 0.114 | **Rangeland/Native** |
| 84.916 | 85.218 | 0.302 | **Non-Irrigated** |
| 85.218 | 85.226 | 0.008 | **ROW** |
| 85.226 | 85.321 | 0.095 | **Non-Irrigated** |
| 85.321 | 85.460 | 0.138 | **Irrigated** |
| 85.460 | 85.823 | 0.364 | **Rangeland/Native** |
| 85.823 | 86.903 | 1.080 | **Non-Irrigated** |
| 86.903 | 86.909 | 0.006 | **ROW** |
| 86.909 | 87.508 | 0.599 | **Non-Irrigated** |
| 87.508 | 87.513 | 0.006 | **ROW** |
| 87.513 | 88.185 | 0.671 | **Non-Irrigated** |
| 88.185 | 88.228 | 0.044 | **Rangeland/Native** |
| 88.228 | 88.416 | 0.187 | **Non-Irrigated** |
| 88.416 | 89.181 | 0.766 | **Rangeland/Native** |
| 89.181 | 89.190 | 0.008 | **ROW** |
| 89.190 | 89.359 | 0.169 | **Rangeland/Native** |
| 89.359 | 89.371 | 0.012 | **ROW** |
| 89.371 | 89.745 | 0.375 | **Rangeland/Native** |
| 89.745 | 89.764 | 0.019 | **Riparian** |
| 89.764 | 89.804 | 0.040 | **Water** |
| 89.804 | 89.822 | 0.018 | **Riparian** |
| 89.822 | 89.992 | 0.170 | **Rangeland/Native** |
| 89.992 | 90.165 | 0.173 | **Non-Irrigated** |
| 90.165 | 90.219 | 0.054 | **Rangeland/Native** |
| 90.219 | 90.367 | 0.148 | **Non-Irrigated** |
| 90.367 | 90.739 | 0.372 | **Rangeland/Native** |
| 90.739 | 91.124 | 0.385 | **Non-Irrigated** |
| 91.124 | 91.137 | 0.013 | **ROW** |
| 91.137 | 91.692 | 0.555 | **Non-Irrigated** |
| 91.692 | 91.696 | 0.004 | **ROW** |

| TABLE H- 1<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 91.696 | 91.940 | 0.244 | **Non-Irrigated** |
| 91.940 | 92.198 | 0.258 | **Rangeland/Native** |
| 92.198 | 92.575 | 0.378 | **Non-Irrigated** |
| 92.575 | 92.582 | 0.006 | **ROW** |
| 92.582 | 92.809 | 0.227 | **Non-Irrigated** |
| 92.809 | 92.813 | 0.005 | **ROW** |
| 92.813 | 93.913 | 1.100 | **Rangeland/Native** |
| 93.913 | 93.933 | 0.020 | **ROW** |
| 93.933 | 94.101 | 0.169 | **Rangeland/Native** |
| 94.101 | 94.138 | 0.037 | **ROW** |
| 94.138 | 94.920 | 0.782 | **Rangeland/Native** |
| 94.920 | 95.059 | 0.139 | **Non-Irrigated** |
| 95.059 | 95.828 | 0.769 | **Rangeland/Native** |
| 95.828 | 95.836 | 0.008 | **Riparian** |
| 95.836 | 96.061 | 0.225 | **Rangeland/Native** |
| 96.061 | 96.077 | 0.016 | **Riparian** |
| 96.077 | 97.026 | 0.949 | **Rangeland/Native** |
| 97.026 | 97.038 | 0.012 | **Riparian** |
| 97.038 | 98.837 | 1.799 | **Rangeland/Native** |
| 98.837 | 98.840 | 0.003 | **ROW** |
| 98.840 | 99.529 | 0.689 | **Rangeland/Native** |
| 99.529 | 99.532 | 0.003 | **ROW** |
| 99.532 | 99.893 | 0.361 | **Non-Irrigated** |
| 99.893 | 99.974 | 0.081 | **ROW** |
| 99.974 | 100.159 | 0.185 | **Non-Irrigated** |
| 100.159 | 100.164 | 0.005 | **ROW** |
| 100.164 | 101.103 | 0.939 | **Non-Irrigated** |
| 101.103 | 101.115 | 0.011 | **ROW** |
| 101.115 | 102.349 | 1.234 | **Non-Irrigated** |
| 102.349 | 102.354 | 0.005 | **ROW** |
| 102.354 | 102.518 | 0.165 | **Non-Irrigated** |
| 102.518 | 102.673 | 0.155 | **Riparian** |
| 102.673 | 102.942 | 0.269 | **Non-Irrigated** |
| 102.942 | 103.051 | 0.109 | **Riparian** |
| 103.051 | 103.565 | 0.514 | **Non-Irrigated** |
| 103.565 | 103.576 | 0.011 | **ROW** |
| 103.576 | 104.665 | 1.089 | **Non-Irrigated** |
| 104.665 | 104.672 | 0.007 | **ROW** |
| 104.672 | 108.203 | 3.530 | **Non-Irrigated** |
| 108.203 | 108.213 | 0.010 | **ROW** |
| 108.213 | 110.405 | 2.192 | **Non-Irrigated** |
| 110.405 | 110.434 | 0.029 | **Riparian** |
| 110.434 | 110.716 | 0.282 | **Non-Irrigated** |
| 110.716 | 110.735 | 0.019 | **ROW** |

| TABLE H- 1<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 110.735 | 111.698 | 0.963 | **Non-Irrigated** |
| 111.698 | 111.836 | 0.138 | **Rangeland/Native** |
| 111.836 | 111.858 | 0.021 | **ROW** |
| 111.858 | 112.900 | 1.042 | **Rangeland/Native** |
| 112.900 | 113.374 | 0.474 | **Non-Irrigated** |
| 113.374 | 113.400 | 0.026 | **ROW** |
| 113.400 | 114.031 | 0.631 | **Non-Irrigated** |
| 114.031 | 114.082 | 0.051 | **Rangeland/Native** |
| 114.082 | 114.641 | 0.559 | **Non-Irrigated** |
| 114.641 | 114.898 | 0.257 | **Rangeland/Native** |
| 114.898 | 114.907 | 0.009 | **ROW** |
| 114.907 | 116.412 | 1.505 | **Non-Irrigated** |
| 116.412 | 116.417 | 0.004 | **ROW** |
| 116.417 | 117.304 | 0.888 | **Non-Irrigated** |
| 117.304 | 117.321 | 0.017 | **Riparian** |
| 117.321 | 117.643 | 0.321 | **Non-Irrigated** |
| 117.643 | 117.779 | 0.136 | **Riparian** |
| 117.779 | 117.904 | 0.125 | **Rangeland/Native** |
| 117.904 | 117.919 | 0.015 | **ROW** |
| 117.919 | 118.334 | 0.415 | **Non-Irrigated** |
| 118.334 | 118.676 | 0.342 | **Rangeland/Native** |
| 118.676 | 118.914 | 0.238 | **Non-Irrigated** |
| 118.914 | 118.917 | 0.003 | **ROW** |
| 118.917 | 120.155 | 1.238 | **Non-Irrigated** |
| 120.155 | 120.172 | 0.017 | **ROW** |
| 120.172 | 120.715 | 0.543 | **Non-Irrigated** |
| 120.715 | 120.748 | 0.033 | **Riparian** |
| 120.748 | 121.663 | 0.915 | **Non-Irrigated** |
| 121.663 | 124.585 | 2.923 | **Rangeland/Native** |
| 124.585 | 125.515 | 0.929 | **Non-Irrigated** |
| 125.515 | 125.532 | 0.018 | **ROW** |
| 125.532 | 127.454 | 1.922 | **Non-Irrigated** |
| 127.454 | 127.491 | 0.037 | **Rangeland/Native** |
| 127.491 | 127.833 | 0.342 | **Non-Irrigated** |
| 127.833 | 127.852 | 0.020 | **Riparian** |
| 127.852 | 127.868 | 0.016 | **Non-Irrigated** |
| 127.868 | 127.904 | 0.036 | **Riparian** |
| 127.904 | 128.020 | 0.116 | **Non-Irrigated** |
| 128.020 | 128.030 | 0.011 | **ROW** |
| 128.030 | 128.145 | 0.115 | **Non-Irrigated** |
| 128.145 | 128.166 | 0.020 | **Rangeland/Native** |
| 128.166 | 128.226 | 0.060 | **Riparian** |
| 128.226 | 128.303 | 0.077 | **Rangeland/Native** |
| 128.303 | 128.355 | 0.052 | **Riparian** |

| TABLE H- 1<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 2 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 128.355 | 128.383 | 0.029 | **Rangeland/Native** |
| 128.383 | 129.349 | 0.966 | **Non-Irrigated** |
| 129.349 | 129.363 | 0.014 | **Rangeland/Native** |
| 129.363 | 129.883 | 0.520 | **Non-Irrigated** |
| 0.000 | 129.883 | 129.883 | **Total** |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

DEQ has developed alternative alignments for Alternative 2 to reduce some of the effects on farming. Table H-2 through Table H-12 indicate the mileposts in Alternative 2 and the land use associated with the potential realignment.

**TABLE H- 2**
**DIAMOND VALLEY MIDDLE**
**(REPLACES ALTERNATIVE 2 MILEPOST 30.519 TO 36.734)**

| Mile Post Begin | Mile Post End | Distance (Miles)[1] | Land Use |
|---|---|---|---|
| 0.000 | 0.037 | 0.037 | **Rangeland/Native** |
| 0.037 | 0.919 | 0.882 | **Non-Irrigated** |
| 0.919 | 0.952 | 0.033 | **Rangeland/Native** |
| 0.952 | 0.963 | 0.011 | **Riparian** |
| 0.963 | 1.000 | 0.037 | **Rangeland/Native** |
| 1.000 | 1.195 | 0.194 | **Non-Irrigated** |
| 1.195 | 1.205 | 0.010 | **ROW** |
| 1.205 | 1.215 | 0.011 | **Non-Irrigated** |
| 1.215 | 1.231 | 0.016 | **ROW** |
| 1.231 | 4.220 | 2.989 | **Non-Irrigated** |
| 4.220 | 4.303 | 0.084 | **Riparian** |
| 4.303 | 5.186 | 0.883 | **Non-Irrigated** |
| 5.186 | 5.193 | 0.006 | **ROW** |
| 5.193 | 6.101 | 0.909 | **Non-Irrigated** |
| 6.101 | 6.518 | 0.416 | **Rangeland/Native** |
| 6.518 | 7.177 | 0.659 | **Non-Irrigated** |
| 7.177 | 7.399 | 0.222 | **Rangeland/Native** |
| 7.399 | 7.571 | 0.172 | **Non-Irrigated** |
| 0.000 | 7.571 | 7.571 | **Total** |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 3<br>DIAMOND VALLEY NORTH<br>(REPLACES ALTERNATIVE 2 MILEPOST 30.519 TO 36.734) | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.040 | 0.040 | Rangeland/Native |
| 0.040 | 0.922 | 0.882 | Non-Irrigated |
| 0.922 | 0.957 | 0.034 | Rangeland/Native |
| 0.957 | 0.967 | 0.010 | Riparian |
| 0.967 | 1.006 | 0.039 | Rangeland/Native |
| 1.006 | 1.200 | 0.194 | Non-Irrigated |
| 1.200 | 1.213 | 0.013 | ROW |
| 1.213 | 1.441 | 0.228 | Non-Irrigated |
| 1.441 | 1.485 | 0.044 | Rangeland/Native |
| 1.485 | 2.215 | 0.729 | Non-Irrigated |
| 2.215 | 2.221 | 0.007 | ROW |
| 2.221 | 3.209 | 0.988 | Non-Irrigated |
| 3.209 | 3.224 | 0.015 | ROW |
| 3.224 | 3.764 | 0.540 | Non-Irrigated |
| 3.764 | 3.842 | 0.077 | Rangeland/Native |
| 3.842 | 3.847 | 0.005 | ROW |
| 3.847 | 3.990 | 0.143 | Non-Irrigated |
| 3.990 | 4.088 | 0.099 | Rangeland/Native |
| 4.088 | 5.746 | 1.658 | Non-Irrigated |
| 5.746 | 5.753 | 0.006 | Rangeland/Native |
| 5.753 | 5.764 | 0.011 | ROW |
| 5.764 | 6.324 | 0.560 | Non-Irrigated |
| 6.324 | 6.681 | 0.358 | Rangeland/Native |
| 6.681 | 6.687 | 0.006 | Riparian |
| 6.687 | 6.839 | 0.151 | Rangeland/Native |
| 6.839 | 7.317 | 0.478 | Non-Irrigated |
| 7.317 | 7.321 | 0.005 | ROW |
| 7.321 | 7.387 | 0.065 | Non-Irrigated |
| 7.387 | 7.680 | 0.294 | Rangeland/Native |
| 7.680 | 7.875 | 0.194 | Non-Irrigated |
| 0 | 7.875 | 7.875 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

**TABLE H- 4**
**DIAMOND VALLEY SOUTH**
**(REPLACES ALTERNATIVE 2 MILEPOST 30.519 TO 36.734)**

| Mile Post Begin | Mile Post End | Distance (Miles)[1] | Land Use |
|---|---|---|---|
| 0.000 | 0.025 | 0.025 | Rangeland/Native |
| 0.025 | 0.333 | 0.309 | Non-Irrigated |
| 0.333 | 0.428 | 0.095 | Rangeland/Native |
| 0.428 | 0.448 | 0.020 | Riparian |
| 0.448 | 0.616 | 0.168 | Rangeland/Native |
| 0.616 | 2.381 | 1.765 | Non-Irrigated |
| 2.381 | 2.482 | 0.101 | Rangeland/Native |
| 2.482 | 2.577 | 0.217 | Non-Irrigated |
| 2.577 | 2.699 | 0.217 | Rangeland/Native |
| 2.699 | 2.737 | 0.037 | Non-Irrigated |
| 2.737 | 2.746 | 0.010 | Riparian |
| 2.746 | 2.761 | 0.015 | Non-Irrigated |
| 2.761 | 3.070 | 0.309 | Rangeland/Native |
| 3.070 | 3.081 | 0.010 | ROW |
| 3.081 | 3.577 | 0.496 | Rangeland/Native |
| 3.577 | 5.032 | 1.455 | Non-Irrigated |
| 5.032 | 5.045 | 0.013 | ROW |
| 5.045 | 5.882 | 0.837 | Non-Irrigated |
| 5.882 | 6.199 | 0.317 | Rangeland/Native |
| 6.199 | 6.282 | 0.083 | Non-Irrigated |
| 6.282 | 6.292 | 0.010 | Rangeland/Native |
| 6.292 | 6.297 | 0.005 | Riparian |
| 6.297 | 6.322 | 0.025 | Rangeland/Native |
| 6.322 | 7.041 | 0.719 | Non-Irrigated |
| 7.041 | 7.044 | 0.003 | ROW |
| 7.044 | 7.178 | 0.134 | Non-Irrigated |
| 7.178 | 7.266 | 0.087 | Rangeland/Native |
| 7.266 | 7.269 | 0.004 | Riparian |
| 7.269 | 7.543 | 0.273 | Rangeland/Native |
| 7.543 | 7.686 | 0.144 | Non-Irrigated |
| 7.686 | 7.890 | 0.204 | Rangeland/Native |
| 7.890 | 8.028 | 0.138 | Non-Irrigated |
| 0.000 | 8.028 | 8.245 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 5<br>TETON RIVER CROSSING<br>(REPLACES ALTERNATIVE 2 MILEPOST 37.240 TO 37.984) | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.170 | 0.170 | Non-Irrigated |
| 0.170 | 0.179 | 0.009 | Rangeland/Native |
| 0.179 | 0.190 | 0.011 | Forest Total |
| 0.190 | 0.263 | 0.073 | Riparian |
| 0.263 | 0.275 | 0.012 | Water |
| 0.275 | 0.285 | 0.010 | Riparian |
| 0.285 | 0.892 | 0.606 | Rangeland/Native |
| 0.000 | 0.892 | 0.892 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 6<br>SOUTHEAST OF CONRAD<br>(REPLACES ALTERNATIVE 2 MILEPOST 53.723 TO 56.629) | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.054 | 0.054 | Non-Irrigated |
| 0.054 | 0.077 | 0.023 | Rangeland/Native |
| 0.077 | 0.168 | 0.091 | Non-Irrigated |
| 0.168 | 0.181 | 0.013 | Rangeland/Native |
| 0.181 | 0.250 | 0.069 | Non-Irrigated |
| 0.250 | 0.275 | 0.025 | Riparian |
| 0.275 | 0.637 | 0.362 | Non-Irrigated |
| 0.637 | 0.671 | 0.035 | Rangeland/Native |
| 0.671 | 0.687 | 0.015 | Non-Irrigated |
| 0.687 | 0.738 | 0.051 | Rangeland/Native |
| 0.738 | 0.746 | 0.008 | Non-Irrigated |
| 0.746 | 1.062 | 0.316 | Rangeland/Native |
| 1.062 | 1.096 | 0.034 | ROW |
| 1.096 | 1.312 | 0.216 | Rangeland/Native |
| 1.312 | 1.525 | 0.214 | Non-Irrigated |
| 1.525 | 2.010 | 0.484 | Rangeland/Native |
| 2.010 | 2.073 | 0.063 | Non-Irrigated |
| 2.073 | 2.645 | 0.572 | Rangeland/Native |
| 2.645 | 2.693 | 0.048 | ROW |
| 2.693 | 2.893 | 0.201 | Non-Irrigated |
| 2.893 | 2.987 | 0.093 | Rangeland/Native |
| 0.000 | 2.987 | 2.987 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 7<br>WEST OF CONRAD<br>(REPLACES ALTERNATIVE 2 MILEPOST 62.307 TO 63.755) | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.638 | 0.638 | Rangeland/Native |
| 0.638 | 0.641 | 0.004 | ROW |
| 0.641 | 1.210 | 0.568 | Non-Irrigated |
| 1.210 | 1.225 | 0.015 | ROW |
| 1.225 | 1.954 | 0.729 | Non-Irrigated |
| 0.000 | 1.954 | 1.954 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 8<br>NORTHWEST OF CONRAD<br>(REPLACES ALTERNATIVE 2 MILEPOST 66.735 TO 69.505) | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.283 | 0.283 | Rangeland/Native |
| 0.283 | 0.763 | 0.481 | Non-Irrigated |
| 0.763 | 0.774 | 0.010 | ROW |
| 0.774 | 1.147 | 0.374 | Non-Irrigated |
| 1.147 | 1.452 | 0.305 | Rangeland/Native |
| 1.452 | 1.465 | 0.012 | ROW |
| 1.465 | 1.536 | 0.071 | Rangeland/Native |
| 1.536 | 1.786 | 0.250 | Non-Irrigated |
| 1.786 | 2.540 | 0.754 | Rangeland/Native |
| 2.540 | 2.891 | 0.350 | Non-Irrigated |
| 0 | 2.891 | 2.891 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 9<br>BELGIAN HILL<br>(REPLACES ALTERNATIVE 2 MILEPOST 71.237 TO 73.661) | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.432 | 0.432 | Non-Irrigated |
| 0.432 | 0.444 | 0.012 | ROW |
| 0.444 | 0.740 | 0.296 | Non-Irrigated |
| 0.740 | 0.749 | 0.009 | Water |
| 0.749 | 0.767 | 0.018 | Rangeland/Native |
| 0.767 | 1.401 | 0.634 | Non-Irrigated |
| 1.401 | 1.422 | 0.021 | Riparian |
| 1.422 | 1.470 | 0.048 | Non-Irrigated |
| 1.470 | 1.480 | 0.010 | ROW |
| 1.480 | 1.573 | 0.093 | Non-Irrigated |
| 1.573 | 1.693 | 0.120 | Rangeland/Native |
| 1.693 | 1.932 | 0.239 | Non-Irrigated |
| 1.932 | 2.130 | 0.198 | Irrigation Total |
| 2.130 | 2.236 | 0.106 | Rangeland/Native |
| 2.236 | 2.244 | 0.009 | Water |
| 2.244 | 2.548 | 0.303 | Rangeland/Native |
| 0.000 | 2.548 | 2.548 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 10<br>BULLHEAD COULEE SOUTH<br>(REPLACES ALTERNATIVE 2 MILEPOST 76.374 TO 77.740) | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.185 | 0.185 | Non-Irrigated |
| 0.185 | 0.415 | 0.230 | Rangeland/Native |
| 0.415 | 1.138 | 0.724 | Non-Irrigated |
| 1.138 | 1.652 | 0.514 | Rangeland/Native |
| 1.652 | 1.714 | 0.062 | Non-Irrigated |
| 0.000 | 1.714 | 1.714 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 11<br>BULLHEAD COULEE NORTH<br>(REPLACES ALTERNATIVE 2 MILEPOST 82.089 TO 83.709) | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.998 | 0.998 | Non-Irrigated |
| 0.998 | 1.004 | 0.006 | ROW |
| 1.004 | 1.646 | 0.643 | Non-Irrigated |
| 0.000 | 1.646 | 1.646 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 12<br>SOUTH OF CUT BANK<br>(REPLACES ALTERNATIVE 2 MILEPOST 97.227 TO 99.532) | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.739 | 0.739 | Rangeland/Native |
| 0.739 | 0.745 | 0.006 | ROW |
| 0.745 | 1.513 | 0.768 | Rangeland/Native |
| 1.513 | 1.519 | 0.006 | ROW |
| 1.519 | 2.405 | 0.886 | Rangeland/Native |
| 2.405 | 2.411 | 0.006 | ROW |
| 2.411 | 2.447 | 0.036 | Rangeland/Native |
| 2.447 | 2.455 | 0.008 | ROW |
| 0.000 | 2.455 | 2.455 | Total |

[1] Subtracting the beginning miles from the ending miles does not necessarily equal the total miles displayed due to rounding.

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 0.000 | 0.040 | 0.040 | Non-Irrigated |
| 0.040 | 0.568 | 0.527 | Rangeland/Native |
| 0.568 | 0.586 | 0.019 | Riparian |
| 0.586 | 0.650 | 0.064 | Rangeland/Native |
| 0.650 | 0.654 | 0.004 | Riparian |
| 0.654 | 0.670 | 0.016 | Rangeland/Native |
| 0.670 | 0.673 | 0.002 | ROW |
| 0.673 | 0.694 | 0.021 | Rangeland/Native |
| 0.694 | 0.697 | 0.003 | ROW |
| 0.697 | 0.733 | 0.037 | Rangeland/Native |
| 0.733 | 0.739 | 0.006 | ROW |
| 0.739 | 0.755 | 0.016 | Rangeland/Native |
| 0.755 | 0.774 | 0.018 | Non-Irrigated |
| 0.774 | 0.783 | 0.009 | Rangeland/Native |
| 0.783 | 0.925 | 0.142 | ROW |
| 0.925 | 2.312 | 1.387 | Non-Irrigated |
| 2.312 | 2.339 | 0.027 | ROW |
| 2.339 | 3.310 | 0.971 | Non-Irrigated |
| 3.310 | 3.338 | 0.028 | ROW |
| 3.338 | 3.465 | 0.128 | Rangeland/Native |
| 3.465 | 4.008 | 0.543 | Non-Irrigated |
| 4.008 | 4.540 | 0.532 | Rangeland/Native |
| 4.540 | 4.583 | 0.043 | ROW |
| 4.583 | 5.029 | 0.446 | Rangeland/Native |
| 5.029 | 5.042 | 0.014 | ROW |
| 5.042 | 5.186 | 0.144 | Rangeland/Native |
| 5.186 | 5.193 | 0.007 | ROW |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| Mile Post Begin | Mile Post End | Distance (Miles)[1] | Land Use |
| 5.193 | 5.296 | 0.102 | Rangeland/Native |
| 5.296 | 5.308 | 0.013 | ROW |
| 5.308 | 5.677 | 0.369 | Rangeland/Native |
| 5.677 | 5.989 | 0.312 | Non-Irrigated |
| 5.989 | 6.464 | 0.475 | Rangeland/Native |
| 6.464 | 10.741 | 4.278 | Non-Irrigated |
| 10.741 | 10.762 | 0.020 | ROW |
| 10.762 | 14.869 | 4.107 | Non-Irrigated |
| 14.869 | 14.888 | 0.019 | ROW |
| 14.888 | 19.022 | 4.134 | Non-Irrigated |
| 19.022 | 19.102 | 0.080 | Rangeland/Native |
| 19.102 | 19.256 | 0.155 | Non-Irrigated |
| 19.256 | 19.268 | 0.012 | ROW |
| 19.268 | 19.481 | 0.213 | Non-Irrigated |
| 19.481 | 19.510 | 0.028 | Rangeland/Native |
| 19.510 | 20.914 | 1.405 | Non-Irrigated |
| 20.914 | 20.980 | 0.066 | Rangeland/Native |
| 20.980 | 21.060 | 0.080 | Riparian |
| 21.060 | 21.119 | 0.058 | Rangeland/Native |
| 21.119 | 21.772 | 0.653 | Non-Irrigated |
| 21.772 | 21.837 | 0.066 | Rangeland/Native |
| 21.837 | 21.885 | 0.048 | Riparian |
| 21.885 | 22.159 | 0.274 | Rangeland/Native |
| 22.159 | 22.801 | 0.642 | Non-Irrigated |
| 22.801 | 22.807 | 0.006 | ROW |
| 22.807 | 23.362 | 0.555 | Non-Irrigated |
| 23.362 | 23.379 | 0.017 | Rangeland/Native |
| 23.379 | 23.664 | 0.285 | Non-Irrigated |
| 23.664 | 23.678 | 0.014 | ROW |
| 23.678 | 23.733 | 0.055 | Rangeland/Native |
| 23.733 | 23.769 | 0.035 | Riparian |
| 23.769 | 23.883 | 0.115 | Rangeland/Native |
| 23.883 | 24.511 | 0.627 | Non-Irrigated |
| 24.511 | 24.542 | 0.031 | ROW |
| 24.542 | 24.819 | 0.277 | Non-Irrigated |
| 24.819 | 24.864 | 0.046 | Riparian |
| 24.864 | 25.128 | 0.264 | Non-Irrigated |
| 25.128 | 25.140 | 0.011 | ROW |
| 25.140 | 26.315 | 1.175 | Non-Irrigated |
| 26.315 | 26.383 | 0.068 | Rangeland/Native |
| 26.383 | 26.398 | 0.015 | Riparian |
| 26.398 | 26.410 | 0.012 | Rangeland/Native |
| 26.410 | 26.770 | 0.360 | Non-Irrigated |
| 26.770 | 26.777 | 0.007 | ROW |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 26.777 | 27.620 | 0.843 | Non-Irrigated |
| 27.620 | 27.638 | 0.018 | ROW |
| 27.638 | 27.820 | 0.182 | Non-Irrigated |
| 27.820 | 27.827 | 0.007 | ROW |
| 27.827 | 28.365 | 0.538 | Non-Irrigated |
| 28.365 | 28.389 | 0.024 | Riparian |
| 28.389 | 28.725 | 0.336 | Non-Irrigated |
| 28.725 | 28.742 | 0.017 | Riparian |
| 28.742 | 28.986 | 0.244 | Non-Irrigated |
| 28.986 | 28.997 | 0.011 | ROW |
| 28.997 | 30.349 | 1.352 | Non-Irrigated |
| 30.349 | 30.363 | 0.014 | ROW |
| 30.363 | 30.834 | 0.472 | Non-Irrigated |
| 30.834 | 30.869 | 0.035 | Riparian |
| 30.869 | 31.699 | 0.830 | Non-Irrigated |
| 31.699 | 31.711 | 0.012 | ROW |
| 31.711 | 32.241 | 0.529 | Non-Irrigated |
| 32.241 | 32.266 | 0.026 | Rangeland/Native |
| 32.266 | 32.304 | 0.038 | Non-Irrigated |
| 32.304 | 32.454 | 0.150 | Rangeland/Native |
| 32.454 | 32.470 | 0.015 | Riparian |
| 32.470 | 32.717 | 0.248 | Rangeland/Native |
| 32.717 | 33.010 | 0.292 | Non-Irrigated |
| 33.010 | 33.021 | 0.011 | ROW |
| 33.021 | 33.093 | 0.072 | Non-Irrigated |
| 33.093 | 33.723 | 0.630 | Rangeland/Native |
| 33.723 | 33.828 | 0.105 | Riparian |
| 33.828 | 33.862 | 0.034 | Forest |
| 33.862 | 34.097 | 0.235 | Rangeland/Native |
| 34.097 | 36.462 | 2.366 | Non-Irrigated |
| 36.462 | 36.473 | 0.010 | ROW |
| 36.473 | 36.890 | 0.417 | Non-Irrigated |
| 36.890 | 36.903 | 0.014 | ROW |
| 36.903 | 38.477 | 1.574 | Non-Irrigated |
| 38.477 | 38.492 | 0.015 | ROW |
| 38.492 | 41.334 | 2.841 | Non-Irrigated |
| 41.334 | 41.355 | 0.022 | ROW |
| 41.355 | 42.421 | 1.066 | Non-Irrigated |
| 42.421 | 42.436 | 0.015 | ROW |
| 42.436 | 44.327 | 1.891 | Non-Irrigated |
| 44.327 | 44.344 | 0.017 | Riparian |
| 44.344 | 44.627 | 0.284 | Non-Irrigated |
| 44.627 | 44.663 | 0.035 | Rangeland/Native |
| 44.663 | 44.759 | 0.096 | Non-Irrigated |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 44.759 | 44.770 | 0.011 | ROW |
| 44.770 | 45.017 | 0.247 | Non-Irrigated |
| 45.017 | 45.032 | 0.015 | ROW |
| 45.032 | 45.188 | 0.156 | Non-Irrigated |
| 45.188 | 45.199 | 0.010 | ROW |
| 45.199 | 45.953 | 0.754 | Non-Irrigated |
| 45.953 | 45.968 | 0.015 | ROW |
| 45.968 | 47.526 | 1.558 | Non-Irrigated |
| 47.526 | 47.543 | 0.017 | ROW |
| 47.543 | 47.785 | 0.242 | Non-Irrigated |
| 47.785 | 47.865 | 0.079 | Rangeland/Native |
| 47.865 | 47.905 | 0.040 | Riparian |
| 47.905 | 47.929 | 0.024 | Water |
| 47.929 | 48.144 | 0.216 | Non-Irrigated |
| 48.144 | 48.362 | 0.217 | Agriculture |
| 48.362 | 48.513 | 0.151 | Rangeland/Native |
| 48.513 | 48.533 | 0.020 | Riparian |
| 48.533 | 48.994 | 0.461 | Non-Irrigated |
| 48.994 | 49.015 | 0.021 | ROW |
| 49.015 | 49.321 | 0.307 | Non-Irrigated |
| 49.321 | 49.505 | 0.184 | Rangeland/Native |
| 49.505 | 49.542 | 0.037 | Riparian |
| 49.542 | 49.690 | 0.147 | Rangeland/Native |
| 49.690 | 49.724 | 0.035 | Riparian |
| 49.724 | 49.755 | 0.031 | Rangeland/Native |
| 49.755 | 49.773 | 0.017 | Riparian |
| 49.773 | 50.053 | 0.280 | Non-Irrigated |
| 50.053 | 50.173 | 0.120 | ROW |
| 50.173 | 50.222 | 0.049 | Non-Irrigated |
| 50.222 | 50.238 | 0.016 | Rangeland/Native |
| 50.238 | 50.288 | 0.050 | Non-Irrigated |
| 50.288 | 50.335 | 0.046 | Rangeland/Native |
| 50.335 | 50.434 | 0.099 | Non-Irrigated |
| 50.434 | 50.463 | 0.029 | Rangeland/Native |
| 50.463 | 50.733 | 0.270 | Non-Irrigated |
| 50.733 | 50.811 | 0.078 | Rangeland/Native |
| 50.811 | 51.996 | 1.186 | Non-Irrigated |
| 51.996 | 52.018 | 0.022 | ROW |
| 52.018 | 52.522 | 0.504 | Non-Irrigated |
| 52.522 | 52.531 | 0.009 | Rangeland/Native |
| 52.531 | 52.536 | 0.006 | ROW |
| 52.536 | 52.871 | 0.335 | Rangeland/Native |
| 52.871 | 52.906 | 0.035 | ROW |
| 52.906 | 53.081 | 0.175 | Non-Irrigated |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 53.081 | 53.394 | 0.313 | Rangeland/Native |
| 53.394 | 53.534 | 0.139 | Non-Irrigated |
| 53.534 | 53.574 | 0.040 | Rangeland/Native |
| 53.574 | 53.920 | 0.346 | Non-Irrigated |
| 53.920 | 53.932 | 0.012 | ROW |
| 53.932 | 54.045 | 0.112 | Rangeland/Native |
| 54.045 | 54.162 | 0.118 | Non-Irrigated |
| 54.162 | 54.209 | 0.047 | Rangeland/Native |
| 54.209 | 54.216 | 0.007 | ROW |
| 54.216 | 54.236 | 0.020 | Rangeland/Native |
| 54.236 | 54.290 | 0.054 | Non-Irrigated |
| 54.290 | 54.376 | 0.087 | Rangeland/Native |
| 54.376 | 55.640 | 1.264 | Non-Irrigated |
| 55.640 | 55.657 | 0.017 | ROW |
| 55.657 | 56.997 | 1.340 | Non-Irrigated |
| 56.997 | 57.016 | 0.019 | ROW |
| 57.016 | 57.170 | 0.154 | Non-Irrigated |
| 57.170 | 57.179 | 0.010 | ROW |
| 57.179 | 57.224 | 0.044 | Non-Irrigated |
| 57.224 | 57.262 | 0.038 | Residential |
| 57.262 | 57.332 | 0.070 | ROW |
| 57.332 | 58.006 | 0.674 | Non-Irrigated |
| 58.006 | 58.097 | 0.091 | Rangeland/Native |
| 58.097 | 58.122 | 0.024 | Riparian |
| 58.122 | 58.151 | 0.029 | Water |
| 58.151 | 58.181 | 0.031 | Riparian |
| 58.181 | 58.310 | 0.129 | Non-Irrigated |
| 58.310 | 58.393 | 0.083 | Rangeland/Native |
| 58.393 | 58.478 | 0.085 | Riparian |
| 58.478 | 58.516 | 0.038 | Rangeland/Native |
| 58.516 | 58.686 | 0.170 | Non-Irrigated |
| 58.686 | 58.689 | 0.003 | Water |
| 58.689 | 58.954 | 0.264 | Irrigated |
| 58.954 | 58.962 | 0.008 | ROW |
| 58.962 | 59.925 | 0.963 | Irrigated |
| 59.925 | 59.936 | 0.011 | ROW |
| 59.936 | 59.981 | 0.044 | Non-Irrigated |
| 59.981 | 59.992 | 0.012 | ROW |
| 59.992 | 60.843 | 0.850 | Non-Irrigated |
| 60.843 | 61.611 | 0.768 | Rangeland/Native |
| 61.611 | 62.234 | 0.624 | Non-Irrigated |
| 62.234 | 62.243 | 0.008 | ROW |
| 62.243 | 62.393 | 0.150 | Rangeland/Native |
| 62.393 | 62.408 | 0.015 | Riparian |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| Mile Post Begin | Mile Post End | Distance (Miles)[1] | Land Use |
| 62.408 | 62.454 | 0.046 | Rangeland/Native |
| 62.454 | 62.563 | 0.109 | Riparian |
| 62.563 | 62.631 | 0.068 | Rangeland/Native |
| 62.631 | 62.988 | 0.357 | Irrigated |
| 62.988 | 63.016 | 0.027 | Riparian |
| 63.016 | 63.126 | 0.111 | Non-Irrigated |
| 63.126 | 63.132 | 0.006 | ROW |
| 63.132 | 63.382 | 0.250 | Non-Irrigated |
| 63.382 | 63.390 | 0.008 | ROW |
| 63.390 | 63.722 | 0.332 | Non-Irrigated |
| 63.722 | 63.739 | 0.016 | Rangeland/Native |
| 63.739 | 64.004 | 0.266 | Non-Irrigated |
| 64.004 | 64.013 | 0.009 | ROW |
| 64.013 | 65.169 | 1.156 | Non-Irrigated |
| 65.169 | 65.272 | 0.104 | Rangeland/Native |
| 65.272 | 65.613 | 0.341 | Non-Irrigated |
| 65.613 | 65.650 | 0.037 | Rangeland/Native |
| 65.650 | 65.900 | 0.251 | Non-Irrigated |
| 65.900 | 66.144 | 0.244 | Rangeland/Native |
| 66.144 | 66.157 | 0.012 | Riparian |
| 66.157 | 66.208 | 0.051 | Rangeland/Native |
| 66.208 | 66.404 | 0.196 | Irrigated |
| 66.404 | 66.470 | 0.066 | Non-Irrigated |
| 66.470 | 66.486 | 0.016 | Riparian |
| 66.486 | 66.512 | 0.026 | Rangeland/Native |
| 66.512 | 66.523 | 0.011 | ROW |
| 66.523 | 66.940 | 0.417 | Non-Irrigated |
| 66.940 | 67.000 | 0.060 | Rangeland/Native |
| 67.000 | 67.085 | 0.086 | Non-Irrigated |
| 67.085 | 67.121 | 0.036 | Rangeland/Native |
| 67.121 | 67.285 | 0.164 | Riparian |
| 67.285 | 67.317 | 0.032 | Rangeland/Native |
| 67.317 | 67.353 | 0.037 | Riparian |
| 67.353 | 67.548 | 0.194 | Rangeland/Native |
| 67.548 | 67.562 | 0.014 | Riparian |
| 67.562 | 67.697 | 0.135 | Rangeland/Native |
| 67.697 | 67.716 | 0.019 | ROW |
| 67.716 | 67.775 | 0.058 | Riparian |
| 67.775 | 67.893 | 0.119 | Rangeland/Native |
| 67.893 | 68.639 | 0.746 | Non-Irrigated |
| 68.639 | 68.652 | 0.013 | ROW |
| 68.652 | 68.688 | 0.036 | Residential |
| 68.688 | 68.767 | 0.079 | Non-Irrigated |
| 68.767 | 68.792 | 0.025 | Riparian |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 68.792 | 68.848 | 0.055 | Non-Irrigated |
| 68.848 | 68.871 | 0.023 | Riparian |
| 68.871 | 68.889 | 0.018 | Non-Irrigated |
| 68.889 | 68.910 | 0.021 | Riparian |
| 68.910 | 69.104 | 0.194 | Non-Irrigated |
| 69.104 | 69.115 | 0.010 | ROW |
| 69.115 | 69.379 | 0.265 | Non-Irrigated |
| 69.379 | 69.407 | 0.028 | Riparian |
| 69.407 | 69.498 | 0.090 | Non-Irrigated |
| 69.498 | 69.652 | 0.155 | Rangeland/Native |
| 69.652 | 70.519 | 0.867 | Non-Irrigated |
| 70.519 | 70.533 | 0.014 | Riparian |
| 70.533 | 70.568 | 0.035 | Rangeland/Native |
| 70.568 | 70.876 | 0.308 | Irrigated |
| 70.876 | 70.890 | 0.014 | Rangeland/Native |
| 70.890 | 70.907 | 0.017 | ROW |
| 70.907 | 70.928 | 0.022 | Rangeland/Native |
| 70.928 | 71.352 | 0.424 | Irrigated |
| 71.352 | 71.384 | 0.032 | ROW |
| 71.384 | 71.628 | 0.244 | Irrigated |
| 71.628 | 71.672 | 0.043 | Riparian |
| 71.672 | 71.990 | 0.318 | Non-Irrigated |
| 71.990 | 71.997 | 0.007 | ROW |
| 71.997 | 72.270 | 0.273 | Non-Irrigated |
| 72.270 | 72.395 | 0.125 | Irrigated |
| 72.395 | 72.585 | 0.189 | Non-Irrigated |
| 72.585 | 72.599 | 0.015 | Riparian |
| 72.599 | 73.077 | 0.477 | Non-Irrigated |
| 73.077 | 73.082 | 0.005 | ROW |
| 73.082 | 73.491 | 0.409 | Non-Irrigated |
| 73.491 | 73.500 | 0.009 | Riparian |
| 73.500 | 73.993 | 0.493 | Non-Irrigated |
| 73.993 | 74.017 | 0.024 | ROW |
| 74.017 | 74.160 | 0.143 | Non-Irrigated |
| 74.160 | 74.170 | 0.010 | ROW |
| 74.170 | 74.440 | 0.270 | Non-Irrigated |
| 74.440 | 74.668 | 0.228 | Rangeland/Native |
| 74.668 | 75.189 | 0.521 | Non-Irrigated |
| 75.189 | 75.215 | 0.026 | Riparian |
| 75.215 | 75.459 | 0.245 | Irrigated |
| 75.459 | 75.467 | 0.008 | ROW |
| 75.467 | 75.705 | 0.238 | Non-Irrigated |
| 75.705 | 75.777 | 0.072 | Rangeland/Native |
| 75.777 | 75.801 | 0.025 | Riparian |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 75.801 | 75.876 | 0.074 | Rangeland/Native |
| 75.876 | 75.897 | 0.021 | Riparian |
| 75.897 | 76.026 | 0.129 | Rangeland/Native |
| 76.026 | 76.190 | 0.165 | Non-Irrigated |
| 76.190 | 76.202 | 0.011 | ROW |
| 76.202 | 76.356 | 0.155 | Non-Irrigated |
| 76.356 | 76.362 | 0.006 | Water |
| 76.362 | 77.235 | 0.873 | Non-Irrigated |
| 77.235 | 77.247 | 0.012 | ROW |
| 77.247 | 77.521 | 0.274 | Non-Irrigated |
| 77.521 | 77.532 | 0.011 | Rangeland/Native |
| 77.532 | 77.666 | 0.134 | Non-Irrigated |
| 77.666 | 77.670 | 0.003 | Rangeland/Native |
| 77.670 | 77.679 | 0.009 | ROW |
| 77.679 | 78.712 | 1.033 | Non-Irrigated |
| 78.712 | 78.737 | 0.025 | ROW |
| 78.737 | 78.908 | 0.171 | Rangeland/Native |
| 78.908 | 79.324 | 0.416 | Non-Irrigated |
| 79.324 | 79.330 | 0.005 | Rangeland/Native |
| 79.330 | 79.637 | 0.307 | Non-Irrigated |
| 79.637 | 79.645 | 0.008 | Water |
| 79.645 | 79.707 | 0.062 | Rangeland/Native |
| 79.707 | 79.884 | 0.177 | Non-Irrigated |
| 79.884 | 79.904 | 0.021 | Riparian |
| 79.904 | 79.973 | 0.068 | Non-Irrigated |
| 79.973 | 79.991 | 0.018 | ROW |
| 79.991 | 80.417 | 0.426 | Non-Irrigated |
| 80.417 | 80.646 | 0.228 | Irrigated |
| 80.646 | 82.121 | 1.476 | Non-Irrigated |
| 82.121 | 82.149 | 0.028 | ROW |
| 82.149 | 82.188 | 0.039 | Non-Irrigated |
| 82.188 | 82.192 | 0.004 | ROW |
| 82.192 | 83.429 | 1.237 | Non-Irrigated |
| 83.429 | 83.703 | 0.274 | Rangeland/Native |
| 83.703 | 83.712 | 0.009 | ROW |
| 83.712 | 84.350 | 0.639 | Rangeland/Native |
| 84.350 | 84.376 | 0.026 | Non-Irrigated |
| 84.376 | 84.425 | 0.048 | Rangeland/Native |
| 84.425 | 84.509 | 0.084 | Forest |
| 84.509 | 84.572 | 0.063 | Water |
| 84.572 | 84.728 | 0.156 | Rangeland/Native |
| 84.728 | 85.425 | 0.697 | Non-Irrigated |
| 85.425 | 85.458 | 0.033 | Rangeland/Native |
| 85.458 | 85.937 | 0.479 | Non-Irrigated |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 85.937 | 85.948 | 0.011 | ROW |
| 85.948 | 86.508 | 0.560 | Non-Irrigated |
| 86.508 | 86.512 | 0.004 | ROW |
| 86.512 | 86.798 | 0.286 | Non-Irrigated |
| 86.798 | 87.075 | 0.277 | Rangeland/Native |
| 87.075 | 87.570 | 0.495 | Non-Irrigated |
| 87.570 | 87.588 | 0.017 | Rangeland/Native |
| 87.588 | 87.595 | 0.007 | ROW |
| 87.595 | 87.622 | 0.027 | Non-Irrigated |
| 87.622 | 87.625 | 0.003 | Rangeland/Native |
| 87.625 | 87.630 | 0.004 | ROW |
| 87.630 | 88.753 | 1.123 | Rangeland/Native |
| 88.753 | 88.769 | 0.016 | ROW |
| 88.769 | 88.981 | 0.212 | Rangeland/Native |
| 88.981 | 88.985 | 0.004 | ROW |
| 88.985 | 89.060 | 0.075 | Rangeland/Native |
| 89.060 | 89.096 | 0.037 | ROW |
| 89.096 | 89.119 | 0.023 | Rangeland/Native |
| 89.119 | 89.123 | 0.005 | ROW |
| 89.123 | 89.157 | 0.033 | Rangeland/Native |
| 89.157 | 89.172 | 0.015 | Riparian |
| 89.172 | 89.195 | 0.023 | Rangeland/Native |
| 89.195 | 89.222 | 0.027 | ROW |
| 89.222 | 89.470 | 0.248 | Rangeland/Native |
| 89.470 | 89.523 | 0.053 | ROW |
| 89.523 | 90.569 | 1.046 | Rangeland/Native |
| 90.569 | 90.575 | 0.006 | Riparian |
| 90.575 | 90.886 | 0.311 | Rangeland/Native |
| 90.886 | 90.903 | 0.017 | Riparian |
| 90.903 | 93.693 | 2.789 | Rangeland/Native |
| 93.693 | 93.698 | 0.006 | ROW |
| 93.698 | 94.386 | 0.687 | Rangeland/Native |
| 94.386 | 94.390 | 0.004 | ROW |
| 94.390 | 94.749 | 0.359 | Non-Irrigated |
| 94.749 | 94.833 | 0.084 | ROW |
| 94.833 | 95.017 | 0.184 | Non-Irrigated |
| 95.017 | 95.021 | 0.004 | ROW |
| 95.021 | 95.961 | 0.940 | Non-Irrigated |
| 95.961 | 95.968 | 0.007 | ROW |
| 95.968 | 97.205 | 1.237 | Non-Irrigated |
| 97.205 | 97.211 | 0.006 | ROW |
| 97.211 | 97.327 | 0.117 | Non-Irrigated |
| 97.327 | 97.375 | 0.048 | Agriculture |
| 97.375 | 97.532 | 0.157 | Riparian |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 97.532 | 97.796 | 0.264 | Non-Irrigated |
| 97.796 | 97.909 | 0.112 | Riparian |
| 97.909 | 98.424 | 0.515 | Non-Irrigated |
| 98.424 | 98.435 | 0.011 | ROW |
| 98.435 | 99.522 | 1.087 | Non-Irrigated |
| 99.522 | 99.529 | 0.007 | ROW |
| 99.529 | 102.368 | 2.839 | Non-Irrigated |
| 102.368 | 102.390 | 0.022 | Rangeland/Native |
| 102.390 | 103.023 | 0.633 | Non-Irrigated |
| 103.023 | 103.038 | 0.016 | ROW |
| 103.038 | 105.525 | 2.486 | Non-Irrigated |
| 105.525 | 105.539 | 0.015 | ROW |
| 105.539 | 106.282 | 0.743 | Non-Irrigated |
| 106.282 | 106.950 | 0.668 | Rangeland/Native |
| 106.950 | 106.971 | 0.021 | Riparian |
| 106.971 | 107.536 | 0.565 | Rangeland/Native |
| 107.536 | 107.539 | 0.003 | ROW |
| 107.539 | 108.554 | 1.015 | Non-Irrigated |
| 108.554 | 108.558 | 0.004 | ROW |
| 108.558 | 109.550 | 0.991 | Non-Irrigated |
| 109.550 | 109.564 | 0.015 | ROW |
| 109.564 | 109.993 | 0.429 | Non-Irrigated |
| 109.993 | 109.997 | 0.004 | ROW |
| 109.997 | 110.631 | 0.634 | Non-Irrigated |
| 110.631 | 110.680 | 0.049 | Rangeland/Native |
| 110.680 | 110.843 | 0.163 | Non-Irrigated |
| 110.843 | 110.847 | 0.004 | ROW |
| 110.847 | 111.645 | 0.798 | Non-Irrigated |
| 111.645 | 111.910 | 0.265 | Rangeland/Native |
| 111.910 | 112.067 | 0.156 | Non-Irrigated |
| 112.067 | 113.597 | 1.530 | Rangeland/Native |
| 113.597 | 114.088 | 0.492 | Non-Irrigated |
| 114.088 | 114.339 | 0.251 | Rangeland/Native |
| 114.339 | 115.431 | 1.092 | Non-Irrigated |
| 115.431 | 115.491 | 0.060 | Rangeland/Native |
| 115.491 | 115.539 | 0.048 | ROW |
| 115.539 | 115.670 | 0.130 | Rangeland/Native |
| 115.670 | 117.245 | 1.575 | Non-Irrigated |
| 117.245 | 117.308 | 0.063 | Rangeland/Native |
| 117.308 | 117.325 | 0.017 | Riparian |
| 117.325 | 117.514 | 0.189 | Rangeland/Native |
| 117.514 | 118.198 | 0.684 | Non-Irrigated |
| 118.198 | 118.230 | 0.033 | Riparian |
| 118.230 | 118.762 | 0.532 | Rangeland/Native |

| TABLE H- 13<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 3 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 118.762 | 118.777 | 0.015 | ROW |
| 118.777 | 119.750 | 0.974 | Non-Irrigated |
| 119.750 | 119.766 | 0.015 | ROW |
| 119.766 | 119.957 | 0.192 | Non-Irrigated |
| 119.957 | 119.975 | 0.018 | Rangeland/Native |
| 119.975 | 120.080 | 0.105 | Non-Irrigated |
| 120.080 | 120.109 | 0.029 | Rangeland/Native |
| 120.109 | 120.268 | 0.159 | Non-Irrigated |
| 120.268 | 120.272 | 0.003 | ROW |
| 120.272 | 121.594 | 1.322 | Non-Irrigated |
| 121.594 | 121.621 | 0.027 | Rangeland/Native |
| 0 | 121.621 | 121.621 | Total |

[1] Subtracting the beginning Distance (Miles)1 from the ending Distance (Miles)1 does not necessarily equal the total Distance (Miles)1 displayed due to rounding.

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| Mile Post Begin | Mile Post End | Distance (Miles)[1] | Land Use |
| 0.000 | 0.126 | 0.126 | Non-Irrigated |
| 0.126 | 0.734 | 0.608 | Rangeland/Native |
| 0.734 | 0.782 | 0.048 | Riparian |
| 0.782 | 0.817 | 0.035 | Rangeland/Native |
| 0.817 | 0.823 | 0.006 | ROW |
| 0.823 | 0.872 | 0.049 | Rangeland/Native |
| 0.872 | 2.552 | 1.680 | Non-Irrigated |
| 2.552 | 2.566 | 0.014 | ROW |
| 2.566 | 2.692 | 0.125 | Non-Irrigated |
| 2.692 | 2.706 | 0.014 | ROW |
| 2.706 | 3.153 | 0.447 | Non-Irrigated |
| 3.153 | 3.662 | 0.509 | Rangeland/Native |
| 3.662 | 3.685 | 0.024 | ROW |
| 3.685 | 4.044 | 0.359 | Non-Irrigated |
| 4.044 | 4.854 | 0.810 | Rangeland/Native |
| 4.854 | 5.090 | 0.236 | Non-Irrigated |
| 5.090 | 5.468 | 0.378 | Rangeland/Native |
| 5.468 | 5.521 | 0.054 | Non-Irrigated |
| 5.521 | 5.802 | 0.280 | Rangeland/Native |
| 5.802 | 5.817 | 0.015 | Riparian |
| 5.817 | 6.016 | 0.199 | Non-Irrigated |
| 6.016 | 6.330 | 0.314 | Rangeland/Native |
| 6.330 | 6.337 | 0.007 | ROW |
| 6.337 | 6.833 | 0.496 | Rangeland/Native |
| 6.833 | 6.838 | 0.005 | ROW |
| 6.838 | 7.281 | 0.443 | Rangeland/Native |
| 7.281 | 7.450 | 0.169 | Non-Irrigated |
| 7.450 | 8.052 | 0.602 | Rangeland/Native |
| 8.052 | 8.061 | 0.009 | Riparian |
| 8.061 | 9.941 | 1.880 | Rangeland/Native |
| 9.941 | 9.955 | 0.014 | ROW |
| 9.955 | 10.097 | 0.142 | Rangeland/Native |
| 10.097 | 10.250 | 0.153 | Non-Irrigated |
| 10.250 | 10.569 | 0.319 | Rangeland/Native |
| 10.569 | 10.575 | 0.006 | Riparian |
| 10.575 | 11.714 | 1.138 | Rangeland/Native |
| 11.714 | 11.722 | 0.008 | Riparian |
| 11.722 | 11.991 | 0.269 | Rangeland/Native |
| 11.991 | 12.411 | 0.421 | Non-Irrigated |
| 12.411 | 12.770 | 0.359 | Rangeland/Native |
| 12.770 | 12.969 | 0.199 | Non-Irrigated |
| 12.969 | 14.662 | 1.693 | Rangeland/Native |
| 14.662 | 15.130 | 0.467 | Non-Irrigated |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 15.130 | 15.216 | 0.086 | Rangeland/Native |
| 15.216 | 15.730 | 0.515 | Non-Irrigated |
| 15.730 | 15.770 | 0.040 | ROW |
| 15.770 | 16.769 | 0.999 | Non-Irrigated |
| 16.769 | 16.778 | 0.008 | ROW |
| 16.778 | 18.781 | 2.004 | Non-Irrigated |
| 18.781 | 18.799 | 0.018 | ROW |
| 18.799 | 19.732 | 0.933 | Non-Irrigated |
| 19.732 | 21.548 | 1.816 | Rangeland/Native |
| 21.548 | 21.858 | 0.310 | Non-Irrigated |
| 21.858 | 21.867 | 0.009 | ROW |
| 21.867 | 21.942 | 0.075 | Rangeland/Native |
| 21.942 | 21.959 | 0.017 | Riparian |
| 21.959 | 22.790 | 0.831 | Rangeland/Native |
| 22.790 | 22.835 | 0.045 | Riparian |
| 22.835 | 23.316 | 0.480 | Rangeland/Native |
| 23.316 | 23.328 | 0.012 | Riparian |
| 23.328 | 23.403 | 0.076 | Rangeland/Native |
| 23.403 | 23.769 | 0.365 | Non-Irrigated |
| 23.769 | 23.802 | 0.034 | Riparian |
| 23.802 | 24.102 | 0.300 | Non-Irrigated |
| 24.102 | 24.112 | 0.010 | ROW |
| 24.112 | 24.934 | 0.823 | Non-Irrigated |
| 24.934 | 24.945 | 0.010 | ROW |
| 24.945 | 25.122 | 0.177 | Non-Irrigated |
| 25.122 | 25.179 | 0.057 | Rangeland/Native |
| 25.179 | 25.188 | 0.009 | ROW |
| 25.188 | 26.157 | 0.969 | Rangeland/Native |
| 26.157 | 26.182 | 0.025 | Riparian |
| 26.182 | 26.288 | 0.106 | Rangeland/Native |
| 26.288 | 26.724 | 0.437 | Non-Irrigated |
| 26.724 | 26.837 | 0.113 | Rangeland/Native |
| 26.837 | 28.266 | 1.430 | Non-Irrigated |
| 28.266 | 28.290 | 0.024 | ROW |
| 28.290 | 29.226 | 0.936 | Non-Irrigated |
| 29.226 | 29.254 | 0.028 | Riparian |
| 29.254 | 30.172 | 0.918 | Non-Irrigated |
| 30.172 | 30.219 | 0.047 | Rangeland/Native |
| 30.219 | 30.268 | 0.048 | Non-Irrigated |
| 30.268 | 30.278 | 0.010 | Rangeland/Native |
| 30.278 | 30.295 | 0.018 | ROW |
| 30.295 | 30.305 | 0.010 | Rangeland/Native |
| 30.305 | 30.491 | 0.186 | Non-Irrigated |
| 30.491 | 30.588 | 0.097 | Rangeland/Native |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| Mile Post Begin | Mile Post End | Distance (Miles)[1] | Land Use |
| 30.588 | 31.014 | 0.427 | Non-Irrigated |
| 31.014 | 31.077 | 0.063 | Rangeland/Native |
| 31.077 | 31.958 | 0.881 | Non-Irrigated |
| 31.958 | 31.992 | 0.034 | Rangeland/Native |
| 31.992 | 32.008 | 0.016 | Riparian |
| 32.008 | 32.044 | 0.037 | Rangeland/Native |
| 32.044 | 32.235 | 0.191 | Non-Irrigated |
| 32.235 | 32.248 | 0.013 | ROW |
| 32.248 | 32.476 | 0.229 | Non-Irrigated |
| 32.476 | 32.525 | 0.049 | Riparian |
| 32.525 | 34.659 | 2.134 | Non-Irrigated |
| 34.659 | 34.726 | 0.066 | Rangeland/Native |
| 34.726 | 35.524 | 0.799 | Non-Irrigated |
| 35.524 | 35.538 | 0.014 | ROW |
| 35.538 | 36.177 | 0.639 | Non-Irrigated |
| 36.177 | 36.414 | 0.237 | Rangeland/Native |
| 36.414 | 36.425 | 0.012 | Riparian |
| 36.425 | 36.439 | 0.013 | Rangeland/Native |
| 36.439 | 36.466 | 0.027 | Riparian |
| 36.466 | 36.692 | 0.226 | Rangeland/Native |
| 36.692 | 37.175 | 0.483 | Non-Irrigated |
| 37.175 | 37.179 | 0.004 | ROW |
| 37.179 | 37.270 | 0.091 | Non-Irrigated |
| 37.270 | 37.389 | 0.119 | Rangeland/Native |
| 37.389 | 37.400 | 0.011 | Riparian |
| 37.400 | 37.529 | 0.129 | Rangeland/Native |
| 37.529 | 38.019 | 0.490 | Non-Irrigated |
| 38.019 | 38.231 | 0.212 | Riparian |
| 38.231 | 38.390 | 0.160 | Non-Irrigated |
| 38.390 | 38.432 | 0.042 | Forest |
| 38.432 | 38.514 | 0.082 | Riparian |
| 38.514 | 38.563 | 0.049 | Non-Irrigated |
| 38.563 | 38.908 | 0.346 | Rangeland/Native |
| 38.908 | 39.097 | 0.189 | Non-Irrigated |
| 39.097 | 39.447 | 0.350 | Rangeland/Native |
| 39.447 | 39.733 | 0.286 | Non-Irrigated |
| 39.733 | 40.166 | 0.432 | Rangeland/Native |
| 40.166 | 40.198 | 0.032 | Non-Irrigated |
| 40.198 | 40.219 | 0.021 | Rangeland/Native |
| 40.219 | 40.321 | 0.102 | Non-Irrigated |
| 40.321 | 40.391 | 0.071 | Rangeland/Native |
| 40.391 | 40.634 | 0.243 | Non-Irrigated |
| 40.634 | 41.136 | 0.502 | Rangeland/Native |
| 41.136 | 41.264 | 0.127 | Non-Irrigated |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 41.264 | 41.369 | 0.106 | Rangeland/Native |
| 41.369 | 41.650 | 0.280 | Non-Irrigated |
| 41.650 | 41.715 | 0.066 | Rangeland/Native |
| 41.715 | 41.726 | 0.011 | ROW |
| 41.726 | 43.160 | 1.434 | Non-Irrigated |
| 43.160 | 43.165 | 0.004 | ROW |
| 43.165 | 43.716 | 0.551 | Non-Irrigated |
| 43.716 | 43.720 | 0.004 | ROW |
| 43.720 | 45.067 | 1.348 | Non-Irrigated |
| 45.067 | 45.076 | 0.009 | ROW |
| 45.076 | 48.161 | 3.084 | Non-Irrigated |
| 48.161 | 48.176 | 0.015 | ROW |
| 48.176 | 49.887 | 1.712 | Non-Irrigated |
| 49.887 | 49.918 | 0.030 | Riparian |
| 49.918 | 50.665 | 0.747 | Non-Irrigated |
| 50.665 | 50.680 | 0.015 | ROW |
| 50.680 | 52.180 | 1.500 | Non-Irrigated |
| 52.180 | 52.184 | 0.004 | ROW |
| 52.184 | 54.210 | 2.026 | Non-Irrigated |
| 54.210 | 54.220 | 0.009 | ROW |
| 54.220 | 54.712 | 0.493 | Non-Irrigated |
| 54.712 | 54.716 | 0.004 | ROW |
| 54.716 | 55.213 | 0.497 | Non-Irrigated |
| 55.213 | 55.219 | 0.006 | ROW |
| 55.219 | 55.815 | 0.596 | Non-Irrigated |
| 55.815 | 55.851 | 0.036 | Rangeland/Native |
| 55.851 | 57.273 | 1.422 | Non-Irrigated |
| 57.273 | 57.284 | 0.011 | ROW |
| 57.284 | 58.282 | 0.998 | Non-Irrigated |
| 58.282 | 58.287 | 0.006 | ROW |
| 58.287 | 59.042 | 0.754 | Non-Irrigated |
| 59.042 | 59.302 | 0.261 | Rangeland/Native |
| 59.302 | 59.801 | 0.498 | Non-Irrigated |
| 59.801 | 59.806 | 0.005 | ROW |
| 59.806 | 60.299 | 0.493 | Non-Irrigated |
| 60.299 | 60.319 | 0.020 | ROW |
| 60.319 | 60.451 | 0.132 | Non-Irrigated |
| 60.451 | 60.509 | 0.058 | Rangeland/Native |
| 60.509 | 60.518 | 0.009 | Riparian |
| 60.518 | 60.559 | 0.041 | Rangeland/Native |
| 60.559 | 60.586 | 0.027 | Riparian |
| 60.586 | 60.675 | 0.089 | Rangeland/Native |
| 60.675 | 61.257 | 0.582 | Non-Irrigated |
| 61.257 | 61.307 | 0.050 | Rangeland/Native |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 61.307 | 61.333 | 0.026 | Non-Irrigated |
| 61.333 | 62.333 | 1.001 | Irrigated |
| 62.333 | 62.345 | 0.011 | ROW |
| 62.345 | 62.841 | 0.496 | Non-Irrigated |
| 62.841 | 62.938 | 0.097 | Rangeland/Native |
| 62.938 | 63.041 | 0.104 | Riparian |
| 63.041 | 63.098 | 0.056 | Rangeland/Native |
| 63.098 | 63.288 | 0.190 | Irrigated |
| 63.288 | 63.442 | 0.154 | Rangeland/Native |
| 63.442 | 63.883 | 0.441 | Irrigated |
| 63.883 | 63.893 | 0.010 | Rangeland/Native |
| 63.893 | 63.916 | 0.023 | ROW |
| 63.916 | 64.794 | 0.878 | Non-Irrigated |
| 64.794 | 64.921 | 0.128 | Rangeland/Native |
| 64.921 | 65.399 | 0.478 | Non-Irrigated |
| 65.399 | 65.468 | 0.069 | Rangeland/Native |
| 65.468 | 65.501 | 0.033 | Non-Irrigated |
| 65.501 | 65.654 | 0.153 | Rangeland/Native |
| 65.654 | 65.728 | 0.074 | Non-Irrigated |
| 65.728 | 65.732 | 0.004 | Rangeland/Native |
| 65.732 | 65.993 | 0.260 | Non-Irrigated |
| 65.993 | 66.009 | 0.016 | ROW |
| 66.009 | 66.689 | 0.680 | Non-Irrigated |
| 66.689 | 66.789 | 0.099 | Rangeland/Native |
| 66.789 | 66.919 | 0.130 | Non-Irrigated |
| 66.919 | 67.025 | 0.106 | Rangeland/Native |
| 67.025 | 67.479 | 0.454 | Non-Irrigated |
| 67.479 | 67.484 | 0.005 | ROW |
| 67.484 | 68.240 | 0.756 | Non-Irrigated |
| 68.240 | 68.246 | 0.006 | ROW |
| 68.246 | 69.661 | 1.415 | Non-Irrigated |
| 69.661 | 69.663 | 0.002 | ROW |
| 69.663 | 69.842 | 0.179 | Non-Irrigated |
| 69.842 | 69.961 | 0.119 | Rangeland/Native |
| 69.961 | 70.025 | 0.063 | Non-Irrigated |
| 70.025 | 70.157 | 0.132 | Rangeland/Native |
| 70.157 | 70.165 | 0.008 | ROW |
| 70.165 | 70.451 | 0.286 | Non-Irrigated |
| 70.451 | 70.488 | 0.037 | Rangeland/Native |
| 70.488 | 70.492 | 0.005 | Riparian |
| 70.492 | 71.987 | 1.495 | Rangeland/Native |
| 71.987 | 72.000 | 0.012 | ROW |
| 72.000 | 72.553 | 0.553 | Rangeland/Native |
| 72.553 | 72.639 | 0.087 | ROW |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 72.639 | 72.799 | 0.160 | Rangeland/Native |
| 72.799 | 72.819 | 0.020 | ROW |
| 72.819 | 72.899 | 0.080 | Non-Irrigated |
| 72.899 | 72.918 | 0.020 | Rangeland/Native |
| 72.918 | 72.949 | 0.031 | Riparian |
| 72.949 | 73.411 | 0.462 | Rangeland/Native |
| 73.411 | 73.489 | 0.077 | Non-Irrigated |
| 73.489 | 73.523 | 0.034 | Rangeland/Native |
| 73.523 | 73.534 | 0.011 | ROW |
| 73.534 | 73.555 | 0.021 | Rangeland/Native |
| 73.555 | 73.605 | 0.050 | Non-Irrigated |
| 73.605 | 73.635 | 0.030 | Rangeland/Native |
| 73.635 | 73.641 | 0.006 | Riparian |
| 73.641 | 73.704 | 0.063 | Rangeland/Native |
| 73.704 | 73.713 | 0.009 | ROW |
| 73.713 | 73.938 | 0.226 | Rangeland/Native |
| 73.938 | 74.005 | 0.066 | Riparian |
| 74.005 | 74.528 | 0.523 | Rangeland/Native |
| 74.528 | 74.542 | 0.015 | ROW |
| 74.542 | 75.262 | 0.720 | Rangeland/Native |
| 75.262 | 75.272 | 0.011 | ROW |
| 75.272 | 75.645 | 0.373 | Rangeland/Native |
| 75.645 | 75.648 | 0.003 | Riparian |
| 75.648 | 75.660 | 0.011 | Rangeland/Native |
| 75.660 | 75.664 | 0.005 | Riparian |
| 75.664 | 75.691 | 0.027 | Rangeland/Native |
| 75.691 | 75.695 | 0.004 | Riparian |
| 75.695 | 75.744 | 0.049 | Rangeland/Native |
| 75.744 | 75.817 | 0.073 | Non-Irrigated |
| 75.817 | 75.999 | 0.182 | Rangeland/Native |
| 75.999 | 76.338 | 0.340 | Non-Irrigated |
| 76.338 | 76.384 | 0.046 | Rangeland/Native |
| 76.384 | 76.434 | 0.051 | Riparian |
| 76.434 | 76.628 | 0.194 | Rangeland/Native |
| 76.628 | 76.871 | 0.242 | Non-Irrigated |
| 76.871 | 77.630 | 0.760 | Rangeland/Native |
| 77.630 | 77.640 | 0.009 | ROW |
| 77.640 | 77.844 | 0.204 | Rangeland/Native |
| 77.844 | 77.854 | 0.010 | Agriculture |
| 77.854 | 78.490 | 0.636 | Rangeland/Native |
| 78.490 | 78.642 | 0.153 | Non-Irrigated |
| 78.642 | 78.693 | 0.051 | Rangeland/Native |
| 78.693 | 78.700 | 0.007 | Riparian |
| 78.700 | 79.150 | 0.450 | Rangeland/Native |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| Mile Post Begin | Mile Post End | Distance (Miles)[1] | Land Use |
| 79.150 | 79.391 | 0.241 | Non-Irrigated |
| 79.391 | 79.485 | 0.094 | Rangeland/Native |
| 79.485 | 79.785 | 0.300 | Non-Irrigated |
| 79.785 | 79.957 | 0.171 | Rangeland/Native |
| 79.957 | 80.171 | 0.214 | Non-Irrigated |
| 80.171 | 80.496 | 0.325 | Rangeland/Native |
| 80.496 | 80.506 | 0.010 | Riparian |
| 80.506 | 81.028 | 0.522 | Rangeland/Native |
| 81.028 | 81.047 | 0.020 | Riparian |
| 81.047 | 81.518 | 0.471 | Rangeland/Native |
| 81.518 | 81.525 | 0.006 | ROW |
| 81.525 | 81.670 | 0.146 | Rangeland/Native |
| 81.670 | 81.708 | 0.038 | Riparian |
| 81.708 | 81.750 | 0.042 | Rangeland/Native |
| 81.750 | 81.766 | 0.016 | Riparian |
| 81.766 | 81.807 | 0.041 | Rangeland/Native |
| 81.807 | 82.029 | 0.222 | ROW |
| 82.029 | 82.762 | 0.733 | Non-Irrigated |
| 82.762 | 82.773 | 0.011 | Water |
| 82.773 | 83.279 | 0.506 | Rangeland/Native |
| 83.279 | 83.301 | 0.021 | ROW |
| 83.301 | 83.484 | 0.184 | Rangeland/Native |
| 83.484 | 83.536 | 0.051 | Non-Irrigated |
| 83.536 | 83.624 | 0.088 | Rangeland/Native |
| 83.624 | 83.661 | 0.037 | Non-Irrigated |
| 83.661 | 83.695 | 0.035 | Rangeland/Native |
| 83.695 | 83.708 | 0.012 | Non-Irrigated |
| 83.708 | 83.822 | 0.114 | Rangeland/Native |
| 83.822 | 84.517 | 0.695 | Non-Irrigated |
| 84.517 | 84.531 | 0.013 | Rangeland/Native |
| 84.531 | 85.390 | 0.859 | Non-Irrigated |
| 85.390 | 85.445 | 0.056 | Rangeland/Native |
| 85.445 | 86.190 | 0.745 | Non-Irrigated |
| 86.190 | 86.266 | 0.076 | Rangeland/Native |
| 86.266 | 86.469 | 0.203 | Non-Irrigated |
| 86.469 | 86.616 | 0.147 | Rangeland/Native |
| 86.616 | 86.646 | 0.030 | Non-Irrigated |
| 86.646 | 86.796 | 0.150 | Rangeland/Native |
| 86.796 | 86.915 | 0.119 | Non-Irrigated |
| 86.915 | 87.265 | 0.350 | Rangeland/Native |
| 87.265 | 87.340 | 0.075 | Non-Irrigated |
| 87.340 | 87.406 | 0.065 | Rangeland/Native |
| 87.406 | 87.467 | 0.061 | Non-Irrigated |
| 87.467 | 87.537 | 0.069 | Rangeland/Native |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 87.537 | 87.580 | 0.043 | Non-Irrigated |
| 87.580 | 87.601 | 0.021 | Rangeland/Native |
| 87.601 | 87.666 | 0.065 | Non-Irrigated |
| 87.666 | 87.859 | 0.193 | Rangeland/Native |
| 87.859 | 87.972 | 0.113 | Non-Irrigated |
| 87.972 | 89.106 | 1.134 | Rangeland/Native |
| 89.106 | 89.346 | 0.240 | Non-Irrigated |
| 89.346 | 89.387 | 0.041 | Rangeland/Native |
| 89.387 | 89.395 | 0.008 | Riparian |
| 89.395 | 89.800 | 0.405 | Non-Irrigated |
| 89.800 | 90.190 | 0.389 | Rangeland/Native |
| 90.190 | 90.203 | 0.014 | Riparian |
| 90.203 | 90.495 | 0.292 | Rangeland/Native |
| 90.495 | 90.511 | 0.017 | ROW |
| 90.511 | 90.564 | 0.052 | Rangeland/Native |
| 90.564 | 90.570 | 0.006 | Riparian |
| 90.570 | 90.653 | 0.083 | Rangeland/Native |
| 90.653 | 90.662 | 0.009 | ROW |
| 90.662 | 90.791 | 0.129 | Rangeland/Native |
| 90.791 | 90.802 | 0.011 | Riparian |
| 90.802 | 90.946 | 0.144 | Rangeland/Native |
| 90.946 | 91.112 | 0.166 | Non-Irrigated |
| 91.112 | 91.125 | 0.013 | ROW |
| 91.125 | 91.217 | 0.092 | Non-Irrigated |
| 91.217 | 91.226 | 0.009 | Water |
| 91.226 | 92.003 | 0.777 | Non-Irrigated |
| 92.003 | 92.025 | 0.022 | Rangeland/Native |
| 92.025 | 92.338 | 0.313 | Non-Irrigated |
| 92.338 | 92.409 | 0.071 | Rangeland/Native |
| 92.409 | 92.690 | 0.281 | Non-Irrigated |
| 92.690 | 92.695 | 0.005 | ROW |
| 92.695 | 93.889 | 1.194 | Non-Irrigated |
| 93.889 | 94.048 | 0.159 | Rangeland/Native |
| 94.048 | 94.069 | 0.021 | Non-Irrigated |
| 94.069 | 94.250 | 0.181 | Rangeland/Native |
| 94.250 | 94.403 | 0.154 | Non-Irrigated |
| 94.403 | 94.470 | 0.067 | Rangeland/Native |
| 94.470 | 94.488 | 0.018 | Riparian |
| 94.488 | 94.563 | 0.075 | Rangeland/Native |
| 94.563 | 94.819 | 0.256 | Non-Irrigated |
| 94.819 | 94.827 | 0.008 | ROW |
| 94.827 | 94.922 | 0.095 | Non-Irrigated |
| 94.922 | 95.061 | 0.138 | Irrigated |
| 95.061 | 95.424 | 0.364 | Rangeland/Native |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 95.424 | 96.504 | 1.079 | Non-Irrigated |
| 96.504 | 96.510 | 0.006 | ROW |
| 96.510 | 97.109 | 0.599 | Non-Irrigated |
| 97.109 | 97.113 | 0.004 | ROW |
| 97.113 | 97.783 | 0.670 | Non-Irrigated |
| 97.783 | 97.827 | 0.044 | Rangeland/Native |
| 97.827 | 98.017 | 0.190 | Non-Irrigated |
| 98.017 | 98.781 | 0.764 | Rangeland/Native |
| 98.781 | 98.791 | 0.010 | ROW |
| 98.791 | 98.962 | 0.171 | Rangeland/Native |
| 98.962 | 98.972 | 0.010 | ROW |
| 98.972 | 99.346 | 0.374 | Rangeland/Native |
| 99.346 | 99.372 | 0.026 | Riparian |
| 99.372 | 99.406 | 0.034 | Water |
| 99.406 | 99.422 | 0.016 | Riparian |
| 99.422 | 99.593 | 0.170 | Rangeland/Native |
| 99.593 | 99.766 | 0.173 | Non-Irrigated |
| 99.766 | 99.819 | 0.054 | Rangeland/Native |
| 99.819 | 99.967 | 0.148 | Non-Irrigated |
| 99.967 | 100.340 | 0.372 | Rangeland/Native |
| 100.340 | 100.726 | 0.386 | Non-Irrigated |
| 100.726 | 100.737 | 0.011 | ROW |
| 100.737 | 101.293 | 0.556 | Non-Irrigated |
| 101.293 | 101.298 | 0.005 | ROW |
| 101.298 | 101.536 | 0.239 | Non-Irrigated |
| 101.536 | 101.798 | 0.262 | Rangeland/Native |
| 101.798 | 102.176 | 0.377 | Non-Irrigated |
| 102.176 | 102.181 | 0.005 | ROW |
| 102.181 | 102.409 | 0.228 | Non-Irrigated |
| 102.409 | 102.414 | 0.006 | ROW |
| 102.414 | 103.516 | 1.101 | Rangeland/Native |
| 103.516 | 103.531 | 0.015 | ROW |
| 103.531 | 103.700 | 0.169 | Rangeland/Native |
| 103.700 | 103.739 | 0.039 | ROW |
| 103.739 | 104.520 | 0.781 | Rangeland/Native |
| 104.520 | 104.658 | 0.139 | Non-Irrigated |
| 104.658 | 105.428 | 0.770 | Rangeland/Native |
| 105.428 | 105.438 | 0.010 | Riparian |
| 105.438 | 105.651 | 0.213 | Rangeland/Native |
| 105.651 | 105.680 | 0.029 | Riparian |
| 105.680 | 106.625 | 0.945 | Rangeland/Native |
| 106.625 | 106.638 | 0.013 | Riparian |
| 106.638 | 107.567 | 0.929 | Rangeland/Native |
| 107.567 | 107.573 | 0.006 | ROW |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 107.573 | 108.341 | 0.768 | Rangeland/Native |
| 108.341 | 108.347 | 0.006 | ROW |
| 108.347 | 109.233 | 0.886 | Rangeland/Native |
| 109.233 | 109.239 | 0.006 | ROW |
| 109.239 | 109.275 | 0.035 | Rangeland/Native |
| 109.275 | 109.284 | 0.009 | ROW |
| 109.284 | 109.615 | 0.331 | Non-Irrigated |
| 109.615 | 109.644 | 0.029 | Agriculture |
| 109.644 | 109.725 | 0.081 | ROW |
| 109.725 | 109.910 | 0.186 | Non-Irrigated |
| 109.910 | 109.914 | 0.004 | ROW |
| 109.914 | 110.855 | 0.941 | Non-Irrigated |
| 110.855 | 110.862 | 0.007 | ROW |
| 110.862 | 112.099 | 1.237 | Non-Irrigated |
| 112.099 | 112.104 | 0.005 | ROW |
| 112.104 | 112.219 | 0.115 | Non-Irrigated |
| 112.219 | 112.269 | 0.050 | Agriculture |
| 112.269 | 112.424 | 0.155 | Riparian |
| 112.424 | 112.693 | 0.269 | Non-Irrigated |
| 112.693 | 112.802 | 0.109 | Riparian |
| 112.802 | 113.318 | 0.515 | Non-Irrigated |
| 113.318 | 113.325 | 0.008 | ROW |
| 113.325 | 114.416 | 1.091 | Non-Irrigated |
| 114.416 | 114.423 | 0.007 | ROW |
| 114.423 | 117.955 | 3.532 | Non-Irrigated |
| 117.955 | 117.964 | 0.009 | ROW |
| 117.964 | 120.156 | 2.192 | Non-Irrigated |
| 120.156 | 120.185 | 0.029 | Riparian |
| 120.185 | 120.472 | 0.288 | Non-Irrigated |
| 120.472 | 120.477 | 0.005 | ROW |
| 120.477 | 121.449 | 0.972 | Non-Irrigated |
| 121.449 | 121.590 | 0.141 | Rangeland/Native |
| 121.590 | 121.609 | 0.019 | ROW |
| 121.609 | 122.651 | 1.042 | Rangeland/Native |
| 122.651 | 123.126 | 0.476 | Non-Irrigated |
| 123.126 | 123.148 | 0.022 | ROW |
| 123.148 | 123.782 | 0.634 | Non-Irrigated |
| 123.782 | 123.833 | 0.051 | Rangeland/Native |
| 123.833 | 124.392 | 0.559 | Non-Irrigated |
| 124.392 | 124.648 | 0.256 | Rangeland/Native |
| 124.648 | 124.658 | 0.009 | ROW |
| 124.658 | 126.163 | 1.506 | Non-Irrigated |
| 126.163 | 126.167 | 0.004 | ROW |
| 126.167 | 127.055 | 0.888 | Non-Irrigated |

| TABLE H- 14<br>LAND USES CATEGORIES CROSSED BY ALTERNATIVE 4 | | | |
|---|---|---|---|
| **Mile Post Begin** | **Mile Post End** | **Distance (Miles)[1]** | **Land Use** |
| 127.055 | 127.072 | 0.017 | Riparian |
| 127.072 | 127.394 | 0.321 | Non-Irrigated |
| 127.394 | 127.530 | 0.136 | Riparian |
| 127.530 | 127.657 | 0.126 | Rangeland/Native |
| 127.657 | 127.671 | 0.015 | ROW |
| 127.671 | 128.085 | 0.414 | Non-Irrigated |
| 128.085 | 128.427 | 0.342 | Rangeland/Native |
| 128.427 | 128.665 | 0.238 | Non-Irrigated |
| 128.665 | 128.667 | 0.002 | ROW |
| 128.667 | 129.908 | 1.241 | Non-Irrigated |
| 129.908 | 129.922 | 0.013 | ROW |
| 129.922 | 130.466 | 0.544 | Non-Irrigated |
| 130.466 | 130.498 | 0.033 | Riparian |
| 130.498 | 131.414 | 0.915 | Non-Irrigated |
| 131.414 | 134.329 | 2.915 | Rangeland/Native |
| 134.329 | 135.265 | 0.937 | Non-Irrigated |
| 135.265 | 135.283 | 0.018 | ROW |
| 135.283 | 137.583 | 2.300 | Non-Irrigated |
| 137.583 | 137.603 | 0.020 | Riparian |
| 137.603 | 137.619 | 0.016 | Non-Irrigated |
| 137.619 | 137.655 | 0.036 | Riparian |
| 137.655 | 137.770 | 0.116 | Non-Irrigated |
| 137.770 | 137.781 | 0.011 | ROW |
| 137.781 | 137.896 | 0.115 | Non-Irrigated |
| 137.896 | 137.917 | 0.020 | Rangeland/Native |
| 137.917 | 137.977 | 0.060 | Riparian |
| 137.977 | 138.054 | 0.077 | Rangeland/Native |
| 138.054 | 138.106 | 0.052 | Riparian |
| 138.106 | 138.131 | 0.026 | Rangeland/Native |
| 138.131 | 139.100 | 0.969 | Non-Irrigated |
| 139.100 | 139.116 | 0.016 | Rangeland/Native |
| 139.116 | 139.634 | 0.517 | Non-Irrigated |
| 0 | 139.634 | 139.634 | Total |
| | | | |
| | | | |
| | | | |

[1] Subtracting the beginning Distance (Miles)1 from the ending Distance (Miles)1 does not necessarily equal the total Distance (Miles)1 displayed due to rounding.

# APPENDIX L:
# PHOTOGRAPHIC SIMULATIONS

# APPENDIX L

## Photographic Simulations

Technical information on the generation of photographic simulations is provided here. Computer Aided Design (CAD), Geographic Information System (GIS), and 3-dimensional (3-D) modeling and design software, Global Positioning Systems (GPS) equipment, a Digital Single Lens Reflex (dSLR) camera, and direct conversations with individuals responsible for transmission line pole design were used to prepare the photograph simulations. Photographs were taken in the field at the defined viewpoint locations and used as backgrounds in the computer generated images. Several 3-D models were constructed of the topography and transmission line poles. Pole placement was performed using GIS software. The computer camera placed the poles in the 3-D model at the appropriate location and the images were generated.

On-site GPS data were obtained using the Pharos GPS Pocket Navigator package for a hand-held Dell Axim 51 PDA. Data recorded included date, time of day, latitude, longitude, elevation, and heading. Heading was verified with a hand-held compass. On-site photographs were acquired using a Canon 350D dSLR (1.6 crop factor) and a Canon 18-55 mm zoom lens. Camera information recorded and verified from photograph EXIF information included: film speed, focal length, aperture, and shutter speed. Photographs were saved as both unprocessed data from the image sensor and in a compressed format.

Montana Digital Elevation Model (DEM) data were obtained from the National Elevation Dataset (NED) as of April 2002 for each of the viewpoints. The data used included 30-meter X-Y resolution and one foot resolution in the Z-plane. Horizontal datum is North American Datum of 1927 (NAD27) with a transverse mercator projection, and National Geodetic Vertical Datum (NGVD) 1929 vertical datum.

The proposed transmission line route was presented in the MFSA application (MATL 2006b). The transmission line map datum was converted to NAD27, so that the line could be exported and then re-imported into the 3-D modeling software and aligned with the NAD27 based DEMs. Transmission line and proposed pole specifications and details were obtained from SNC-Lavalin ATP Inc. (2006). Scaled 3-D models were constructed for each of the proposed power pole types and placed into the 3-D model along the proposed transmission line alignment using specified or recommended span distances between poles. Typical conductor and ground cable sag specifications were used unless otherwise specified by SNC-Lavalin.

For each simulation, the photograph taken in the field was imported into the 3-D modeling software package and loaded as a background environment within which the view of the 3-D model is generated. To generate the correct view relative to the actual photograph, a software camera was placed at a location identical to where the photograph was taken relating the field location to the DEM location. Using the JEEEP.com coordinate translation applet, GPS recorded camera locations were converted to Universal Transverse Projection (UTM) northing and easting locations to facilitate placement of the software camera.

# APPENDIX M:
# MATL SYSTEM IMPACT STUDY AND WECC LETTER

Western Electricity Coordinating Council

**Brian Silverstein**
Chair, Planning Coordination Committee
Bonneville Power Administration

(360) 418-2122
blsilverstein@bpa.gov

August 28, 2007

PLANNING COORDINATION COMMITTEE
OPERATING COMMITTEE
TECHNICAL STUDIES SUBCOMMITTEE

Subject: Montana Alberta Tie Ltd. Achieves Phase 3 Status

The MATL project initiated the WECC planning process on September 20, 2005. The Project is a 346 kM, 230/240kV transmission line designed for continuous bidirectional power transfers of over 300 MW. The project consists of a new substation in Alberta that ties into the existing 240 kV Alberta Interconnected Electric System (AIES) system. A phase shifting transformer will be installed to control flows both north and south and to step the voltage down from the Alberta nominal system voltage of 240 kV to the transmission line voltage of 230 kV. A mid-point substation named Marias will be built south of the town of Cut Bank, Montana. The Marias Substation will contain voltage support and be a connection point for proposed wind generation projects in the area. At the south end, the MATL transmission line will terminate at the existing Great Falls, Montana, 230 kV substation.

On February 2, 2006, the Project received Phase II status. A Project Review Group (PRG) was formed and was comprised of representatives from Bonneville Power Administration, Northwestern Energy, Western Area Power Administration, Avista Corporation, AESO, British Columbia Transmission Corporation, TransCanada – Northern Lights Transmission, PacifiCorp, Powerex, and ENMAX Power Corporation.

A Final Draft of the Phase 2 Report was submitted to the MATL Project Review Group (PRG) on June 11, 2007. All comments received have been addressed to the satisfaction of each party providing comments.

On July 25, 2007, MATL sent a request to the PCC to enter Phase 3, along with the PRG Report. No additional comments were received during the 30-day review process. Therefore, in accordance with the WECC Three Phase Project Rating Process, the MATL Project is hereby granted Phase III status with an Accepted Rating of +/- 300 MW.

Sincerely,

Brian Silverstein

Brian Silverstein

cc: Kent Bolton, WECC
Peter Mackin, USE

MONTANA ALBERTA TIE LTD

# MONTANA-ALBERTA TIE LTD.
# PROJECT REVIEW GROUP

## PHASE 2 STUDY REPORT

PROJECT REVIEW GROUP ACCEPTED
JULY 24, 2007

REGISTERED PROFESSIONAL ENGINEER
R. PETER MACKIN
No. 12018
EXP. 9/30/07
ELECTRICAL
STATE OF CALIFORNIA

| | Name | Signature | |
|---|---|---|---|
| Prepared | Peter Mackin, P.E.<br>Utility Systems<br>Efficiencies, Inc. | R. Peter Mackin | 07/24/07 |
| Approved | Mark Abraham, P.Eng.<br>Montana Alberta Tie Ltd. | [signature] | July 24, 2007 |

# I. EXECUTIVE SUMMARY

### Project Overview

Montana Alberta Tie, Ltd. (MATL), a wholly owned subsidiary of Tonbridge Power Inc., is proposing to build a 240/230 kV merchant transmission line from the Lethbridge area in southern Alberta to Great Falls in west-central Montana. This project is Alberta's first direct interconnection to the United States and Montana's first direct interconnection with Alberta. The Project will provide import/export opportunities for power markets in Montana and Alberta and enable wind development opportunities in southern Alberta and northern Montana since the transmission route traverses a region of substantial wind development potential.

The MATL project is a 240/230kV, 330 MVA transmission line designed for continuous bi-directional power transfers of over 300 MW. The project consists of a new substation, named MATL 120S, located approximately 15 km north of the City of Lethbridge, Alberta that ties into the existing 240 kV Alberta Interconnected Electric System (AIES) system. A phase shifting transformer will be installed in the MATL 120S substation to control flows both north and south and to step the voltage down from the Alberta nominal system voltage of 240 kV to transmission line voltage of 230 kV. A mid-point substation named Marias will be built approximately 10 km south of the town of Cut Bank, Montana. The Marias Substation will contain shunt and series capacitance for voltage support and the substation will be a connection point for proposed wind generation projects in the area. At the south end, the MATL transmission line will terminate at the existing Great Falls, Montana, 230 kV substation. The Great Falls Substation is owned and operated by NorthWestern Energy Inc. The transmission line is approximately 346 km long, uses single Falcon 1590 kcmil conductor, and will be built of a combination of monopole and H-frame structures.

### Phase 2 Path Rating Process

On August 19, 2005, MATL initiated the WECC Regional Planning Process for the MATL project through an invitation letter to WECC Planning Coordination Committee (PCC) and Technical Studies Subcommittee (TSS) to form a Regional Planning Review group. A project review group was formed and on December 7, 2005, MATL submitted a Regional Planning Project Report to the PCC. No comments were received during the 30 day comment period. Accordingly, on January 23, 2007, the PCC notified MATL that the Regional Planning Project Review had been completed.

On September 20, 2005, MATL initiated the WECC Path Rating Process for the MATL Project through the submittal of a Comprehensive Progress Report to the PCC and TSS as well as an invitation to form a Path Rating Project Review Group (PRG). During the 60-day comment period, MATL received requests from WECC members to participate in the PRG. On February 2, 2006, the TSS confirmed the MATL Project had achieved Phase 2 status.

As a result of a combination of regulatory, commercial and technical factors, MATL made scope changes to the project and notified the PCC and the TSS of these changes on August 30, 2006. The most notable changes were the addition of series compensation to the transmission line at the Marias Substation in order to increase the emergency rating of the MATL project and the inclusion of a 120MW of wind generation connection to the Marias Substation. Because of these major changes, MATL re-opened the PRG to new WECC members. Two new members subsequently joined.

### Study Plan

The MATL PRG developed a study plan to analyze the impact of the MATL system on neighboring systems. The Phase 2 study is based on a planned in service date of the MATL project of 2008. The MATL Rating Study Scope included the MATL proposed path rating flows defined as -300 MW power transfers into the connection point in Alberta (MATL 120S) from Montana (north flows) and +325 MW power transfers (metered at MATL 120S) from Alberta toward NorthWestern Energy system in Montana (south flows) under the WECC 2007 Heavy Summer and 2007 Light Spring base cases. These flows are effectively 300 MW delivered at the interface ends of the line as MATL line losses at rated flow are approximately 25 MW. Sensitivities include Great Falls, Montana generation, a wind generation connection at the Marias Substation and wind generation in southern Alberta. The wind generation sensitivity at Marias was subsequently removed from the study scope by MATL (with the concurrence of the MATL PRG) in order to expedite the submittal of the Phase 2 Project Rating Report. The TSS was notified of the removal of the Marias wind generation sensitivity on June 11, 2007.

The MATL PRG has performed and reviewed Phase 2 Rating studies according to the guidelines in the WECC "Procedures for Regional Planning Project Review and Rating Transmission Facilities". The purpose of these studies is to demonstrate that the MATL project conforms, or will be able to conform to, all applicable Reliability Criteria. In addition, these studies:

- identify the planned non-simultaneous transfer capability and the planned simultaneous path transfer capability limits for the proposed project configuration,
- address the mitigation of simultaneous transfer capability issues relative to the existing system, and
- resolve comments from BPA, NWE, and BCTC on the MATL Comprehensive Progress Report.

No changes to the current existing WECC path ratings are contemplated or implied in this report.

### Conclusion

In conclusion, the non-simultaneous study demonstrates the MATL project meets NERC/WECC Planning and reliability standards for the proposed path rating of 300 MW northbound and 325 MW southbound, as defined at the MATL 120S metering point, under certain conditions stipulated in this Report.

The conditions identified that require remedial action schemes (RAS) are:

1. Loss of Langdon - Cranbrook,

2. Loss of Cranbrook - Selkirk,
3. Loss of Selkirk - Ashton Creek and Selkirk - Vaseux Lake,
4. Loss of both Ingledow - Custer lines (when BC would separate from the US), and
5. Loss of both Custer - Monroe lines (when BC would separate from the US).

These five contingencies will require a RAS to trip MATL to prevent voltage collapse or transient instability from occurring. The RAS is intended to be armed at all times that the MATL project is in service. If the RAS is out of service for any reason, it is expected that the MATL line will need to be taken out of service to preserve system reliability. Future operating studies may look at possibly defining a lower boundary for RAS arming. If system flows are below the boundary levels defined in the studies, then the RAS may not need to be armed.

In addition to the above RAS, other conditions identified that require mitigation are:

1. Loss of the MATL tie when Nelway - Boundary flow is at or near its limits and the MATL flow is in the same direction as the Nelway - Boundary flow will require either a RAS to trip Nelway - Boundary or an operating procedure to issue a tap changer adjustment order for the Nelway phase shifting transformer.

2. Loss of large amounts of generation in Montana due to operation of the Colstrip ATR can cause a large increase in flows on the MATL project. In order to mitigate these overloads, the MATL phase shifting transformer will need to be adjusted or the MATL line will need to be tripped.

This study also identified simultaneous transfer capability of MATL versus Path 1, Path 3 and Path 8. Nomograms were developed for these simultaneous relationships for the cases studied. In all nomograms, the metering point on MATL is assumed to be the MATL 120S Substation. For the cases studied, MATL and either Path 1 or Path 3 cannot both simultaneously achieve rated transfers due to constraints outside the MATL line and Path 1 or Path 3. Under these operating conditions, simultaneous operating limits (nomograms) or other mitigation methods are required to meet NERC/WECC Planning Standards. Studies for Path 8 indicate there is potential for interaction between MATL and Path 8 transfers. Further operational studies are required to confirm impacts, if any, and corresponding mitigation. These simultaneous conditions are:

1. High simultaneous transfers on Path 1 and MATL,

2. High simultaneous transfers on Path 3 and MATL,

3. High simultaneous transfers on Path 8 and MATL (not confirmed)

Further details regarding the magnitude of the required curtailments and the contingencies that create the need for these curtailments are provided in the Results sections of this report. This report identified limits of simultaneous interactions for specific system conditions defined for MATL path rating purposes. Further studies for a variety of system conditions are needed to establish actual operating limits.

A thorough investigation of flowgates in the Great Falls area has uncovered the existence of five potential flowgates that can limit export from Great Falls in the north-to-south direction.

The first four of these flowgates have limits that allow anywhere from 245 MW to 675 MW of additional power to be injected into the Great Falls 230 kV bus under heavy summer conditions and anywhere from 510 MW to 640 MW of additional power to be injected into the Great Falls 230 kV bus under light spring conditions[1].

The last flowgate (the Great Falls - Landers Fork - Ovando 230 kV flowgate) is constrained by voltage deviations on NWE's 100 kV system in the vicinity of Townsend. Because this constraint is based on voltage deviations, it is difficult to quantify this limit as a function of MW flows through a flowgate. While studies have shown that the other four flowgate limits are usually reached first, there is a possibility that the Great Falls - Landers Fork - Ovando 230 kV flowgate could be limiting. For this reason, either system reinforcements or a RAS may be needed to mitigate the impacts of the Great Falls - Landers Fork - Ovando 230 kV line outage.

The conclusions are based on a comparative analysis between pre-project base case conditions and the base case with the proposed MATL project under the same conditions. This study did not investigate conditions that could not meet WECC/NERC reliability in the pre-project case. In particular, Path 1 flows used in this study were well below the 1000 MW east to west and 1200 MW west to east path rating limit because of limitations in the AIES system.

**Mitigation Plan**

Also required as part of the Phase 2 process is the mitigation plan. MATL's mitigation plan is to:

- develop a mitigation implementation and responsibility plan
- design and implement protection, control and remedial action schemes to meet the mitigation objectives identified in this report or that may be identified through the operating study process,
- comply with WECC Procedures for Project Rating Review subject to the requirements or orders from the connecting Transmission Service Providers or Path Operators.
- operate within transfer capabilities identified in this report or that may be identified through operational studies,
- design and operate to NERC/WECC Planning Standards,
- develop operating procedures or operate to procedures of respective connecting electrical system operators to maintain WECC reliability, and
- negotiate agreements to resolve conflicts as a means to formulate a mitigation strategy with impacted parties where applicable.

For impacts to Path 3 flows as identified in the MATL vs. Path 3 nomogram, MATL's mitigation plan is to:

[1] Note that these additional power injections are subject to the conditions defined in the base cases and were used for the PRG's analysis of the MATL project. Actual allowable power transfer limits will be determined by the area electrical system operator(s).

A. Develop, fund and implement a RAS mutually acceptable to BCTC and/or AESO as appropriate which will reduce or eliminate the MATL impact

B. If the RAS cannot be implemented prior to MATL being energized, MATL, BCTC and other affected transmission operators will develop operating procedures to keep the amount of power that Path 3 can transfer protected from being diminished due to MATL flows. This operating procedure may include curtailing MATL.

C. If a RAS cannot be implemented to fully protect Path 3 transfers from being diminished due to MATL flows, operating procedures to protect Path 3 transfers will be in place along with the RAS.

The details of the mitigation plan will be developed in coordination with impacted electrical system operators and other impacted parties. MATL proposes to execute this plan in Phase 3.

**Next Steps**

Completion of Phase 2 (acceptance of this report by WECC) is one step towards the construction and ultimate operation of the proposed Montana – Alberta 240/230 kV merchant transmission line. More operational study work including development of operational procedures and tools as well as the detailed design and implementation of remedial action schemes (RAS) is required to fully define definitely the envelope of operation for this project. The time to study, design and implement the special protection schemes in addition to the necessary review by the WECC Remedial Action Scheme Reliability Subcommittee (RASRS) could be upwards of one year or more, which may restrict the operational capability of the proposed merchant transmission line until final design, review and implementation of the remedial action schemes are complete.

MONTANA ALBERTA TIE LTD

April 2, 2007

Tom Ring
Senior Environmental Specialist
Facility Siting Program
Montana Department of Environmental Quality
1520 East Sixth Avenue
P.O. Box 200901
Helena, MT 59620-0901
U.S.A

COPY

RECEIVED
APR 06 2007
Dept. Environmental Quality
Env. Management Bureau

Dear Mr. Ring:

Subject: Appendix M of the Draft EIS for Public Comment re: MATL Project

Attached is the NorthWestern Energy (NWE) system impact study that is required for Appendix M of the Environmental Impact Statement (EIS) prepared by the DEQ. MATL requests that the DEQ also include the attached interim progress report on the Western Electricity Coordinating Council (WECC) in Appendix M of the EIS.

MATL would like to address the purpose of the NWE Impact Study (Impact Study) and the WECC Path Rating Study (Path Rating Study). The purpose of both the Impact Study and Path Rating Study is to assess impact of the MATL project on the reliability of the electric transmission grid. The Impact Study addresses the impact on the reliability of the NorthWestern transmission grid, whereas the Path Rating Study addresses the impact on the reliability of the greater western interconnected transmission grid, including NorthWestern Energy's grid and that controlled by the Alberta Electric System Operator.

The key steps conducted for both Impact and Path Rating Studies are:

1. Determine which operating conditions (Base Cases) will be studied to assess the reliability of the transmission grid;
2. Determine how the Base Cases are affected under different operating scenarios (Contingencies);
3. Compare the study results to reliability criteria, set by WECC to assess whether the study results meet reliability criteria or not;
4. In the event that a Base Case does not meet reliability criteria under certain Contingencies, determine an appropriate mitigation plan to ensure such Base Cases do meet the applicable reliability criteria. Typical mitigation plans include the setting operational limits, or implementing remediation control schemes.

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NWE System Impact Study

Currently, MATL and NWE are working together on the facility design and the Interconnection Agreement for the 300MW bi-directional tie at the Great Falls 230 kV Substation. MATL would now like to address the conditions identified in the NWE Impact Study that may limit the transfer capability under certain conditions:

1. The two existing 100 MVA 230/100 kV autotransformers are limiting the power transfer out of the Great Falls 230 kV substation to zero MW.

   MATL's interconnect agreement with NorthWestern stipulates that MATL will pay the cost to replace the two existing 100 MVA autotransformers with two 200 MVA autotransformers, thereby mitigating autotransformer overloads identified in the contingency analysis. As stated in the NWE Impact Study, the existing autotransformers would also need to be replaced to interconnect other projects that are senior to the MATL project in NorthWestern's queue.

2. NorthWestern has requested that MATL consider the operation and voltage set points of the switched shunt capacitors at MATL's Marias substation to prevent high voltage situations.

   MATL will ensure that it's facilities are designed to be operated in accordance with WECC requirements. NorthWestern, in its role as the control area operator of the MATL line in Montana, will have the authority to determine the appropriate set points for the switched shunt capacitors at the Marias substation.

3. Under certain conditions, the south bound flows over the MATL line are constrained in the year 2010LA (light autumn) and year 2012HS (heavy summer) cases to 170-190MW range by the 79 degree angle limit of the phase shifting transformer (PST).

MATL does not consider the PST angle limit as an impediment to commercial operations of the line because the system conditions that create the south bound phase angle limit are typically when south bound flows would be un-economical in any event. The conditions where south bound phase limit occur is when there is heavy power flow east from British Columbia (BC) into Alberta through path #1 and heavy power flow west from Montana into the Pacific North West through Path #8. Short term opportunity power flow would be scheduled in these directions when the market price of electricity was higher in Alberta and the Pacific North West than in BC or Montana and under those same pricing conditions the market would normally want to move power northbound over the MATL line as opposed to southbound.

WECC Path Rating Studies

The enclosed letter from Mr. Peter Mackin, Vice President, Reliability Services & Principal Power System Analyst, Utilities System Efficiencies, confirms that the conclusions of his report dated 16 January 2007 are still valid that is to say that a path rating of 300 MW, both north to south and south to north, is anticipated at the conclusion of the WECC Path Rating process.

Respectfully,

Bob Williams
Vice President, Regulatory
Enclosures (3)

NorthWestern Energy



# Montana Alberta Tie Line (MATL)

## *Third Revision*

## *System Impact Study*

## *Stand-Alone & Co-Existing*



***September 26, 2006***

***Electric Transmission Planning***

*Table of Contents*

## Executive Summary

NorthWestern Energy (NWE) has completed the System Impact Study (SIS) for the Montana Alberta Tie Line (MATL) Project on December 22, 2005. As per the request of MATL to reword the conclusions in the original SIS report, NWE made required wording changes and submitted a revised SIS on February 9, 2006. Upon completion of the SIS, the Facilities Study is to commence. At the beginning of the Facilities Study, it is NWE's practice to confirm the SIS results and mitigation requirements. However, MATL made changes to the line design, interconnection point in Alberta and increased the length of the line. As a result of these modifications, another SIS is necessary to identify the problems and mitigation before the Facilities Study commences. Also, the new Great Falls – Ovando 230 kV line included in the original SIS as a fix for a senior queue project is not needed anymore and hence it is removed in the base case for this study. The study results and the necessary mitigation changed with all these modifications.

This System Impact Study examines the physical interconnection to the Great Falls 230 kV Switchyard and does not constitute a request for transmission service. These studies examine the physics of the electrical system and do not imply that the users of the transmission line will receive any transmission required to deliver the output to load beyond the Great Falls 230 kV Switchyard. The users of the MATL transmission line must follow the procedures described in the transmission tariff available on NWE's OASIS site to request and/or reserve Transmission Service or a Generation Interconnection.

The goal of the System Impact Study is to identify improvements or changes needed in NWE's electric transmission system to reliably *interconnect* your project to NWE's transmission system only. This study does not make any specific presumptions or recommendations regarding NWE's system improvements that will be required to move power away from NWE's 230 kV Switchyard. NWE's transmission system mitigation requirements will be fully defined for the specific Transmission Service Requests to move power away from (or to) NWE's Great Falls 230 kV Switchyard once NWE has received the requests. NWE has not received a Transmission Service Request (TSR) or a Generation Interconnect Application (GIA) that will be associated with (or connected to) the MATL line.

This study was designed to answer two questions:

(I) What is the available unused capability of the Great Falls 230 kV Switchyard with the MATL line interconnected?

Stand-Alone and Co-Existing:

- The existing unused capability of the Great Falls 230 kV Switchyard without any system or network upgrades is 0 MW.

(II) What transmission system upgrades are necessary to allow your line to be interconnected.

Stand-Alone and Co-Existing:

- The overload of the two Great Falls 230/100 kV autotransformers must be mitigated. The mitigation required must be coordinated with senior queue N-1 mitigation requirements. With the autotransformer upgrades, the MATL line will be able to connect its 230 kV line to the GF 230 kV Switchyard without further mitigation in the switchyard based on the information provided and analyzed in this study.

- MATL needs to consider the voltage set points of the switched shunts to prevent high voltages during all conditions (N-0, N-1 and N-2). Also, the high voltages at the proposed Marias and MATL 230 kV buses are present for other contingency conditions.

The above mitigation will be required before the MATL project can be connected to NWE's transmission system. The study results may change if there are changes to MATL's queue position or to the line design and interconnection specifications provided by you to NWE. Any variation in the line or interconnect specifications must be reported to NWE, so a thorough review and/or study can be conducted by NWE. Such review and/or study may yield results different from this analysis, and different mitigation requirements may be required.

The following tables are a summary of the high-level non-binding cost estimates. The cost estimates will be finalized in the Facilities Study. (All estimates are denominated in 2006 US dollars).

Table 1. Cost Estimates for MATL to interconnect

| Interconnection Cost Estimate | $M Cost |
|---|---|
| 230 kV Switchyard Upgrades | 5.605* |
| Transmission Provider Interconnection Facilities | 0.145 |
| Total Cost Estimate | 5.750 |

This study examined the physical performance of the electrical transmission system and does not imply: 1) that transmission service will be received, or 2) entitlement to transmission service that is required to deliver the generation output to load. Conducting a Transmission Service Request Study will be required and may identify additional electric transmission system improvements required on NWE's or other electric transmission provider's transmission systems. It must be noted that upgrades to transmission paths that interconnect NWE with other transmission systems may be identified and required as a result of the Transmission Service Request Study. This may make it necessary to enter into a WECC Regional Planning Process and/or a Three Phase Rating Process. It is possible that fulfilling these WECC requirements may take considerable time.

# Definitions

## Stand-Alone Study

A stand-alone (SA) study is designed to identify changes in the reliability of the local and regional electric transmission system by comparing the performance of the system with and without the addition of the MATL facility. The Stand-Alone Study and associated results represent the transmission system with existing resources and without senior queue generation projects and associated system mitigation that will come online at a later date than the MATL. The mitigation identified for the Stand-Alone Study must be implemented before the MATL facility can interconnect.

## Co-Existing Study

A co-existing (CE) study identifies and evaluates the MATL facility's impact to the transmission system when all relevant generators are also interconnected to NWE's system. The relevant generators include all existing generators and potential new generators that are senior to MATL's queue position. MATL must implement mitigation for problems caused by its interconnection as identified in the Co-Existing System Impact Study. Implementation of some of the MATL mitigation requirements may be appropriately timed, and be completed before the commercial operation of senior queued generation that has a commercial operation date later than MATL.

* This cost might be less, as the mitigation listed for the autotransformers (approximately $3.6M) is to be coordinated with the N-1 senior queue mitigation.

## *Project Description*

The following data is used for the Third Revision SIS of the MATL project. The impedance data used in this project are as shown in the Table 1 below.

Table 2. Line Impedance data

| | FROM | TO | Length (Mi) | R (pu) | X (pu) | B (pu) |
|---|---|---|---|---|---|---|
| PST Data | N LETH 240 kV | MATL 240 kV | NA | 0 | 0.04697 | 0 |
| Transformer Data | MATL 240 kV | MATL 230 kV | NA | 0 | 0.01904 | 0 |
| Line Data | MATL 230 kV | MATL SC1 230 kV | 126.56 | 0.01529 | 0.17927 | 0.38589 |
| Series Cap Data | MATL SC1 230 kV | Marias 230 kV | NA | 0 | -0.11652 | 0 |
| Series Cap Data | Marias 230 kV | MATL SC2 230 kV | NA | 0 | -0.06536 | 0 |
| Line Data | MATL SC2 230 kV | GT Falls 230 kV | 91.82 | 0.01109 | 0.13072 | 0.27736 |

The Phase shifting transformer rating is 330 MVA and the Impedance is 15% on 330 MVA base, with an angle of ±79 degrees. There are two switched shunts, rated 50 MVAr of 2 blocks and 40 MVAr of 4 blocks at the new MATL 240kV and 230 kV substations respectively.

## *Study Parameters*

### Senior Queue Network Generators

In modeling the appropriate parameters for the Co-Existing System Impact Study it was necessary to include the following relevant, potential new network generators that are senior to your project's queue position.

1. 188 MW at Judith gap (existing plant)
2. 109 MW at Hardin (existing plant)
3. 12 MW at Thompson Falls (existing plant)
4. 280 MW at Great Falls[1]
5. 48 MW at South Butte (existing plant)
6. 396 MW at Reed Point (in study process)
7. 268 MW at Great Falls (In study process)

[1] NWE has recently received a cancellation request from this project, but the request is not approved until the FERC accepts the request. Removing this resource will not eliminate the overload on the 230/100 kV autotransformers discussed within this report.

8. 500 MW at Colstrip (in study process)

The dispatch of existing network generators and these new network generators were varied as needed to stress the transmission system and meet network load. Both the 2010 Light Autumn (2010LA) and 2012 Heavy Summer (2012HS) cases are studied with Great Falls generation at minimum as well as maximum as they reflect different scenarios. For the Stand-Alone Study, generation and fixes of 268 MW at Great Falls and 500 MW at Colstrip are removed from the base case.

## Assumptions

The following network system upgrades required for the senior queued projects were included in the system models for the 2010LA and the 2012HS cases.

1. An Overload Mitigation Scheme (OMS) for the Judith Gap Wind Energy facility to mitigate for the Broadview – Judith Gap South 230 kV line outage.

2. A Remedial Action Scheme (RAS) for the Rocky Mountain Power Plant to mitigate for stability issues for the loss of both Broadview - Garrison 500 kV lines.

3. Replace the existing Great Falls 230/100 kV autotransformers to fix the senior queue project problems.

4. A RAS in service for the 268 MW generator at Great Falls to trip for the Facility - Great Falls 230 kV N-2 contingency.

5. Reconductor the Judith Gap to Judith Gap Tap and Judith Gap Tap to Harlowton 100 kV lines.

6. Replace the existing Judith Gap 100 MVA, 230/100 kV autotransformer with 200 MVA, 230/100 kV transformer.

7. An additional 500 MVA, 500/230 kV autotransformer at Colstrip.

8. An OMS for the loss of one of the three 500/230 kV autotransformers at Colstrip.

9. Increase of the ampere rating of the series capacitors and all related equipment to 3000 Amps in the Colstrip – Broadview, Broadview – Garrison, Garrison – Taft, Taft - Bell, and Taft – Dworshak 500 kV lines.

10. A large (up to 450 MVAr) fast responding switched capacitor bank at the Broadview 230 kV bus. This device is necessary to support the steady-state voltage in the Broadview local area during the Colstrip - Broadview 500 kV single line outage.

11. Increase of the percent compensation of the series capacitors and all related equipment to 70% in the Colstrip – Broadview, Broadview – Garrison, Garrison - Taft, Taft – Bell, and Taft - Dworshak 500 kV lines.

12. A dynamic VAr device (up to 100 MVAr) located at the Garrison 230 kV bus. This device is necessary for voltage support during 500 kV N-1 stability contingencies.

13. A dynamic VAr device (up to 50 MVAr) located at the Broadview 230 kV bus. This device is necessary for voltage support during 500 kV N-1 stability contingencies.

14. A RAS for the new Colstrip facility to mitigate for all 500 kV N-2 contingencies.

# Steady-State Power Flow Analysis

The Steady-State Power Flow Analysis examines steady-state system normal operating conditions with no lines out of service (i.e., N-0 conditions) and with one or more lines out of service (i.e., N-1 and N-2 conditions).

## Stand-Alone Study Findings

Table 3. 2012HS Thermal Overloads, Great Falls Generation Maximum

| Outage | Monitored element | Overload % | Prebc % |
|---|---|---|---|
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 110.5 | None |
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 106.4 | None |
| GT Falls 230/100 kV transformer ckt 2 | GT Falls 230/100 kV transformer ckt 1 | 118.6 | None |
| Broadview - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 104.1 | None |
| Broadview - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 101.5 | None |

Table 4. 2012HS Thermal Overloads, Great Falls Generation Minimum

| Outage | Monitored element | Overload % | Prebc % |
|---|---|---|---|
| N-0 conditions | GT Falls 230/100 kV transformer ckt 1 | 114.4 | None |
| N-0 conditions | GT Falls 230/100 kV transformer ckt 2 | 110.2 | None |
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 144.5 | 117.4 |
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 139.2 | 113.1 |
| GT Falls 230/100 kV transformer ckt 2 | GT Falls 230/100 kV transformer ckt 1 | 184.6 | 152.4 |
| Broadview - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 117.2 | None |
| Broadview - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 112.8 | None |
| GT Falls - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 115.9 | None |
| GT Falls - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 111.6 | None |

- When the MATL flows were northbound, a flow of 301.3 MW was achieved at a phase shifting angle of +43.8 degrees in the 2010LA case and a flow of 300.7 was achieved at an angle of +44.9 degrees in the 2012HS case.

- Great Falls 230/100 kV autotransformers are overloaded with the addition of MATL facility under N-0 and N-1 conditions (Tables 5 and 6). These overloads must be mitigated by MATL.

## Stand-Alone Study Mitigation

Completing the following can mitigate the above stand-alone problems:

- MATL needs to consider the voltage set points of the switched shunts to prevent high voltages during all conditions (N-0, N-1 and N-2). Also, the high voltages at the proposed Marias and MATL 230 kV buses are present for all the other contingency conditions. Please see the limit checking reports in Attachment B for more details.

- The mitigation required for the overload of the two Great Falls 230/100 kV autotransformers must be completed by MATL. This mitigation will be coordinated with senior queue N-1 mitigation requirements.

Because the MATL project is scheduled to be in-service before the senior queue projects, the above mitigation requirements must be completed by MATL before the project goes commercial.

## *Co-Existing Study Findings*

Co-Existing Simulated Events

The outages studied for the Co-Existing Study are as follows.

Great Falls - Ovando 230 kV line

Great Falls 230/100 kV autotransformer ckt 1

Great Falls - Great Falls 268 generator 230 kV line ckt 1

Great Falls - Judith Gap 230 kV line

Broadview – Judith Gap South 230 kV line (Judith Gap RAS is implemented for this outage)

The Co-Existing Study found the following system problems. The addition of this project and all senior queued Generation Interconnection projects will require system mitigation.

Table 5. 2010LA Thermal Overloads, Great Falls Generation Minimum

| Outage | Monitored element | Overload % | Prebc % |
|---|---|---|---|
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 144.5 | 125.3 |
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 139.1 | 120.6 |
| GT Falls 230/100 kV transformer ckt 2 | GT Falls 230/100 kV transformer ckt 1 | 151.3 | 112.5 |
| Broadview - JGap South 230 kV line | GT Falls 230/100 kV transformer | 103.7 | None |
| GT Falls - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 121.3 | None |
| GT Falls - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 116.8 | None |

Table 6. 2010LA Thermal Overloads, Great Falls Generation Maximum

| Outage | Monitored element | Overload % | Prebc % |
|---|---|---|---|
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 113.5 | 102.5 |
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 109.3 | None |

Table 7. 2012HS Thermal Overloads, Great Falls Generation Minimum

| Outage | Monitored element | Overload % | Prebc % |
|---|---|---|---|
| N-0 conditions | GT Falls 230/100 kV transformer ckt 1 | 141.8 | 116.7 |
| N-0 conditions | GT Falls 230/100 kV transformer ckt 2 | 136.8 | 112.4 |
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 182 | 156.4 |
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 175.3 | 150.6 |
| GT Falls 230/100 kV transformer ckt 2 | GT Falls 230/100 kV transformer ckt 1 | 228.9 | 186.9 |
| Broadview - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 150.4 | 126.4 |

| | | | |
|---|---|---|---|
| Broadview - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 144.8 | 121.7 |
| GT Falls - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 165.4 | 125.4 |
| GT Falls - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 159.3 | 120.8 |
| GT Falls – GT Falls 268 generator 230 kV line ckt 1 | GT Falls 230/100 kV transfomer ckt 1 | 141.4 | 115.8 |
| GT Falls - Great Falls 268 generator 230 kV line ckt 1 | GT Falls 230/100 kV transformer ckt 2 | 136.1 | 111.5 |

Table 9. 2012HS Thermal Overloads, Great Falls Generation Maximum

| Outage | Monitored element | Overload % | Prebc % |
|---|---|---|---|
| N-0 conditions | GT Falls 230/100 kV transfomer ckt 1 | 102.3 | None |
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 146.6 | 137.1 |
| GT Falls – Ovando 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 141.2 | 132 |
| GT Falls 230/100 kV transformer ckt 2 | GT Falls 230/100 kV transformer ckt 1 | 161.5 | 145.2 |
| Broadview - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 112.7 | 104.4 |
| Broadview - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 108.5 | 100.5 |
| Broadview - JGap South 230 kV line | Threeriv 161/100 kV transformer | 109.5 | None |
| GT Falls - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 1 | 130.3 | 106 |
| GT Falls - JGap South 230 kV line | GT Falls 230/100 kV transformer ckt 2 | 125.5 | 102 |
| GT Falls - Great Falls 268 generator 230 kV line ckt 1 | GT Falls 230/100 kV transformer ckt 1 | 101.5 | None |

Following conclusions can be drawn from the co-existing findings:

- When the MATL flows were northbound, a flow of 300.3 MW was achieved at a phase shifting angle of +41.7 degrees in the 2010LA case and a flow of 300.8 MW was achieved at an angle of +42.4 degrees in the 2012HS case.

- Great falls 230/100 kV autotransformers are overloaded with the addition of MATL facility in 2010LA case under several N-1 conditions. Mitigation must be completed to fix problems when the overload in the Prebc column is "none", MATL will also be responsible for mitigating the difference in percent overload when the autotransformers are overloaded as identified in the Prebc column.

- Great Falls 230/100 kV autotransformers are overloaded with the addition of MATL facility in 2012HS case under several N-1 conditions. Mitigation must be completed to fix problems when the overload in the Prebc column is "none", MATL will also be responsible for mitigating the difference in percent overload when the autotransformers are overloaded as identified in the Prebc column.

## *Co-Existing Study Mitigation*

Completing the following can mitigate the above stand-alone problems:

- MATL needs to consider the voltage set points of the switched shunts to prevent high voltages during all conditions (N-0, N-1 and N-2). Also, the high voltages at the proposed Marias and MATL 230 kV buses are present for all the other contingency conditions. Please see the limit checking reports in Attachment C for more details.

- The over load of the two Great Falls 230/100 kV autotransformers must be mitigated. The mitigation required must be coordinated with senior queue N-1 mitigation requirements. This is also a stand-alone problem.

# Transient Stability Analysis

The Transient Stability Analysis examines the system performance after the loss of one or more transmission line(s), before the system settles to steady state operation.

## Stand-Alone Study Findings

Stand-Alone Simulated Events

In each event description below, the term "fault" refers to a short-circuit between either a single-phase conductor and ground, or all three phases. The events simulated were:

1. A three-phase fault at the Great Falls 230 kV bus with the loss of Great Falls - Ovando 230 kV line.
2. A three-phase fault at the Broadview 230 kV bus with the loss of Broadview - Judith Gap South 230 kV line.
3. A three-phase fault at the Great Falls 230 kV bus with the loss of Great Falls – Judith Gap South 230 kV line.

The Stand-Alone Study did not find any stability problems associated with connecting the MATL 230 kV line to the Great Falls 230 kV Switchyard.

## Co-Existing Study Findings

Co-Existing Simulated Events

1. A three-phase fault at the Great Falls 230 kV bus with the loss of Great Falls - Ovando 230 kV line.
2. A three-phase fault at the Broadview 230 kV bus with the loss of Broadview – Judith Gap South 230 kV line.
3. A three-phase fault at the Great Falls 230 kV bus with the loss of Great Falls - Judith Gap South 230 kV line.
4. A three-phase fault at the Great Falls 268 generator 230 kV bus with the loss of two Great Falls 268 generator – Great Falls 230 kV lines.

5. A three-phase fault at the Great Falls 268 generator 230 kV bus with the loss of two Great Falls 268 generator – Great Falls 230 kV lines with generator tripping at Great Falls 268 generator.

The Co-Existing Study did not find any stability problems associated with connecting the MATL 230 kV line to the Great Falls 230 kV Switchyard

# *Fault Duty Analysis*

When a fault or short circuit occurs on a power line, the protective relay equipment detects the increased current (i.e., fault current) flowing in the line and signals the line's circuit breakers to open. When the circuit breakers open they must be capable of interrupting the full fault current. The worst-case fault current is commonly referred to as the "fault-duty". If the circuit breakers cannot interrupt the fault-duty, the line that is faulted may not be switched out of service and voltages could collapse in the surrounding transmission grid. This event could lead to a wide spread outage.

The results from the Fault Duty Analysis identifies whether or not NWE's existing circuit breakers are capable of interrupting the additional fault-duty created by the addition of the proposed facility.

The events that were examined are listed below. In each event description, the term "fault" refers to a short-circuit between either a single-phase conductor and ground, or all three phases.

## *Stand-Alone Fault Duty Results*

1. A three-phase fault at the Great Falls 230 kV bus.

2. A single-phase fault at the Great Falls 230 kV bus.

The breakers in the area have a sufficient interrupt rating to withstand the maximum short circuit current available with the addition of the MATL project. This project does not require improvements to NWE's existing circuit breakers for fault duty.

## *Co-Existing Fault Duty Results*

The same two faults were examined in the Co-Existing Fault Duty Study. The addition of this project does not require improvements to NWE's existing circuit breakers.

## Cost Estimates

Table 9 is a summary of the high-level non-binding cost estimates for the MATL Transmission Line Interconnect Project. The detailed cost estimates are listed below the table.

Table 9. Cost Estimates for MATL to interconnect

| Interconnection Cost Estimate | $M Cost |
|---|---|
| 230 kV Switchyard Upgrades | 5.605* |
| Transmission Provider Interconnection Facilities | 0.145 |
| Total Cost Estimate | 5.750 |

Upgrades

*Great Falls 230 kV switchyard:*

Replace the 2 - 100 MVA, 230/100 kV autotransformers with

| | | |
|---|---|---|
| 2 - 200 MVA, 230/100 kV autotransformers | 2@1.80M | = $ 3.60* M |
| Add 2- 230 kV breakers | 2@0.25M | = $ 0.50 M |
| 4 230 kV Air Brake switches | 4@0.02M | =$ 0.08 M |
| Bus work | | =$ 0.125 M |
| Steel | | =$ 0.250 M |
| Foundation | | =$ 0.400 M |
| Relaying | | =$ 0.300 M |
| Land | | =$ 0.35 M |
| Total Cost | | $ 5.605 M |

In addition to the above costs, there are Transmission Provider Interconnection Facility (TPIF) costs that MATL will be responsible for. These TPIF cost estimates are the same as those presented in the previous SIS report assuming no changes have been made.

* This cost might be less, as the mitigation listed for the autotransformers (approximately $3.6M) is to be coordinated with the N-1 senior queue mitigation.

**Transmission Provider Interconnection Facility Cost Estimate**

| | |
|---|---|
| Substation work | = $ 0.12 M |
| Metering | = $ 0.010 M |
| SOCC EMS | = $ 0.015 M |
| Total cost | = $ 0.145 M |

## *Conclusions*

This System Impact Study is an evaluation of the MATL projects interconnection to the Great Falls 230 kV Switchyard and does not constitute a request for transmission service. This study does not provide any definitive mitigation, that will be required to move power out of the Great Falls 230 kV Switchyard because NWE has not received a Transmission Service or Generation Interconnection Request. The users of the proposed MATL line must follow the procedures described in the transmission tariff available on NWE's OASIS site to request and/or reserve Transmission Service or a Generation Interconnection. The following conclusions can be made about the MATL projects interconnection to the Great Falls 230 kV Switchyard:

- The unused capability of the Great Falls 230 kV Switchyard without any system or network upgrades is 0 MW.
- The over load of the Great Falls 230/100 kV autotransformers must be mitigated. With the autotransformer upgrades, the MATL line will be able to connect its 230 kV line to the GF 230 kV Switchyard without further mitigation in the switchyard based on the information provided and analyzed in this study. The mitigation required must be coordinated with senior queue mitigation requirements.
- MATL needs to consider the voltage set points of the switched shunts to prevent high voltages during all conditions (N-0, N-1 and N-2). The high voltages at the new Marias and MATL 230 kV buses are present for the other contingency conditions too.

The above mitigation will be required before the MATL project can be connected to NWE's transmission system. The study results may change if there are changes to MATL's queue position or to the line design and interconnection specifications provided by you to NWE. Any variation in the line or interconnect specifications must be reported to NWE, so a thorough review and/or study can be conducted by NWE. Such review and/or study may yield results different from this analysis, and different mitigation requirements may be required.

A summary of the high-level non-binding cost estimates for the MATL Transmission Line Interconnect Project are shown below.

Cost Estimates for MATL to interconnect

| Interconnection Cost Estimate | $M Cost |
|---|---|
| 230 kV Switchyard Upgrades | 5.605* |
| Transmission Provider Interconnection Facilities | 0.145 |
| Total Cost Estimate | 5.750 |

* This cost might be less, as the mitigation listed for the autotransformers (approximately $3.6M) is to be coordinated with the N-1 senior queue mitigation.

# APPENDIX N:
# FARM COST REVIEW FOR MATL PROJECT

**Farming Cost Review (Final)**
**Montana-Alberta Tie Ltd.**

Submitted to:
**Environmental Management Bureau**
**Montana Department of Environmental Quality**

Prepared Under:
**State of Montana Environmental Services Term Contract**
**(SPB06-81195O)**
**Task Order #01-CII**

Prepared by:
**HydroSolutions Inc**
1537 Avenue D
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Billings, Montana 59108
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and

**Fehringer Agricultural Consulting, Inc.**
7033 Highway 312
Billings, Montana 59105-5027
406-373-5985

**July 12, 2007**

HydroSolutions Inc

July 12, 2007

Mr. Tom Ring
Environmental Management Bureau
Montana Department of Environmental Quality
PO Box 200901
1520 East Sixth Avenue
Helena, Montana 59620-0901

**RE: Farming Cost Review Montana-Alberta Tie Ltd. (Final)**
**DEQ Contract #SPB06-81195O**
**Task Order #01-CII**

Dear Mr. Ring:

HydroSolutions Inc and Fehringer Agricultural Consulting, Inc., is pleased to provide this Farming Cost Review Report for the Montana-Alberta Tie Ltd. presented under the State of Montana Environmental Services Term Contract (SPB06-81195O) for Task Order #01-CII to the Montana Department of Environmental Quality (MDEQ).

A report outlining objective and results of this review are attached. The report presents the findings of a detailed and critical review and a range of reasonable values for the annual cost to farming of transmission structures in their crop fields. The review was based on the use of most recent data available and realistic assumptions with respect to the extra work, inputs, yields and time needed by farmers, and was representative of farming in the Great Falls to Cut Bank, Montana area. Please refer to the attached report for specific details.

It has been a pleasure completing this review and look forward to working with you again in the future. If you have any questions, please contact us at (406) 655-9555.

Sincerely,
***HydroSolutions Inc***

Shane A. Bofto
Senior Chemical/Environmental Engineer

Attachment: Farming Cost Review – Montana-Alberta Tie Ltd.

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## *Table of Contents*

***List of Figures***



***List of Tables***



***List of Appendices***

# Executive Summary

This report presents a detailed and critical review of three existing studies that estimate costs of farming around transmission line structures to a ‘representative farmer’ in the Conrad, Montana area. As a result of the review, estimated ranges of reasonable values for the annual cost to farmers of transmission structures in their crop fields were made.

The studies reviewed included two from farmers in area of the proposed Montana Alberta Tie power line path, and one study conducted by researchers at North Dakota State University. The studies either over or under estimated the size of the footprint of land which would be taken out of production due to the obstruction. This was mainly due to either the lack of an implement transition area to navigate around the obstruction or the use of a large safety buffer.

The alternative analysis presented used likely transition areas and safety buffers around the pole(s) for the proposed structure types, orientation to the field and location in the field. A representative farmer was chosen to be either dryland or irrigated, where the dryland farmer grew spring wheat in fallow rotations as well as continuous crop spring wheat. Spring wheat was used because it had the highest value and expenses of crops grown in the in the proposed area. The irrigated farmer would also grow spring wheat for the same reasons listed above.

The results indicated that long-span 6.5-foot diameter mono-poles at the field edges would cost the least to farm around on an overall basis which considers multiple structures within the field. The long-span mono-pole layout would have a larger footprint than the short-span, but would have fewer structures to farm around per mile. On an individual structure basis, the 3.5-foot diameter mono-pole structure at the field edge would be the least cost to farm around.

## A. Introduction

HydroSolutions Inc (HydroSolutions) is pleased to present this report in accordance with the Scope of Service for the Limited Solicitation for Farming Cost Review, Environmental Permit Preparation, Analysis and Assistance Services Term Contract, Contract # SPB06-81195O, Task Order # 01-CII, approved by the Montana Department of Environmental Quality (MDEQ) on June 4, 2007.

On April 27, 2007 the Montana Department of Environmental Quality issued a limited solicitation for a firm to complete the scope of Services described therein. The MDEQ has completed a Draft Environmental Impact Statement for the Montana-Alberta Tie Ltd. (MATL) 230-kV Transmission Line and is currently addressing comments on the Draft Environmental Impact Statement (DEIS). The scope included the review of three existing studies that estimated the cost of transmission line structures to a 'representative farmer' in Conrad, Montana area.

This scope of service was completed by HydroSolutions and Fehringer Agricultural Consulting, Inc. (Fehringer), an agronomic consulting firm.

## B. Background

The MDEQ received comments on the DEIS indicating that locating H-Frame poles on diagonal crossing of cultivated fields has greater costs to farmers than locating the proposed line along field boundaries and section lines. Comments also indicated that the use of single pole structures along field boundaries would result in lower impacts to farming costs. The information in this review would be used with other information in the decision process whether to grant, deny or grant with conditions a certificate of compliance under Montana's Major Facility Siting Act.

## C. Scope and Methods

The scope of service included the critical review of three studies that estimate the cost of transmission line structures to a ‘representative farmer’ in the Conrad, Montana area. Each study was reviewed for assumptions, cost inputs and total area taken out of production. A reasonable range of annual estimated costs to farmers were made due to the structures in their crop fields. The analysis and report was conservative in favor of farmers and used most recent date, realistic assumptions and was to be representative of farmers in the Great Falls to Cut Bank, Montana area.

HydroSolutions and Fehringer reviewed the three referenced studies for approach, applicability, scope, cost basis, timeliness of pricing, and practice. The most representative information was compiled and provided alternative sources of information to estimate cost impacts to farmers as a result of power line structures placed in agricultural fields located from Great Falls to Cut Bank, Montana. Farming expenses reflect 2007 costs and included the following: prices for fuel, maintenance and repair, fertilizer, pesticides, time and labor cost. The estimates were tailored in a conservative direction towards the farmers.

Two ‘representative farmer’ scenarios were created to accurately represent dry land and irrigated farming practices in the Great Falls to Cut Bank, Montana area. Items of focus included farming practices, size of machinery used, typical acreages farmed, typical crops and yields, and other regional characteristics.

The cost values developed were applied to the chosen “representative farmer’ to develop a range of reasonable values for the annual cost to farmers per transmission structure for each of the structures that will be possibly used in their crop fields. The presence of these structures may result in both lost crop production from the structure footprint and overlapping of tillage and inputs as well as increased labor costs.

Several scenarios were addressed including two configurations, Mono-pole (both short-span and long-span) and H-frame, along with location of the power poles, to include edge or interior. As required in the solicitation, farming techniques using auto steer and GPS were of particular consideration.

## D. Summary of Comments

### D.1. MATL DEIS Analysis

A brief review of the MATL DEIS was made to determine its basis and assumptions. The DEIS Land Use analysis assumed a 5 foot buffer around each pole structure in any direction. The H-pole base area (1.5 feet by 23.5 feet) with 5 feet added to all sides was 0.0088 acre (385.25 square feet) removed from production per structure. The short-span mono-pole structure (1.75 foot pole radius plus 5 feet) would remove 0.0027 acre (143.14 square feet) per structure. Long-span mono-poles would remove more acreage from production because of their 6.5-foot-wide concrete foundations, but there would be fewer of them in comparison to the short-span design (DEQ, 2007).

The analysis also stated that farmers have to divert their equipment around structures, make additional passes, take additional time to maneuver equipment, skip areas, or retreat areas, production cost would increase. In addition, efficiency of some large, GPS-guided equipment would be adversely affected in fields with diagonal crossing. (DEQ, 2007).

The DEIS analysis reports (Table 2.3-1) that mono-poles were to be set on an average of 790 feet apart (about 6.6 structures per mile) for long-span, 490 feet apart (about 10.8 structures per mile) for short-span (regular). H-frame structures were to be set on an average of 790 feet apart (about 6.6 structures per mile).

Alternative 2 had no mono-pole structures but 6 acres removed from production. There were 742 H-pole structures spanning a total of 92.7 miles and removing 6.53 acres of production.

Alternative 3 had no mono-pole structures but 6.3 acres removed from production. There were 782 H-pole structures over 97.7 miles with 6.88 acres removed from production.

Alternative 4 had 588 long-span mono-poles or 947 short-span mono-poles over 87.9 miles. There was 3.7 acres removed for production for the long-span, and 1.4 acres for the short-span. There were no H-pole structures in Alternative 4.

As presented in the MATL DEIS analysis, total acreage removed from production for Alternatives 2 and 3 was 12.53 and 13.18 acres, respectively.

Total acreage removed from production for Alternative 4 was 3.7 acres for long-span mono-pole structures and 1.4 acres for short-span for mono-pole structures as there were no H-pole structures used in Alternative 4 (DEQ, 2007).

### D.2. Public Comments and Studies

There were three cost analysis studies reviewed for this report. The first was prepared by Allen Denzer of Conrad, Montana, the second was prepared by Brent MacDonald of Brent MacDonald, Inc. of Floweree, Montana, and the third was a spreadsheet model prepared by Dr. Eric A. DeVuyst, Dean A. Bangsund, and Dr. F. Larry Leistritz. Copies of the comments and studies are included in Appendix A.

Each study was critically reviewed for assumptions, inputs such as costs and acreage taken out of production, and formulas. The results of each study review is detailed below.

#### D.2.a. Denzer Study:

The Denzer study had concerns regarding farming operation around H-frame and Single-pole structures. Also, there were some concerns regarding the use of Global Positioning System (GPS), yield mapping, and variable rate fertilizing around poles. The Denzer study also had concern with the North Dakota study not addressing GPS auto steering around poles and the model was incomplete and used custom farming rates which did not apply.

This study assumed that the lead implement would always be the first to encounter the structure, Also, that the equipment would to be working in unison so one or two pieces of equipment would have to wait for the lead implement to make a lap around an interior pole(s).

If pole(s) are in the middle of the field, it would take alternative planning so that implements are not standing by as another implement is detouring around the pole structure. This could be accomplished by increasing the separation of the implements or work from two sides of a field.

The entire field still required spreading a wildoat herbicide (“Fargo”), spraying, seeding, harvesting, etc., but it will take longer.

Input costs are high or inadequately defined. Crop loss would not be 50% as stated in the study, but likely no more that 20% as used in the alternative analysis.

In regard to yield mapping, GPS and auto-steer, manufacturers have procedures for obstruction avoidance in fields. These obstructions would not be the first ones that this technology has had to encounter.

Structures at field edges would create less of a footprint and cost to farm around. The direction of farming would not matter with edge structures because one to two passes are typically made parallel to all field edges when beginning or ending a field. This creates an area for turning around when approaching field edges at an angle or perpendicular.

For structures placed in the interior of a field, it would not matter what direction the structures are oriented, it is still the same sized obstruction. If they are parallel to the direction of a farming operation, they would all be encountered in the same pass. If they are perpendicular or diagonal to the direction of the operation, they would be encountered in multiple passes – one at a time. There certainly will be more per section on a diagonal direction. However, not all fields run east and west or north and south.

The number and type of operations; as well as, size of equipment used were helpful in creating the alternative analysis. All necessary operations for a cropping cycle were not listed. Please refer to the alternative analysis for specific cropping cycles. No consideration for loss of crop quantity and/or quality was listed.

**D.2.b. MacDonald Study:**

The major concerns of the MacDonald study appeared to be related primarily to the farming operation around the towers associated with GPS auto steer and diagonal lines. Also, concern was raised regarding the increase of specific farming costs since the original analysis was performed.

The safety buffer was figured at 20 feet instead of five feet. This added considerable area to the total outage from each pole(s) and was not necessary. Most farmers will farm closer than five feet. By using the 20 foot safety buffer, overlap area has been over estimated.

The MacDonald study figured a required minimum of 1.5 revolutions around a pole. Farming around an interior structures merely adds one revolution (merely 360 degrees), not 1.5. If 1.5 revolutions (540 degrees) were made, the farmer would be headed the opposite direction as to the approach of the structure. It will not take an additional revolution to “get the GPS back on track”. Tracking would be instantaneous. Auto-steer can be turned off and on at obstructions and at the ends of a field. Again, overlap area has been over estimated by Mr. MacDonald.

Glyphosate (“Roundup”) cost listed in this study was double that of current actual costs. Application expense was listed at $3.75 per acre, and typical farming cost may be consistent with that value, although custom application would be closer to $5.00 per acre.

Aerial applicators have to consider a number of obstacles – regular power lines, trees, towers. They do not charge more for spraying field with obstructions, but they may leave small untreated areas to avoid the obstructions.

The number and type of operations as well as size of equipment was helpful in creating the alternative analysis. Not all necessary operations for a cropping cycle were listed. No consideration for loss of crop quantity and/or quality was listed.

**D.2.c. DeVuyst Study:**

The DeVuyst study estimated cost based on footprint of the towers using various assumptions such as; operations are not discontinued when overlap begins, custom application rates were adequate to cover individual farmer's cost of application, easement settlement covers lost production from the tower footprint and existing crops without irrigation is continued in the foreseeable future.

The study was comprehensive, compared to the other studies reviewed, as it considered more pole scenarios. It considered all crops that could be grown in the area of this power line. Footprint diagrams do not depict actual farming patterns around poles. It assumes that the crop is 100% destroyed by the sprayer's tire tracks. That is not the case unless the crop is being sprayed at the wrong growth stage. More damage is done by doubling the rate of seed, fertilizer (on dryland), and herbicides. Costs for farming around poles were more accurate and more agronomically complete than the previous two studies.

## E. Alternative Analysis

Based on the review of the above referenced comments and studies, and the MATL DEIS, an alternative analysis is presented below.

### E.1. Pole Layouts

A range of most frequently encountered specific pole layouts were evaluated and are presented on Figure 1, Pole Configuration Footprint Layouts. These areas represent the portion of land adjacent to the pole(s) that would not be farmed due to impedance to the farming implements resulting in the portion of land that is taken out of production. Power poles were in two structure types, Mono-pole and H-pole. Mono-poles consisted of a 3.5-foot diameter pole (short-span) or

6.5-foot (long-span) wide concrete foundation, and an H-hole, which consisted of two 3-foot diameter poles spaced 20 feet apart at the centers or 23 feet apart at each outside diameter.

Mono-poles were either located at the edge of the field (Layouts A & B) or in the interior (Layouts C & D). H-poles were oriented either perpendicular with, and at the edge of the field Layout E), perpendicular with, and at the edge of the field and straddling the fence line (Layout F), parallel with, and at the edge of the field (Layout G), and interior (Layout H).

A safety buffer of 5 feet was used around the outside diameters of each pole to assess footprint areas around each structure, location and orientation using conventional farming techniques. The safety buffer is generally dependent upon the specific field, equipment and operator experience, but in this case a 5-foot safety buffer should be adequate to safely clear the pole(s) using typical equipment while still optimizing farmed area.

These footprint areas also consider transition lengths used to navigate farming equipment around the structure located along the edge to maintain the 5-foot safety buffer and return to the previously established row track. These transition lengths include an approximate 1.3:1 (transition length to diversion) transition length for the edge pole(s) diversion (A, B, E, F). These transition lengths are used for pole(s) locations on field edges. For H-poles located parallel and adjacent to the property line (G), a 1:1 transition length was used due to its longer parallel section and flatter transition along the parallel poles adjacent to the property line. This transition does not require the implement to swing out as far as the other edge layouts. Please refer to Table 1 for estimated footprint areas.

### E.2. Representative Farmer

This analysis is based on the ‘representative farmer’ scenarios which represent dry land and irrigated farming practices in the Great Falls to Cut Bank, Montana area. Costs used in the analysis reflect up-to-date information by using current 2007 prices. Fertilizer prices were obtained from Farmer’s Union, (Personal Communications, Farmer’s Union, June 2007).

Herbicide costs were taken from Wilbur-Ellis' 2007 Price List and reflect highest retail cost (Wilbur-Ellis 2007).

A typical dry land field was chosen to grow spring wheat in fallow rotation as well as continuous crop spring wheat. Spring wheat is used because it has the highest value of crops grown in the proposed area. Currently, spring wheat is trading at near $6.00 per bushel. Winter wheat is worth about $5.50 per bushel, and it will generally yield more than spring wheat but the gross per acre will be more with spring wheat. Winter wheat is not a crop that survives winters consistently in the Cut Bank, Montana area. Malt barley is approximately $4.40 per bushel and will yield more than spring wheat but spring wheat will still gross more per acre. In addition, spring wheat requires more fertilizer per acre, particularly nitrogen, than winter wheat, durum, canola, and malt barley. In summary, spring wheat was used because it is the highest valued per acre crop, has the highest inputs per acre, and can be grown in all parts of the proposed area. If a farmer chooses to plant something other than spring wheat, the cost of farming around the poles will be less. Spring wheat provides the worst case scenario from the farmer's perspective.

For dry land crop production, both wheat-fallow rotation and continuous crop farming were evaluated because both practices are used in this area. Many farmers will flex crop, which is recropping a field when enough stored soil moisture is present at planting time to assure a profitable yield. If stored soil moisture is below average, the farmer then chooses to fallow.

A typical irrigated field was chosen to also grow spring wheat for the same reasons listed in the dry land section above. Irrigated malt barley generally has been a more profitable crop than spring, winter wheat, canola, etc., but at the time of this writing, spring wheat has surpassed malt barley. Again, using spring wheat for the irrigated crop provides the worst case scenario.

### E.3. Row Layout

The row layout was applicable to farming equipment with GPS and auto-steer. Please refer to Figure 1 for specific pole layouts.

***E.3.a. Layouts A, B, E, F and G:***

These layouts represent pole(s) locations at the edge of a field. It was assumed that the farmer would not be able to use auto-steer on the initial pass on the field edge containing poles. In this analysis, ample transition space was created to easily farm around the pole. On the second pass, the farmer would establish the AB line for auto-steer or GPS light bar guidance. The transition varied with the type of structure, location and orientation, but always included a 5-foot safety buffer.

***E.3.b. Layouts C, D, and H:***

Interior Mono-pole or H-poles orientation assumed that the farmer would approach the pole(s), turn off the auto-steer, and divert either left or right while maintaining the 5-foot safety buffer. Upon reaching the other side of the pole(s), the tractor and implement would continue around the pole(s) to make an additional 360 degrees and then return to using auto-steer and following the previously established row track. Farming around the pole(s) involves only one lap around the pole not 1.5 to 2.5 extra revolutions as listed in the Denzer and MacDonald studies.

## E.4. Overlap

Using the footprint areas, overlaps of farming rows were calculated using standard implement widths for harrowing, discing, toolbarring, chemical spraying, “Fargo” (wild oat control) application , fertilizer application, seeding, and combining. Implement widths are presented in Table 1. These implement widths were typical of those used in the Great Falls to Cut Bank, Montana farming area, as indicated by the Denzer and MacDonald studies referenced above. Using the footprint areas and implement widths, overlaps were calculated for each pole configuration and orientation using the selected implements for each specific process.

The overlap areas were calculated by adding the footprint areas for the pole(s) at the edge of the field to the implement width chosen. This would account for the implement moving out and around the pole(s) footprint on the first pass, moving into the adjacent row path and overlapping the width of the footprint. The overlap for the interior structures assumed a 360 degree path around the pole(s) footprint, which includes the 5-foot safety buffer, with the selected implement width added.

## E.5. Estimated Costs

Cost for labor, materials, and equipment were estimated from various sources including custom farming and application rates (University of Wyoming "Custom Rates for Wyoming Farm and Ranch Operations, 2004-2006" and Personal Communications, Farmer's Union, June 2007, respectively) site specific vendor information, and personal communications with regional farmers. Provided below is a brief description of the various farming operations anticipated for the Great Falls to Cut Bank area. The information is reflected on Attachments DL-1 to 16 and IRR-1 to 8 found in Appendix B and C, respectively.

Many dry land farmers heavy harrow to incorporate seeds after harvest so that they germinate more uniformly, especially in drier years. Harrowing also distributes crop residue if it did not get uniformly spread behind the combine. Heavy residue rows can cause disease problem, especially when continuous cropping.

Irrigated farmers will most likely disc their fields one to two times after harvest and toolbar it one to two times before planting. For these analysis, two of each of these operations have been included.

Fallow and preplanting sprayings listed represents the highest number of applications needed per year. A farmer may have fewer applications than listed. Herbicide rates are typical for this type of spraying. In addition to the "Roundup" for first fallow application, dicamba ("Banvel") was added to the mix as this would be the ideal mixture but would cost more per acre than if "Roundup" only was applied. The addition of dicamba would provide extended broadleaf weed control and is a prudent practice to reduce the risk of creating "Roundup" resistance in the weeds. For preplant spraying, only "Roundup" was applied for both dry land and irrigated fields.

In regard to wild oat control, "Fargo" application at 15 pounds per acre was used because this is the most expensive method of controlling this weed. It requires a separate application and possibly a harrow incorporation. If a grower uses a post-emergent herbicide that can be tank mixed with the broadleaf weed herbicides, then there is only one application of herbicides to the field, not two and no incorporation with a harrow. Lastly, 15 pounds per acre of "Fargo" was the rate used for barley and winter wheat. Ten to twelve and one-half pounds per acre is the labeled rate on spring wheat. Again, all inputs were designed to be a worst case scenario.

Prices used for fertilizer reflects the cost spike that has occurred in 2007, $450 per ton for 46-0-0, 11-52-0, and 18-46-0. For dry land crops, fertilizer banded with the seed would be 60 pounds per acre of 11-52-0 or 18-46-0. Topdress nitrogen was 55 actual units (pounds) of nitrogen per acre for a total of 61 pounds of nitrogen per acre since six pounds are applied via the 11-52-0 banded with the seed. These amounts of nutrients would be adequate for a spring wheat-fallow rotation yield goal of 50 bushels per acre. For continuous crop dry land spring wheat, 69 pounds of actual nitrogen was topdressed for a total of 75 pounds per acres (including fertilizer banded with the seed) for a yield goal of 35 bushels per acre. For irrigated spring wheat, 80 pounds of 11-52-0 was banded with the seed. Nitrogen applied for a 90 bushel per acre yield goal was a total of 210 pounds per acre. Crop yields listed are from Fehringer's personal knowledge from production in the area and Montana Agricultural Statistics website (USDA 2007).

Seeding rate was figured at 70 pounds per acre for dry land and 100 pounds per acre for irrigated land. The price used is for certified seed that has been cleaned and treated.

Herbicides listed for in-crop spraying to control broadleaf weeds are the more expensive ones available. Herbicides used have only a 60 day plant back restriction so any crop can be planted the next growing season.

Harvesting expense was calculated at custom rates. Overlap was figured for combining even though custom harvesters charge by the acre and what the crop is yielding. They do not have a surcharge for cutting around obstructions.

Crop loss due to overlap was figured at 20% of the yield goal. Yield loss would be from reduced yield and/or quality (test weight, protein, etc.). Yield loss for edge poles would be only the footprint area shown for Layouts A, B, E, F, and G. Yield loss for poles in the field interior was much larger because of having to overlap for one revolution around the pole(s) (Figures C, D, H). The amount of area used was figured by taking the largest implements listed in Table 1, which are sprayer and “Fargo” applicator.

Harrowing, toolbarring, discing, fertilizer application, seeding, and harvesting are all smaller equipment, but again, the worst case situation was used. Crop spraying and “Fargo” application would result in the largest yield loss due to double applying herbicides. Double application would cause the most crop stress. In addition to the reduced yields from overlap, farmers would not have the area of the structure footprint in crop any longer. The foot print areas for each pole situation are shown in Table 1.

Weed control in the pole footprint was also addressed. The best option would be to establish grass in the footprint area. However, this might present a fire danger that MATL does not want to have. In lieu of having grass established, total vegetation control would be the next best option. This could be accomplished each fall by an application rate of up to five quarts of diuron, three pints “Arsenal”, and “Roundup” per acre to each footprint area. Winter moisture would incorporate the herbicides into the soil so that vegetation is controlled all season long. Cost for these herbicides was approximately $150 per acre. Two hundred dollars per acre had been allotted in the cost analyses to cover any other herbicides selected.

Farming Cost Sheets for each dry land and irrigated scenario are included in Appendix B and C, respectively.

### E.6. Results

The alternatives analysis included dry land with a spring wheat-fallow two year crop rotation and continuous cropping spring wheat. Irrigated land included raising continuous spring wheat. Each layout was considered in the evaluation. Results of the Alternative Analysis for dry land and irrigated farming are summarized in Tables 2 and 3, respectively. For MATL and the growers, structures at field edges would cost less to farm around than interior poles.

The results indicated that long-span 6.5-foot diameter mono-poles at the field edges would cost the least to farm around on an overall basis which considers multiple structures within the field. The long-span mono-pole layout would have a larger footprint than the short-span, but would have fewer structures to farm around per mile. On an individual structure basis, the 3.5-foot diameter mono-pole structure at the field edge would be the least to farm around.

All care should be taken to not place structures in a sprinkler irrigated field; due to the additional costs of having to break apart a wheel line to move it past a pole(s) and the cost of disrupting a pivot from making a complete revolution. Those costs have not been addressed in the alternate analysis because each field will have a unique situation to calculate. Pole(s) in flood irrigated fields will have additional costs beyond overlap costs. Again, cost depends upon its location in the field, top, middle, or bottom of field. Structures at the top of the field will result in less crop watered down slope than crop located in the in the middle or bottom of the field. Cost of interior pole(s) will be also influenced by the length the water has to travel.

## F. Standard of Care

Services performed by HSI personnel for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession, currently practicing in this area under similar budget and time restraints. No warranty, expressed or implied, is made.

## G. References

Farmers Union, Worden, Montana, June 2007. Personal communication.

Montana Department of Environmental Quality, Draft Environmental Impact Statement for the Montana Alberta Tie Ltd. (MATL) 230-kV Transmission Line, March 2007.

United States Department of Agriculture, National Agricultural Statistics Services, Montana Agricultural Statistics, Available online at **http://www.nass.usda.gov/Statistics_by_State/Montana/index.asp**, Accessed June 2007.

University of Wyoming "Custom Rates for Wyoming Farm and Ranch Operations", 2004-2006, Hewlett, John P. and Sedman, James, May 2006.

Wilbur-Ellis Company 2007 Price List, Term and Conditions, 4/9/2007.

# Figure

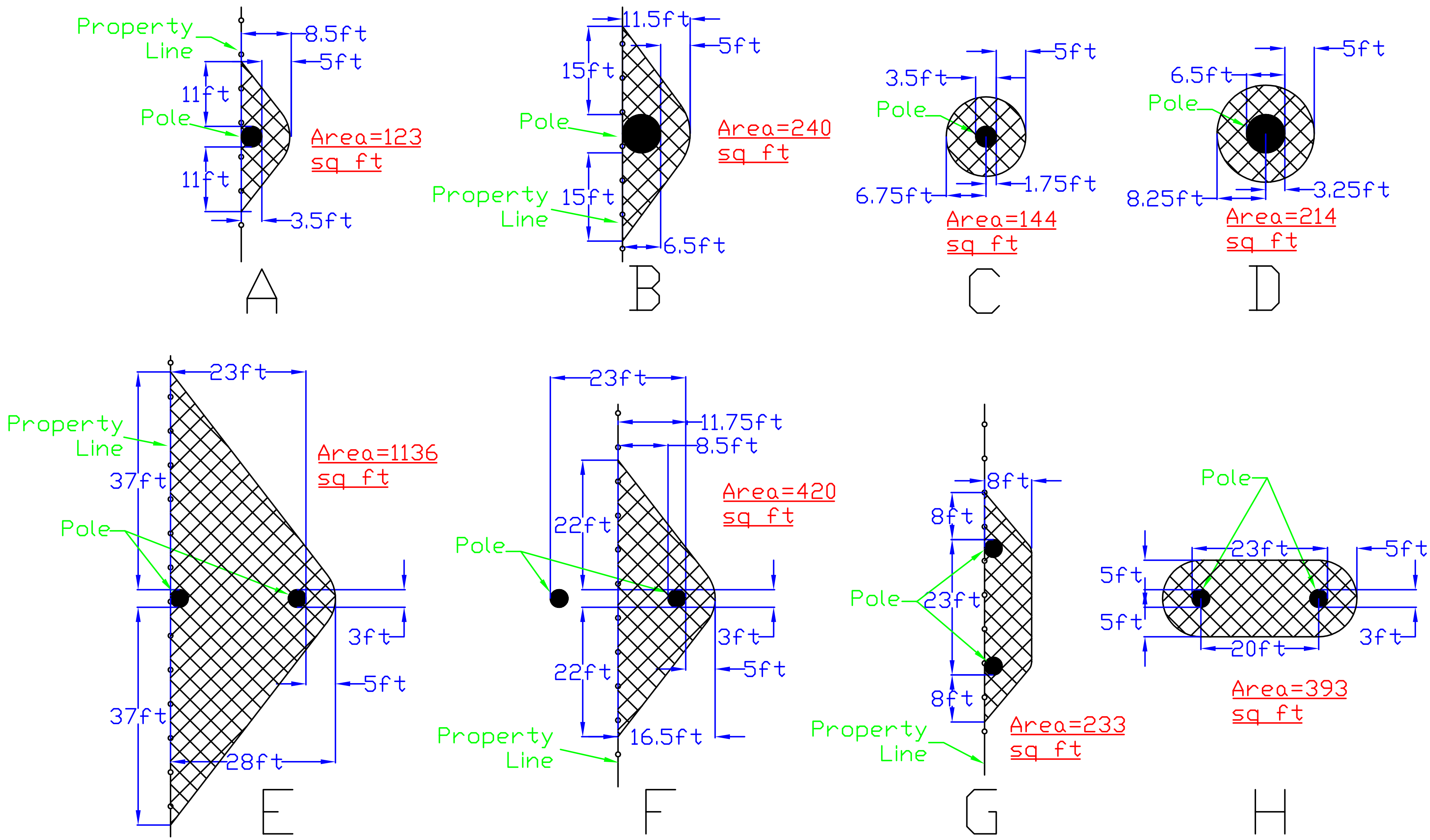


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FIGURE # 1

Pole Configuration Footprint Layouts
MATL Farming Cost Review

Montana Department Of Environmental Quality

# Tables

## Table 1. Footprint and Overlap

| Layout[1] | Structure | Pole Diam. (ft) | Location | Orientation | Minimum Buffer Distance From Center of Pole (ft) | Footprint (square feet) | Implement Width (feet) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 70 | 120 | 36 | 60 |
| | | | | | | | Overlap (square feet) | | | |
| | | | | | | | Harrow | "Fargo" & Spraying | Disc & Combine | Fertilizing, Toolbar & Seeding |
| A | Mono-pole | 3.5 | Edge | | 1.75 | 123 | 123 | 123 | 117 | 123 |
| B | Mono-pole | 6.5 | Edge | | 3.25 | 240 | 240 | 240 | 207 | 240 |
| C | Mono-pole | 3.5 | Interior | | 1.75 | 144 | 18,362 | 50,328 | 5,597 | 13,854 |
| D | Mono-pole | 6.5 | Interior | | 3.25 | 214 | 19,022 | 51,459 | 5,937 | 14,420 |
| E | H-pole | 3.0 | Edge | Perpendicular | 1.5 | 1136 | 1,136 | 1,136 | 1,136 | 1,136 |
| F | H-pole | 3.0 | Edge | Straddling | 1.5 | 420 | 420 | 420 | 420 | 420 |
| G | H-pole | 3.0 | Edge | Parallel | 1.5 | 233 | 233 | 233 | 233 | 233 |
| H | H-pole | 3.0 | Interior | | 1.5 | 393 | 21,052 | 54,490 | 6,982 | 16,160 |

**Notes:** [1]From Figure 1.
Mono-pole: Regular and long span are 3.5 and 6.5-ft diam, respectively.
H-Pole: 3-ft diam. each, 20-ft separation center to center, 23-ft from outside pole to outside pole.
Safety buffer: 5-ft.

Table compiled by Shane Bofto, Engineer & Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/12/07.

## Table 2. Dryland Costs of Farming Around Pole(s).

| Layout[1] | Structure | Pole Diam. (ft) | Location | Orientation | Farming Practice: Spring Wheat-Fallow: Information Source | Farming Practice: Spring Wheat-Fallow: Annual Cost (per structure )[2] | Farming Practice: Continuous Crop: Information Source | Farming Practice: Continuous Crop: Annual Cost (per structure)[2] |
|---|---|---|---|---|---|---|---|---|
| A | Mono-pole | 3.5 | Edge | | Attachment DL-1 | $13.81 | Attachment DL-9 | $14.22 |
| B | Mono-pole | 6.5 | Edge | | Attachment DL-2 | 15.06 | Attachment DL-10 | 15.86 |
| C | Mono-pole | 3.5 | Interior | | Attachment DL-3 | 105.09 | Attachment DL-11 | 156.01 |
| D | Mono-pole | 6.5 | Interior | | Attachment DL-4 | 107.98 | Attachment DL-12 | 160.44 |
| E | H-pole | 3.0 | Edge | Perpendicular | Attachment DL-5 | 37.13 | Attachment DL-13 | 40.91 |
| F | H-pole | 3.0 | Edge | Straddling | Attachment DL-6 | 20.98 | Attachment DL-14 | 22.38 |
| G | H-pole | 3.0 | Edge | Parallel | Attachment DL-7 | 14.99 | Attachment DL-15 | 15.76 |
| H | H-pole | 3.0 | Interior | | Attachment DL-8 | 120.57 | Attachment DL-16 | 177.74 |

**Notes:**

[1]From Figure 1.
[2]Cost reflect 2007 prices.
Mono-pole: Regular and long span are 3.5 and 6.5-ft diam, respectively.
H-Pole: 3-ft diam. each, 20-ft separation center to center, 23-ft from outside pole to outside pole.
Safety buffer: 5-ft.

Table compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/21/07.

## Table 3. Irrigated Costs of Farming Around Pole(s).

| Layout[1] | Structure | Pole Diam. (ft) | Location | Orientation | Irrigated Cropping | |
|---|---|---|---|---|---|---|
| | | | | | Information Source | Annual Cost (per structure)[2] |
| A | Mono-pole | 3.5 | Edge | | Attachment IRR-1 | $15.60 |
| B | Mono-pole | 6.5 | Edge | | Attachment IRR-2 | 18.69 |
| C | Mono-pole | 3.5 | Interior | | Attachment IRR-3 | 258.67 |
| D | Mono-pole | 6.5 | Interior | | Attachment IRR-4 | 266.61 |
| E | H-pole | 3.0 | Edge | Perpendicular | Attachment IRR-5 | 41.81 |
| F | H-pole | 3.0 | Edge | Straddling | Attachment IRR-6 | 23.34 |
| G | H-pole | 3.0 | Edge | Parallel | Attachment IRR-7 | 18.51 |
| H | H-pole | 3.0 | Interior | | Attachment IRR-8 | 290.41 |

**<u>Notes:</u>**
[1]From Figure 1.
[2]Cost reflect 2007 prices.
Mono-pole: Regular and long span are 3.5 and 6.5-ft diam, respectively.
H-Pole: 3-ft diam. each, 20-ft separation center to center, 23-ft from outside pole to outside pole.
Safety buffer: 5-ft.

Table compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/21/07.

# Appendix A
# Comments

I Allen Denzer, Terri Denzer, and Darlene Denzer appreciate the effort the DEQ put into the Draft Impact Study and statement.

Upon reading it I noted you took into account the following:

1. All the concerns raised by myself and the other farmers
2. Single poles.
3. Non diagonal.
4. Diagonally only on grass land.
5. Difficulty farming around 2 power lines in close proximity to each other.
6. Weed control around double poles.
7. Added liability with poles in the middle of fields.

Concerns we have that need to be addressed.

1. The difficulties our son will have operating around an H frame or a Single pole structure. Rick lost his arm 3 years ago. We have made many improvements to help him with this, by moving all unnecessary structure that are in his way. He is the 5th generation on our family farm and wants to continue to farming. With his son we are looking at a 6th generation of farming. Rick's capability has changed making him unable to use some of the old machinery, but is able to use modern guidance equipment. All consideration should be taken to help him continue farming. These diagonal poles will be one more obstacle he has to negotiate around for the rest of his working life adding a great burden on his other arm. Using Alternative 4, or moving the line south by ¼ mile would take it off our crop land giving Rick the opportunity to farm with less interference. This power line should be done right the first time, for the impact we will have to live with forever.
2. Modern GPS, auto steering, yield mapping, and variable rate fertilizing doesn't work in fields with poles in them. As you cut around and around these poles to clean up your skips the yield monitor records a very low yield, as it thinks the 36 ft. header is full not just cutting skips. The next year the variable rate fertilizer come to the pole and is told because of the low yield last year to dump on the fertilizer to make up for the pervious low year. You have just created a big problem as far as quality and yield of your crop, wasted fertilizer and possibility environmental concerns by going way beyond the recommended rate. The problem continues with chemical applications being doubled or tripled.

Modern farming has progressed very rapidly within a few years these guidance systems will not even need a human in the operating cab. John Deere has an unmanned tractor testing now that doesn't have an operator seat. We will see these in the near future except in fields with power poles, oil wells, and other obstacles.

Farmers make sacrifices for the good of the public, but we shouldn't have to sacrifice our progress of the future for the cheap way out now. Again you need to know the farmers expenses and try to figure out want they well be in 10 to 50 years. Once the power line is built, MATL will have little maintenance for years. (Northwest line has had no poles replaced on our farm since being built in the 60's). So MATL has basically a one time expense while the farmer will have continued expense.

3. On December 10, 2006, I met with MATL's people, and the North Dakota professors MATL haired to calculate the cost to farm around the poles. In the professors opening statement he stated GPS auto steering makes farming around the poles way easier, enabling you to get closer to the poles. I informed him that GPS and auto steering doesn't drive themselves around the poles and are incapable of sensing an object ahead of them. He agreed that he hadn't used it but his students told him they could. There model was very incomplete as it showed the impacted area of the pole on the boarder of a field being a perfect ½ circle which its not. Their model showed the impacted area around the poles in middle of the field as being a perfect circle the width of the implement which is again wrong. As it takes at least 2 circles around the poles to get all the corners and skips. Their model uses custom per acre rates which don't apply here. The custom rate is figured at doing a whole field or farm at a normal ground speed, not going slowly around and around poles. There is a lot of time and productivity lost with these poles in the middle of a crop field. There is no time lost with poles on the edges of fields.

We are again sending you our cost to farm around the poles:

Example:

What our yearly cost is on the existing H structure:

(1)-**Fargo application**

2-60 ft Fargo (wild oat spreaders), working together at 15 mph. 112 acres per machine.

One works around poles while to other one sits and waits.

$5.00 dollars an acre for each machine

$17.00 an acre of chemical

3 minutes lost per pole X 2 = $55.99 lost production.

17.00 dollars x 2 acres chemical overlap= $34.00 dollars.

$55.99
$ 34.00
--------
$ 89.99

(2)- **Broad Cast Fertilizer**

60 ft. at 15 mph. = 112 acres per hour. Rate $5.00 acre around poles loss 3 Minutes=$27.99

Fertilizer doubled around poles = $52.49

$350 per ton at 150pounds an acre x 2 $ = 52.50

$52.49

$52.50

--------

$80.49

(3) **Pre Plant Spray**

3 Sprayers:

90ft. at 12 mph at $5.00 per acre 116 acre per hour

90 ft at 12 mph at $5.00 per acre 116 acre per hour

60 ft at 12 mph at $5.00 per acre 87 acre per hour

One sprayer goes around poles while the other 2 wait at in line for the first to get back in the row. Time lost 9 minutes =$230.00

Chemical = $ 9.18

---------

$248.43

(4) **Heavy Harrow**

60 ft. at 14 mph = 105 acres per hour

$5.00 per acre, 3 minutes lost =

$26.25

(5) **Seeding:**

57 ft. air drill at 6 mph, $42.75 acre per hour at $7.00 per acre

525 hp tractor

3 minutes lost $14.97

Seed and fertilizer $24.00 x 2 =$48.00

$14.96

$ 48.00

--------

$62.96

(6) **Weed spraying same as #3 for time and machinery**

| | |
|---|---|
| Time | $239.25 |
| Chemical | |
| $15.00 x 2 | $30.00 |
| | ---------- |
| | $269.25 |

(7) **Harvest:**

3 combines; tractor and grain cart working together totals $1,000.00

Investment one cuts around poles while the others wait. Operating cost of

$160.00 an hour, for each combines. Loss 9 minutes
Loss $72.00

**Summer fallow second year:**
4 sprayers operation the same as # 3
248.43
X4
----------
$ 993.72

**Cost 2 seasons = $1843.09**

Or $921.54 per year

**Crop Loss:**
75 bushels x $4.00 =$300.00 an acre x 2 acres x 50 % reduced production
$300.00 per crop
Or $150.00 per year

A senior loan officer from Northwest Farm Credit looked over our figures and said some were a little high and some were a little low but that our price came out the same as his.

**Total cost per year is: $1071.54**

**These were 2005 production costs**

Plus additional weed problems and liability.

The farmer should know exactly what the costs to farm around the poles are. They do it year after year. A computerized program is not capable of figuring out wasted time, double seeding, double spraying, compaction of the ground, loss in bushels per acre, loss of spray, etc, etc, etc. Why should we settle for less? What MATL is offering is nothing compared to our real costs. MATL is out to make a profit for the businessmen of Canada. MATL will recover the cost of alternative 4 in a mater of months while it takes farmers 20 to 30 years to pay for their land, shouldn't the farmers of the United States still be able to keep making the profit they were making before MATL decided to make another power line. This power will be sent out of state, used in Canada, not one bit in Montana.

We have Northwestern double diagonal poles in our fields that create a lot of problems and cost. We also have 5 miles of the WAPA line running down section lines and field boarders that create no problems or additional costs.

4. Alternative 4 seems to be a will thought out that covers all my concerns. Alternative 2 basically fallows MATL's route in being the cheapest for a

foreign company building in the United States. The state of Montana should only be worried about doing what's right for its citizens, and shouldn't concern itself about Bob Williams comment that they can't afford alternative 4. The draft should not take into consideration that MATL already has easements on some land. Farmers that signed did so under derris, they were told to sign or be condemned. MATL's right a way agents and lawyer, misled local farmers telling them they had to sign and they were the only ones that hadn't. We were even told we had 3 day to sign. That the line was decided. MALT went ahead and got some easement before the DEQ had made they decision where the line should go. I feel this put added pressure on you to decide on their route.

5. The DEQ worked very hard to figure the impact on the Canadian MATL Company, the water, antelope, birds, mule deer, and teepee rings, but seemed to leave out the financial impact on the Montana's farmers. We have paid our taxes and donated our land for roads, highways, power lines, missile lines and sights, fiber optic lines, petroleum lines, and oil wells. The state should recognize this and make sure when this power line is built that it is the best for everyone. I hear politicians stating this is so good and if they went through there land they'd give it to them. Words are cheap. I guess I would say that to, if they were not even near my land. This seems to me that the politicians always have ideas how to use farmers land. Like the wolf and bear introductions. Again the farmer and rancher have to take it and can't protect what's theirs. Why is this? I hope the DEQ decides on the right way to do this power line and not buckle to political pressure.

Allen Denzer

Terri Denzer

Darlene Denzer

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59425-0936

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**Actual costs of farming around a double pole utility set:**

16.5 feet x 2640 ft.(1/2 mile) = 1 acre or 43560 square ft.

Spraying with a 120 ft sprayer: 160 ft. diameter circle (leaving 20 ft around poles) 160 x 3.1416 = 502 ft. x 1.5 = 753.9 linear ft.

120 ft./ 16.5 = 7.272727 acres/ 2640 ft. = .002755 acres per ft. x 753.9 ft = 2.0768 acres per pole set.

application costs: $3.75/ acre
chemical costs: $6.00/ acre ( Roundup)
$9.75 x 2.0768 x 4 = $81.00 (4 applications of Roundup)

Maverick costs: $11.00/ acre + $3.75 app. = 14.75 x 2.0768 acres = $30.63
Total cost of going around a pole 1.5 times = $101.63

If we have to go around a pole an additional time to keep the GPS on track, it will be a 280 ft dia. or an additional 2.42 acres.
$9.75 x 4 x 2.42 = $94.38 (Roundup cost)
$14.75 x 2.42 = $35.70 Total of second loop: $130.08
Total cost of 2.5 loops $231.71

Heavy harrowing with a 70 ft. tool: 90 ft. dia. (leaving 10 ft. around poles) 90 x 3.1416 = 282.75 ft. x 1.5 = 425 ft.
70/16.5 = 4.25 acres/ 2640 ft. = .001606978(acres per ft.) x 425 ft. = .683 acres at $ 10.00 = $ 6.83 per pole set.
An additional time around poles at 160 ft. dia = 502.66 ft. or .8 acres x $10.00 = $8.00
Total cost of 2.5 loops: $14.83

Seeding with a 60 ft air drill: 80 ft dia x 3.1416 = 251.328 x 1.5 = 377 linear ft.
60/16.5/2640 = .00137741 acre per ft. x 377 ft. = .52 acres
Fertilizer: $36.00/ acre
Seed $7.50 / acre
Application $12.00/ acre
total $ 55.50/ acre x .52 = $28.86 per pole set
An additional time around a pole set at 140 ft. dia. = .6058 acres x $55.50 = $33.62
Total cost of 2.5 loops: $62.48

Combining with a 36 ft. header: 82 ft. dia. x 3.1416 = 257.61 ft. x 1.5 = 386.42 ft.
36/16.5/2640 = .000826446 acres per ft. x 386.42 ft. = .32 acres
$20.00 per acre x .32 = $6.40
Additional costs will be incurred while other combines wait for 1 combine to clean up around a pole set. Also, combines need to be run at capacity and will lose grain out the back of the machine when it is not fully loaded or comes to a stop according to the grain loss monitor.

Approximately 2 acres around each pole set will have a reduction in yield due to over applied spray, fertilizer and compaction from the additional traffic from the equipment. If the reduction is 30% on a 58 bushel per acre proven yield, the results are 17.4 bushels per acre.
17.4 x 2 acres x $4.00 per acre = $139.20 per pole set.

Total out of pocket costs of going around a pole 1.5 times plus the yield reduction:**$282.92**

Total out of pocket costs of going around a pole set 2.5 times plus the yield reduction: **$454.62**

These costs will be spread over a two (2) year period so the above figures will be divided by 2 to get an annual cost
of farming around a double pole set.

Annual cost of going around a pole 1.5 times: **$141.46**
Annual cost of going around a pole 2.5 times: **$227.31**

I suspect that it will take 2.5 loops around each pole set so as to NOT leave skips and to give the equipment enough room to get
back on the preceding line and lock on the GPS and auto steer. I don't have a difinitive answer at this time as we have just installed the
auto steer recently. I'll have a better idea in about a month after we spray around some existing double pole sets.

There are other factors that enter into farming around an above gound power line such as unlocking and locking the GPS autosteer
(functions on the equipment when you come to a pole set). There is also difficulty getting back on the pass without the use of a foam marker.
Another will involve the option of arial (sp) spraying when there are two double poled power lines running in parrallel about 200 ft. apart.

I suspect Arial Applicators may not want to spray fields with (2) diagonal power lines running through it for obvious reasons.

I am certainly not against power lines **if they run North/South, East/West following section lines**. Diagonal lines just create too much expense in todays farming environment. I would be willing to sign an easement for a line **if it followed section lines** for a reasonable fee, but, the diagonal lines are simply unacceptable.

Sincerely,

Brent MacDonald
President
Brent MacDonald, Inc.
1250 Anderson Road
Floweree, MT 59440-9012

**Fertilizer costs have increased by 30% since this analysis was done in the summer of 2006 - so the costs will increase accordingly.**

**Model Overview**
The methodology of the spreadsheet is based on professional assessment by Dr. Eric A. DeVuyst, Dean. A. Bangsund, and Dr. F. Larry Leistritz on how to find a reasonable estimate of the additional expense of having to farm around electrical towers in a crop field. The formulas and approach used in the model were not found in existing academic literature, although we cannot assume that a similar approach has not been used in other studies. Our approach may not be unique or novel.

The intent of the model is to use site-specific values and inputs, if available, to estimate the highest reasonable expectation for the cost to farm around electrical towers and guy wires. Costs are expected to vary based on the location or placement of the structure in the field. Towers located in the interior of the field require farming around the entire structure and so will cost more than those located on the field edge. The estimates in the model are considered conservative since the maximum amount of overlap, based on machinery size, is used in all field operations (both machinery cost and overlapped inputs). Further, the model assumes that complete crop failure occurs under the tire tracks of the sprayer when the sprayer drives over standing crop. Again, scientific evidence suggesting the actual (likely) amount or the relationship to yield loss associated with those actions could not be found. To be consistent, a worst case scenario (complete yield loss) was used.

The methodology has a number of assumptions. These assumptions include

1) operations are not discontinued when overlap begins–for example, the farmer does not shut off part of the sprayer as he sprays over areas that are considered overlap;

2) custom application rates are adequate to cover individual farmer's cost of application, which include machinery depreciation, power requirements (tractor fuel, depreciation on tractor), and operator labor;

3) estimations of the loss of productivity stemming from the 'footprint' of the towers is adequately covered by the easement settlement;

4) the existing crops grown and the lack of irrigation are continued into the foreseeable future. In other words, a new, high value, crop is not raised on the affected fields in the next several years.

The spreadsheet model is a work in progress and will not cover all situations encountered in the field. However, it is intended to be useful in a wide number of situations. If significantly different situations are encountered, modifications will be necessary.

**MATL Spreadsheet Instructions**

The purpose of this spreadsheet is to compute 1) yield loss associated with additional tire tracks and 2) additional costs associated with the overlapping of crop inputs from farming operations that have to maneuver around electrical tower bases. Throughout the spreadsheet, a conservative approach is used by assuming the maximum amount of overlap possible according to the farmer's machinery size.

The spreadsheet is comprised of five sheets. The tabs in the lower left corner, labeled INPUTS, AREA CALCULATIONS, COST CALCULATIONS, REVENUE LOSSES and TOTAL LOSS, direct the user to each section. Cells shaded turquoise are input cells and cells shaded yellow are calculated or fixed.

INPUTS

Start with the INPUTS sheet. All information enter here is carried through to the other sheets. First, enter the landowner's name and the field identification (such as legal description).

**TABLE A. Structure Measurements and Number by Location**

In Table A, three different pole configurations (1 pole, 2 pole and 3 pole) and 2 different guy wire configurations (1 wire and 3 wire) are allowed. Only 1-pole and 2-poles structures are allowed on the EDGE of the field or in the INTERIOR of the field. (An EDGE structure is too close to the field boundary to allow farming on all sides of the structure. An INTERIOR structure is distant enough from the field boundaries to allow farming on all sides of the structure.) All pole configurations are allowed in field CORNERs. Both 1-wire and 2-wire configurations are assumed to be in field CORNERs. (A CORNER structure is too close to two field boundaries to allow farming on two sides of the structure.)

For EDGE configurations, enter the distance from the field boundary to the farthest (from the boundary) edge of the poles. See FIGUREs 1-POLE EDGE FOOTPRINT and 2-POLE EDGE FOOTPRINT. Enter a safety margin if the farmer states a need for one. Also, enter the number of each type of EDGE structure.

For INTERIOR configurations, the distance from the outside edges of the tower(s). For example, a 1-pole structure may measure three feet across and a 2-pole structure may measure 23 feet from outside edge to outside edge of the poles. See FIGUREs 1-POLE INTERIOR FOOTPRINTand 2-INTERIOR FOOTPRINT.

CORNER configurations require more input. To allow for reasonable estimation of overlapped areas and nonplantable areas, it is necessary to assume a rectangular footprint for each corner configuration. Enter the farther point into the field from each boundary. These are entered as "width" and "length". Also, enter a safety margin if requested. Then, enter the number of each type of corner configuration. Last, enter the easement area for each type of CORNER structure in the field. (The easement area may be different than the footprint.) See FIGUREs 1-POLE CORNER FOOTPRINT, 2-POLE CORNER FOOTPRINT, 3-POLE CORNER FOOTPRINT, 1-

WIRE CORNER FOOTPRINT AND 3-WIRE CORNER FOOTPRINT.

**TABLE B. Machinery Size and Custom Rates**

In Table B, enter the farm's tillage, seeding, harvest, pesticide application and other relevant equipment used in actual field operations for the crops grown. Also, enter the width of each implement. Default widths can be over-written. Enter a custom rate for each implement/field operation. Again, a default set of values is included but can be over-written. The default values are from western ND and were taken from a North Dakota State University publication. The western ND rates were inflated by 20% above the published rate to account for recent increases in fuel prices.

Also, in Table B, enter the wheel base of the farm's crop sprayer and the width of the sprayer's tires. The model assumes that spraying operations are done with a self-propelled sprayer–if the farmer uses a tractor and pull-type sprayer, the model will need to be modified.

**TABLE C. Crops, Yields and Rotation**

In Table C, enter the crops grown on this *field*. DO NOT INCLUDE ANY CROPS GROWN ON THE FARM BUT NOT IN THIS FIELD. Enter the average (last few years) yield for each crop in this field. It is recommended that the APH yield from the farm's crop insurance forms be used. An estimate of the crop rotation as percent is needed for this *field*. The cropping history from the insurance forms can be of help. The rotation is entered as a percent. For example, if durum is raised about one out of four years, enter "25". Note FALLOW is treated as a crop for this spreadsheet. Other crops can be added.

**TABLE D. Pesticides**

Enter all pesticides used on the field for any crop. These include herbicides, insecticides (if any), and fungicides (if any). Enter the rate, the price per unit (such as per quart) and the unit (such as quart). Multiple rates for the same pesticide can be entered on separate lines. It is assumed that sprayers are not shut off on overlap areas.

**TABLE E. Fertilizers**

For each crop, enter the fertilizer rate and price.

**TABLE F. Seeding**

For each crop, enter seeding rate and price.

AREA CALCULATIONS

This sheet computes the area of overlap for each field operation listed in Table B and for each structure listed in TABLE A..

Diagrams 1-Pole or Wire Structures, Diagrams 2-Pole Structures, and Diagrams 3-Pole Structures

These sheets contain the diagrams referenced in TABLE A and throughout this manual.

**TABLE G. Estimates of Overlap by Field Operation**

Using the data entered on the INPUTS sheet, the area overlapped by each field operation is computed. For all INTERIOR structures, circular formulas are used. The area of a circle is computed as pi times radius squared ($\pi R^2$). A circle around each structure (the inner orange circles in Figures 1-POLE INTERIOR FOOTPRINT and 2-POLE INTERIOR FOOTPRINT) is assumed to be lost to production and not overlapped.

The outer circular area (shaded in blue in INTERIOR figures) is the computed area of overlap. The area of overlap will vary across field operations due to the different widths of implements. The overlap areas for edge of field structures are given as one-half the area in INTERIOR figures and are given in Figures 1-POLE INTERIOR OVERLAP and 2-POLE INTERIOR OVERLAP.

For EDGE structures, one-half of a circle with a diameter equal to the sum of the width of the structure and the safety margin is assumed to be non-overlap. (See Figures 1-POLE EDGE FOOTPRINT and 2-POLE EDGE FOOTPRINT.) Overlap area estimates for EDGE structures are shown in Figure 1-POLE EDGE OVERLAP and 2-POLE EDGE OVERLAP.

For CORNER structures, the non-overlap areas are shown in Figures 1-POLE CORNER OVERLAP, 2-POLE CORNER OVERLAP, 3-POLE CORNER OVERLAP, 1-WIRE CORNER OVERLAP, and 2-WIRE CORNER OVERLAP. Rectangular formulas are used to estimate overlapped areas. Areas assumed to not be planted are given in figures 1-POLE CORNER NONPLANT, 2-POLE CORNER NONPLANT, 3-POLE CORNER NONPLANT, 1-WIRE CORNER NONPLANT, and 2-WIRE CORNER NONPLANT.

**TABLE H. Change in Quality**

Table H is not used to compute economic loss and is presented for demonstration purposes. In Table H the change in grain quality due to overlapping of inputs is computed. Input cells are total acres in the field, yields, test weights, and protein levels. The affected acres are computed from the width of the air seeder. The model assumes that fertilizer is applied through the air seeder. If the producer broadcasts fertilizer, contact Jose as changes will need to be made to the formulas.

Providing reasonable values are entered in Table H, the potential economic effects of a change in the quality of malting barley from the placement of electrical towers will be negligible.

COST CALCULATIONS

Using the previously entered data and the number of trips/applications for each field operation, this sheet computes the costs associated with overlapping inputs–including both material costs and custom work rates for field operations.

Each crop –including FALLOW– that was entered on the INPUTS sheet has a separate table. NOTE: If a 0% area was enter for a crop's rotation percent in TABLE C, NO TABLE FOR COST CALCULATIONS WILL BE VIEWABLE OF THIS SHEET. Only Table I is discussed below, since the input requirements for the other crops are the same.

**TABLE I. First Crop, Estimates of the Cost of Overlap**
**SPRING WHEAT**

For each field operation, enter the number of times the operation is completed. The formula then uses the overlap calculations from the AREA CALCULATIONS sheet, the input prices and rates and the custom work rates from the INPUTS sheet. The resulting overlap costs are given PER FIELD.

REVENUE LOSS

This sheet computes losses associated with additional tire tracks, which are considered to drive over standing crop and result in complete yield loss under the tires. All tracks are considered to be due to spraying operations, since that is the only operation assumed to drive over standing crop, and it is assumed that no tracks would have been made around/through the field where the structure is located..

**TABLE P. Yield loss due to tire tracks around towers**

It assumed that each tire on the sprayer makes a unique track in the standing crop and that no yield is realized in each tire track. The circumference of each tire track (depending on its location relative to the tower) is computed as $2\pi R$ for INTERIOR structures. The radius R is computed based on the distance to the center of the circle using the width of the sprayer and the sprayer's wheel base. The area covered by each tire is equal to the distance it travels (circumference) times the tire width. For EDGE structures, a half circle is assumed. For CORNER structures, straight lines parallel to the field edges are assumed.

The economic value of yield loss is equal to the area covered by the tires ×yield×price. Areas are computed in the top of Table P and the yields used were reported on the INPUTS sheet. Prices are computed as a 10-year average of real (2006$) prices. Historical marketing-year average prices for MT (taken from Montana Agricultural Statistics Service and National Agricultural Statistics Service online data bases) are inflated to 2006$ using Producer Price Indices for wheats (spring, winter and durum) and barley (taken from US Bureau of Labor Statistics). For other crops, contact Jose as alternative data will need to be used.

The remaining tables on this sheet are the supporting price data and indices.

**TABLE Q. Yield loss due to unfarmable areas around towers and guy wires**

Some areas may be difficult to farm because of tight turns. These areas are shown in the figures as NON PLANT.

TOTAL LOSS

**TABLE R. Total Losses**

This sheet aggregates the losses from overlap and tire tracks. Losses for each crop are weighted by the crop rotation percentages and summed. No inputs are allowed on this page. The results are AVERAGE ANNUAL (or per year) losses and reported per field and per total number poles plus wires.

# Appendix B

# Farming Cost Sheets
# Attachments DL-1 to 16

**Attachment DL-1**

# Dryland Wheat-Fallow Rotation

## Regular Span Mono-Pole at Field Edge (Layout A)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft² | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 123 | 0.003 | $0.02 |
| Chemical Fallow: | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 4 | $10.75 | | | | |
| Dicamba | $71.00 | gallon | 4 | ounce | 1 | 2.22 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 4 | 3.00 | | | | |
| Application | $5.00 | acre | | | 4 | 20.00 | 35.97 | 123 | 0.003 | 0.10 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 123 | 0.003 | 0.08 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N | $450 | ton | 120 | pound | 1 | 27.00 | | | | |
| Topdress App | $5.00 | acre | | | 1 | 5.00 | 45.50 | 123 | 0.003 | 0.13 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 123 | 0.003 | 0.07 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 123 | 0.003 | 0.03 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 123 | 0.003 | 0.06 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 50 | bushel | 20% | $60.00 | 60.00 | 123 | 0.003 | 0.17 |
| Pole Footprint | $6.00 | bushel | 50 | bushel | | $300.00 | 300.00 | 123 | 0.003 | 0.85 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 2 | $400.00 | 400.00 | 123 | 0.003 | 1.13 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 2 | $25.00 | 25.00 | | | 25.00 |
| **TOTAL COST OF 2 YEAR ROTATION** | | | | | | | | | | **$27.63** |
| **ANNUAL COST OF FARMING AROUND REGULAR SPAN MONO-POLE AT FIELD EDGE** | | | | | | | | | | **$13.81** |

Estimated Spring Wheat Yield: 50 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.
[2]Applying a total of 61 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-2**

# Dryland Wheat-Fallow Rotation

## Long Span Mono-Pole at Field Edge (Layout B)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap $Ft^2$ | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 240 | 0.006 | $0.04 |
| Chemical Fallow: | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 4 | $10.75 | | | | |
| Dicamba | $71.00 | gallon | 4 | ounce | 1 | 2.22 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 4 | 3.00 | | | | |
| Application | $5.00 | acre | | | 4 | 20.00 | 35.97 | 240 | 0.006 | 0.20 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 240 | 0.006 | 0.15 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N | $450 | ton | 120 | pound | 1 | 27.00 | | | | |
| Topdress App | $5.00 | acre | | | 1 | 5.00 | 45.50 | 240 | 0.006 | 0.25 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 240 | 0.006 | 0.13 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 240 | 0.006 | 0.06 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 240 | 0.006 | 0.11 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 50 | bushel | 20% | $60.00 | 60.00 | 240 | 0.006 | 0.33 |
| Pole Footprint | $6.00 | bushel | 50 | bushel | | $300.00 | 300.00 | 240 | 0.006 | 1.65 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 2 | $400.00 | 400.00 | 240 | 0.006 | 2.20 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 2 | $25.00 | 25.00 | | | 25.00 |
| **TOTAL COST OF 2 YEAR ROTATION** | | | | | | | | | | **$30.13** |
| **ANNUAL COST OF FARMING AROUND LONG SPAN MONO-POLE AT FIELD EDGE** | | | | | | | | | | **$15.06** |

Estimated Spring Wheat Yield: 50 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 61 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-3**

# Dryland Wheat-Fallow Rotation

## Regular Span Mono-Pole in Field Interior (Layout C)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost/Ac | Overlap $Ft^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 18,362 | 0.422 | $2.95 |
| Chemical Fallow: | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 4 | $10.75 | | | | |
| Dicamba | $71.00 | gallon | 4 | ounce | 1 | 2.22 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 4 | 3.00 | | | | |
| Application | $5.00 | acre | | | 4 | 20.00 | 35.97 | 50,328 | 1.155 | 41.56 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 50,328 | 1.155 | 31.20 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N | $450 | ton | 120 | pound | 1 | 27.00 | | | | |
| Topdress App | $5.00 | acre | | | 1 | 5.00 | 45.50 | 13,854 | 0.318 | 14.47 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 13,854 | 0.318 | 7.38 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 50,328 | 1.155 | 13.42 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 5,597 | 0.128 | 2.57 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 50 | bushel | 20% | $60.00 | 60.00 | 50,328 | 1.155 | 69.32 |
| Pole Footprint | $6.00 | bushel | 50 | bushel | | $300.00 | 300.00 | 144 | 0.003 | 0.99 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 2 | $400.00 | 400.00 | 144 | 0.003 | 1.32 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 2 | $25.00 | | | | 25.00 |
| **TOTAL COST PER POLE DURING 2 YEAR ROTATION** | | | | | | | | | | **$210.18** |
| **ANNUAL COST OF FARMING AROUND REGULAR SPAN MONO-POLE IN FIELD INTERIOR** | | | | | | | | | | **$105.09** |

Estimated Spring Wheat Yield: 50 bu/ac

[1] Banding 11-52-0 or 18-46-0 with seed.

[2] Applying a total of 61 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-4**

# Dryland Wheat-Fallow Rotation

## Long Span Mono-Pole in Field Interior (Layout D)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost/Ac | Overlap Ft$^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 19,022 | 0.437 | $3.06 |
| Chemical Fallow: | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 4 | $10.75 | | | | |
| Dicamba | $71.00 | gallon | 4 | ounce | 1 | 2.22 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 4 | 3.00 | | | | |
| Application | $5.00 | acre | | | 4 | 20.00 | 35.97 | 51,459 | 1.181 | 42.49 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 51,459 | 1.181 | 31.90 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N | $450 | ton | 120 | pound | 1 | 27.00 | | | | |
| Topdress App | $5.00 | acre | | | 1 | 5.00 | 45.50 | 14,420 | 0.331 | 15.06 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 14,420 | 0.331 | 7.68 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 51,459 | 1.181 | 13.72 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 5,937 | 0.136 | 2.73 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 50 | bushel | 20% | $60.00 | 60.00 | 51,459 | 1.181 | 70.88 |
| Pole Footprint | $6.00 | bushel | 50 | bushel | | $300.00 | 300.00 | 214 | 0.005 | 1.47 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 2 | $400.00 | 400.00 | 214 | 0.005 | 1.97 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 2 | $25.00 | 25.00 | 25.00 | | 25.00 |

**TOTAL COST PER POLE DURING 2 YEAR ROTATION** **$215.95**

**ANNUAL COST OF FARMING AROUND LONG SPAN MONO-POLE IN FIELD INTERIOR** **$107.98**

Estimated Spring Wheat Yield: 50 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 61 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-5**

# Dryland Wheat-Fallow Rotation

## H-Poles Perpendicular to Field Edge (Layout E)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 1,136 | 0.026 | $0.18 |
| Chemical Fallow: | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 4 | $10.75 | | | | |
| Dicamba | $71.00 | gallon | 4 | ounce | 1 | 2.22 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 4 | 3.00 | | | | |
| Application | $5.00 | acre | | | 4 | 20.00 | 35.97 | 1,136 | 0.026 | 0.94 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 1,136 | 0.026 | 0.70 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N | $450 | ton | 120 | pound | 1 | 27.00 | | | | |
| Topdress App | $5.00 | acre | | | 1 | 5.00 | 45.50 | 1,136 | 0.026 | 1.19 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 1,136 | 0.026 | 0.61 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 1,136 | 0.026 | 0.30 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 1,136 | 0.026 | 0.52 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 50 | bushel | 20% | $60.00 | 60.00 | 1,136 | 0.026 | 1.56 |
| Pole Footprint | $6.00 | bushel | 50 | bushel | | $300.00 | 300.00 | 1,136 | 0.026 | 7.82 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 2 | $400.00 | 400.00 | 1136 | 0.026 | 10.43 |
| Labor & Equipment | $50 | hour | 0.5 | hour | 2 | $50.00 | 50.00 | | | 50.00 |
| **TOTAL COST OF 2 YEAR ROTATION** | | | | | | | | | | **$74.26** |
| **ANNUAL COST OF FARMING AROUND H-POLES PERPENDICULAR TO FIELD EDGE** | | | | | | | | | | **$37.13** |

Estimated Spring Wheat Yield: 50 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 61 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-6**

# Dryland Wheat-Fallow Rotation

## H-Poles Perpendicular to Field Edge & Splitting Property Line (Layout F)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft[2] | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 420 | 0.010 | $0.07 |
| Chemical Fallow: | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 4 | $10.75 | | | | |
| Dicamba | $71.00 | gallon | 4 | ounce | 1 | 2.22 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 4 | 3.00 | | | | |
| Application | $5.00 | acre | | | 4 | 20.00 | 35.97 | 420 | 0.010 | 0.35 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 420 | 0.010 | 0.26 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N | $450 | ton | 120 | pound | 1 | 27.00 | | | | |
| Topdress App | $5.00 | acre | | | 1 | 5.00 | 45.50 | 420 | 0.010 | 0.44 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 420 | 0.010 | 0.22 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 420 | 0.010 | 0.11 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 420 | 0.010 | 0.19 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 50 | bushel | 20% | $60.00 | 60.00 | 420 | 0.010 | 0.58 |
| Pole Footprint | $6.00 | bushel | 50 | bushel | | $300.00 | 300.00 | 420 | 0.010 | 2.89 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 2 | $400.00 | 400.00 | 420 | 0.010 | 3.86 |
| Labor & Equipment | $50 | hour | 0.33 | hour | 2 | $33.00 | 33.00 | | | 33.00 |
| **TOTAL COST OF 2 YEAR ROTATION** | | | | | | | | | | **$41.97** |

**ANNUAL COST OF FARMING AROUND H-POLES PERPENDICULAR TO FIELD EDGE & SPLITTING PROPERTY LINE** **$20.98**

Estimated Spring Wheat Yield: 50 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.
[2]Applying a total of 61 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-7**

# Dryland Wheat-Fallow Rotation

## H-Poles Parallel to Field Edge (Layout G)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft[2] | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 233 | 0.005 | $0.04 |
| Chemical Fallow: | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 4 | $10.75 | | | | |
| Dicamba | $71.00 | gallon | 4 | ounce | 1 | 2.22 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 4 | 3.00 | | | | |
| Application | $5.00 | acre | | | 4 | 20.00 | 35.97 | 233 | 0.005 | 0.19 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 233 | 0.005 | 0.14 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N | $450 | ton | 120 | pound | 1 | 27.00 | | | | |
| Topdress App | $5.00 | acre | | | 1 | 5.00 | 45.50 | 233 | 0.005 | 0.24 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 233 | 0.005 | 0.12 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 233 | 0.005 | 0.06 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 233 | 0.005 | 0.11 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 50 | bushel | 20% | $60.00 | 60.00 | 233 | 0.005 | 0.32 |
| Pole Footprint | $6.00 | bushel | 50 | bushel | | $300.00 | 300.00 | 233 | 0.005 | 1.60 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 2 | $400.00 | 400.00 | 233 | 0.005 | 2.14 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 2 | $25.00 | 25.00 | | | 25.00 |
| **TOTAL COST OF 2 YEAR ROTATION** | | | | | | | | | | **$29.98** |
| **ANNUAL COST OF FARMING AROUND H-POLES PARALLEL TO FIELD EDGE** | | | | | | | | | | **$14.99** |

Estimated Spring Wheat Yield: 50 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 61 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-8**

# Dryland Wheat-Fallow Rotation

## H-Pole in Field Interior (Layout H)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost/Ac | Overlap Ft$^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 21,052 | 0.483 | $3.38 |
| Chemical Fallow: | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 4 | $10.75 | | | | |
| Dicamba | $71.00 | gallon | 4 | ounce | 1 | 2.22 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 4 | 3.00 | | | | |
| Application | $5.00 | acre | | | 4 | 20.00 | 35.97 | 54,940 | 1.261 | 45.37 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 54,940 | 1.261 | 34.05 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N | $450 | ton | 120 | pound | 1 | 27.00 | | | | |
| Topdress App | $5.00 | acre | | | 1 | 5.00 | 45.50 | 16,160 | 0.371 | 16.88 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 16,160 | 0.371 | 8.61 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 54,940 | 1.261 | 14.65 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 6,982 | 0.160 | 3.21 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 50 | bushel | 20% | $60.00 | 60.00 | 54,940 | 1.261 | 75.67 |
| Pole Footprint | $6.00 | bushel | 50 | bushel | | $300.00 | 300.00 | 393 | 0.009 | 2.71 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 2 | $400.00 | 400.00 | 393 | 0.009 | 3.61 |
| Labor & Equipment | $50 | hour | 0.33 | hour | 2 | $33.00 | 33.00 | | | 33.00 |
| **TOTAL COST PER POLE DURING 2 YEAR ROTATION** | | | | | | | | | | **$241.14** |
| **ANNUAL COST OF FARMING AROUND H-POLE IN FIELD INTERIOR** | | | | | | | | | | **$120.57** |

Estimated Spring Wheat Yield: 50 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 61 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-9**

# Dryland Continuous Crop Rotation

## Regular Span Mono-Pole at Field Edge (Layout A)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft[2] | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 123 | 0.003 | $0.02 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 2 | $5.38 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 2 | 1.50 | | | | |
| Application | $5.00 | acre | | | 2 | 10.00 | 16.88 | 123 | 0.003 | 0.05 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 123 | 0.003 | 0.08 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N[2] | $450 | ton | 150 | pound | 1 | 33.75 | | | | |
| Topdress App | $5 | acre | | | 1 | 5.00 | 52.25 | 123 | 0.003 | 0.15 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 123 | 0.003 | 0.07 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 123 | 0.003 | 0.03 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 123 | 0.003 | 0.06 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 35 | bushel | 20% | $42.00 | 42.00 | 123 | 0.003 | 0.12 |
| Pole Footprint | $6.00 | bushel | 35 | bushel | | $210.00 | 210.00 | 123 | 0.003 | 0.59 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 123 | 0.003 | 0.56 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND REGULAR SPAN MONO-POLE AT FIELD EDGE** | | | | | | | | | | **$14.22** |

Estimated Spring Wheat Yield: 35 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 75 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-10**

# Dryland Continuous Crop Rotation

## Long Span Mono-Pole at Field Edge (Layout B)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft² | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 240 | 0.006 | $0.04 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 2 | $5.38 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 2 | 1.50 | | | | |
| Application | $5.00 | acre | | | 2 | 10.00 | 16.88 | 240 | 0.006 | 0.09 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 240 | 0.006 | 0.15 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N[2] | $450 | ton | 150 | pound | 1 | 33.75 | | | | |
| Topdress App | $5 | acre | | | 1 | 5.00 | 52.25 | 240 | 0.006 | 0.29 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 240 | 0.006 | 0.13 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 240 | 0.006 | 0.06 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 240 | 0.006 | 0.11 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 35 | bushel | 20% | $42.00 | 42.00 | 240 | 0.006 | 0.23 |
| Pole Footprint | $6.00 | bushel | 35 | bushel | | $210.00 | 210.00 | 240 | 0.006 | 1.16 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 240 | 0.006 | 1.10 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND LONG SPAN MONO-POLE AT FIELD EDGE** | | | | | | | | | | **$15.86** |

Estimated Spring Wheat Yield: 35 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 75 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-11**

# Dryland Continuous Crop Rotation

## Regular Span Mono-Pole in Field Interior (Layout C)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 18,362 | 0.422 | $2.95 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 2 | $5.38 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 2 | 1.50 | | | | |
| Application | $5.00 | acre | | | 2 | 10.00 | 16.88 | 50,328 | 1.155 | 19.50 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 50,328 | 1.155 | 31.20 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N[2] | $450 | ton | 150 | pound | 1 | 33.75 | | | | |
| Topdress App | $5 | acre | | | 1 | 5.00 | 52.25 | 13,854 | 0.318 | 16.62 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 13,854 | 0.318 | 7.38 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 50,328 | 1.155 | 13.42 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 5,597 | 0.128 | 2.57 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 35 | bushel | 20% | $42.00 | 42.00 | 50,328 | 1.155 | 48.53 |
| Pole Footprint | $6.00 | bushel | 35 | bushel | | $210.00 | 210.00 | 144 | 0.003 | 0.69 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 144 | 0.003 | 0.66 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND REGULAR SPAN MONO-POLE IN FIELD INTERIOR** | | | | | | | | | | **$156.01** |

Estimated Spring Wheat Yield: 35 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 75 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-12**

# Dryland Continuous Crop Rotation

## Long Span Mono-Pole in Field Interior (Layout D)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap $Ft^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 19,022 | 0.437 | $3.06 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 2 | $5.38 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 2 | 1.50 | | | | |
| Application | $5.00 | acre | | | 2 | 10.00 | 16.88 | 51,459 | 1.181 | 19.94 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 51,459 | 1.181 | 31.90 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N[2] | $450 | ton | 150 | pound | 1 | 33.75 | | | | |
| Topdress App | $5 | acre | | | 1 | 5.00 | 52.25 | 14,420 | 0.331 | 17.30 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 14,420 | 0.331 | 7.68 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 51,459 | 1.181 | 13.72 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 5,937 | 0.136 | 2.73 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 35 | bushel | 20% | $42.00 | 42.00 | 51,459 | 1.181 | 49.62 |
| Pole Footprint | $6.00 | bushel | 35 | bushel | | $210.00 | 210.00 | 214 | 0.005 | 1.03 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 214 | 0.005 | 0.98 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND LONG SPAN MONO-POLE IN FIELD INTERIOR** | | | | | | | | | | **$160.44** |

Estimated Spring Wheat Yield: 35 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 75 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-13**

# Dryland Continuous Crop Rotation

## H-Poles Perpendicular to Field Edge (Layout E)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $Ft^2$ | Acres | Cost/Pole |
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 1,136 | 0.026 | $0.18 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 2 | $5.38 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 2 | 1.50 | | | | |
| Application | $5.00 | acre | | | 2 | 10.00 | 16.88 | 1,136 | 0.026 | 0.44 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 1,136 | 0.026 | 0.70 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N[2] | $450 | ton | 150 | pound | 1 | 33.75 | | | | |
| Topdress App | $5 | acre | | | 1 | 5.00 | 52.25 | 1,136 | 0.026 | 1.36 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 1,136 | 0.026 | 0.61 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 1,136 | 0.026 | 0.30 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 1,136 | 0.026 | 0.52 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 35 | bushel | 20% | $42.00 | 42.00 | 1,136 | 0.026 | 1.10 |
| Pole Footprint | $6.00 | bushel | 35 | bushel | | $210.00 | 210.00 | 1,136 | 0.026 | 5.48 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 1136 | 0.026 | 5.22 |
| Labor & Equipment | $50 | hour | 0.5 | hour | 1 | $25.00 | 25.00 | | | 25.00 |
| **ANNUAL COST OF FARMING AROUND H-POLES PERPENDICULAR TO FIELD EDGE** | | | | | | | | | | **$40.91** |

Estimated Spring Wheat Yield: 35 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 75 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-14**

# Dryland Continuous Crop Rotation

## H-Poles Perpendicular to Field Edge & Splitting Property Line (Layout F)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 420 | 0.010 | $0.07 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 2 | $5.38 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 2 | 1.50 | | | | |
| Application | $5.00 | acre | | | 2 | 10.00 | 16.88 | 420 | 0.010 | 0.16 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 420 | 0.010 | 0.26 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N[2] | $450 | ton | 150 | pound | 1 | 33.75 | | | | |
| Topdress App | $5 | acre | | | 1 | 5.00 | 52.25 | 420 | 0.010 | 0.50 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 420 | 0.010 | 0.22 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 420 | 0.010 | 0.11 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 420 | 0.010 | 0.19 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 35 | bushel | 20% | $42.00 | 42.00 | 420 | 0.010 | 0.40 |
| Pole Footprint | $6.00 | bushel | 35 | bushel | | $210.00 | 210.00 | 420 | 0.010 | 2.02 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 420 | 0.010 | 1.93 |
| Labor & Equipment | $50 | hour | 0.33 | hour | 1 | $16.50 | 16.50 | | | 16.50 |

**ANNUAL COST OF FARMING AROUND H-POLES PERPENDICULAR TO FIELD EDGE & SPLITTING PROPERTY LINE** **$22.38**

Estimated Spring Wheat Yield: 35 bu/ac

[1] Banding 11-52-0 or 18-46-0 with seed.
[2] Applying a total of 75 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-15**

# Dryland Continuous Crop Rotation

## H-Poles Parallel to Field Edge (Layout G)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 233 | 0.005 | $0.04 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 2 | $5.38 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 2 | 1.50 | | | | |
| Application | $5.00 | acre | | | 2 | 10.00 | 16.88 | 233 | 0.005 | 0.09 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 233 | 0.005 | 0.14 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N[2] | $450 | ton | 150 | pound | 1 | 33.75 | | | | |
| Topdress App | $5 | acre | | | 1 | 5.00 | 52.25 | 233 | 0.005 | 0.28 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 233 | 0.005 | 0.12 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 233 | 0.005 | 0.06 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 233 | 0.005 | 0.11 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 35 | bushel | 20% | $42.00 | 42.00 | 233 | 0.005 | 0.22 |
| Pole Footprint | $6.00 | bushel | 35 | bushel | | $210.00 | 210.00 | 233 | 0.005 | 1.12 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 233 | 0.005 | 1.07 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND H-POLES PARALLEL TO FIELD EDGE** | | | | | | | | | | **$15.76** |

Estimated Spring Wheat Yield: 35 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 75 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

**Attachment DL-16**

# Dryland Continuous Crop Rotation

## H-Poles in Field Interior (Layout H)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Heavy Harrow | $7.00 | acre | | | 1 | $7.00 | $7.00 | 21,052 | 0.483 | $3.38 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 2 | $5.38 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 2 | 1.50 | | | | |
| Application | $5.00 | acre | | | 2 | 10.00 | 16.88 | 54,940 | 1.261 | 21.28 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 54,940 | 1.261 | 34.05 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 60 | pound | 1 | $13.50 | | | | |
| Topdress N[2] | $450 | ton | 150 | pound | 1 | 33.75 | | | | |
| Topdress App | $5 | acre | | | 1 | 5.00 | 52.25 | 16,160 | 0.371 | 19.38 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 70 | pound | 1 | $11.20 | | | | |
| Seeding | $12.00 | acre | | | 1 | 12.00 | 23.20 | 16,160 | 0.371 | 8.61 |
| In Crop Spraying: | | | | | | | | | | |
| Affinity Broad Spectrum | $9.25 | ounce | 0.6 | ounce | 1 | $5.55 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 11.62 | 54,940 | 1.261 | 14.65 |
| Harvesting: | | | | | | | | | | |
| Combine | $20.00 | acre | | | 1 | $20.00 | 20.00 | 6,982 | 0.160 | 3.21 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 35 | bushel | 20% | $42.00 | 42.00 | 54,940 | 1.261 | 52.97 |
| Pole Footprint | $6.00 | bushel | 35 | bushel | | $210.00 | 210.00 | 393 | 0.009 | 1.89 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 393 | 0.009 | 1.80 |
| Labor & Equipment | $50 | hour | 0.33 | hour | 1 | $16.50 | 16.50 | | | 16.50 |
| **ANNUAL COST OF FARMING AROUND H-POLES IN FIELD INTERIOR** | | | | | | | | | | **$177.74** |

Estimated Spring Wheat Yield: 35 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.
[2]Applying a total of 75 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/13/07.

# Appendix C

# Farming Cost Sheet
# Attachments IRR-1 to 8

**Attachment IRR-1**

# Irrigated Farming

## Regular Span Mono-Pole at Field Edge (Layout A)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Disc, Offset | $13.00 | acre | | | 2 | $26.00 | $26.00 | 123 | 0.003 | $0.07 |
| Toobar | $10.00 | acre | | | 2 | 20.00 | 20.00 | 123 | 0.003 | 0.06 |
| Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 1 | $2.69 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 1 | 0.75 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 8.44 | 123 | 0.003 | 0.02 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 123 | 0.003 | 0.08 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 80 | pound | 1 | $18.00 | | | | |
| Topdress N[2] | $450 | ton | 437 | pound | 1 | 98.33 | | | | |
| Topdress App | $6 | acre | | | 1 | 6.00 | 122.33 | 123 | 0.003 | 0.35 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 100 | pound | 1 | $16.00 | | | | |
| Seeding | $14.00 | acre | | | 1 | 14.00 | 30.00 | 123 | 0.003 | 0.08 |
| In Crop Spraying: | | | | | | | | | | |
| Harmony Extra | $16.00 | ounce | 0.5 | ounce | 1 | $8.00 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 14.07 | 123 | 0.003 | 0.04 |
| Harvesting: | | | | | | | | | | |
| Combine | $28.00 | acre | | | 1 | $28.00 | 28.00 | 123 | 0.003 | 0.08 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 90 | bushel | 20% | $108.00 | 108.00 | 123 | 0.003 | 0.30 |
| Pole Footprint | $6.00 | bushel | 90 | bushel | | $540.00 | 540.00 | 123 | 0.003 | 1.52 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 123 | 0.003 | 0.56 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND REGULAR SPAN MONO-POLE AT FIELD EDGE** | | | | | | | | | | **$15.60** |

Estimated Spring Wheat Yield: 90 bu/ac

[1] Banding 11-52-0 or 18-46-0 with seed.

[2] Applying a total of 210 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/15/07.

**Attachment IRR-2**

# Irrigated Farming

## Long Span Mono-Pole at Field Edge (Layout B)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft[2] | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Disc, Offset | $13.00 | acre | | | 2 | $26.00 | $26.00 | 240 | 0.006 | $0.14 |
| Toobar | $10.00 | acre | | | 2 | 20.00 | 20.00 | 240 | 0.006 | 0.11 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 1 | $2.69 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 1 | 0.75 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 8.44 | 240 | 0.006 | 0.05 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 240 | 0.006 | 0.15 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 80 | pound | 1 | $18.00 | | | | |
| Topdress N[2] | $450 | ton | 437 | pound | 1 | 98.33 | | | | |
| Topdress App | $6 | acre | | | 1 | 6.00 | 122.33 | 240 | 0.006 | 0.67 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 100 | pound | 1 | $16.00 | | | | |
| Seeding | $14.00 | acre | | | 1 | 14.00 | 30.00 | 240 | 0.006 | 0.17 |
| In Crop Spraying: | | | | | | | | | | |
| Harmony Extra | $16.00 | ounce | 0.5 | ounce | 1 | $8.00 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 14.07 | 240 | 0.006 | 0.08 |
| Harvesting: | | | | | | | | | | |
| Combine | $28.00 | acre | | | 1 | $28.00 | 28.00 | 240 | 0.006 | 0.15 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 90 | bushel | 20% | $108.00 | 108.00 | 240 | 0.006 | 0.60 |
| Pole Footprint | $6.00 | bushel | 90 | bushel | | $540.00 | 540.00 | 240 | 0.006 | 2.98 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 240 | 0.006 | 1.10 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND LONG SPAN MONO-POLE AT FIELD EDGE** | | | | | | | | | | **$18.69** |

Estimated Spring Wheat Yield: 90 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 210 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/15/07.

**Attachment IRR-3**

# Irrigated Farming

## Regular Span Mono-Pole in Field Interior (Layout C)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Disc, Offset | $13.00 | acre | | | 2 | $26.00 | $26.00 | 5,597 | 0.128 | $3.34 |
| Toobar | $10.00 | acre | | | 2 | 20.00 | 20.00 | 13,854 | 0.318 | 6.36 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 1 | $2.69 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 1 | 0.75 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 8.44 | 50,328 | 1.155 | 9.75 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 50,328 | 1.155 | 31.20 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 80 | pound | 1 | $18.00 | | | | |
| Topdress N[2] | $450 | ton | 437 | pound | 1 | 98.33 | | | | |
| Topdress App | $6 | acre | | | 1 | 6.00 | 122.33 | 13,854 | 0.318 | 38.90 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 100 | pound | 1 | $16.00 | | | | |
| Seeding | $14.00 | acre | | | 1 | 14.00 | 30.00 | 13,854 | 0.318 | 9.54 |
| In Crop Spraying: | | | | | | | | | | |
| Harmony Extra | $16.00 | ounce | 0.5 | ounce | 1 | $8.00 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 14.07 | 50,328 | 1.155 | 16.25 |
| Harvesting: | | | | | | | | | | |
| Combine | $28.00 | acre | | | 1 | $28.00 | 28.00 | 5,597 | 0.128 | 3.60 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 90 | bushel | 20% | $108.00 | 108.00 | 50,328 | 1.155 | 124.78 |
| Pole Footprint | $6.00 | bushel | 90 | bushel | | $540.00 | 540.00 | 144 | 0.003 | 1.79 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 144 | 0.003 | 0.66 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND REGULAR SPAN MONO-POLE IN FIELD INTERIOR** | | | | | | | | | | **$258.67** |

Estimated Spring Wheat Yield: 90 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.
[2]Applying a total of 210 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/15/07.

**Attachment IRR-4**

# Irrigated Farming

## Long Span Mono-Pole in Field Interior (Layout D)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap $Ft^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Disc, Offset | $13.00 | acre | | | 2 | $26.00 | $26.00 | 5,937 | 0.136 | $3.54 |
| Toobar | $10.00 | acre | | | 2 | 20.00 | 20.00 | 14,420 | 0.331 | 6.62 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 1 | $2.69 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 1 | 0.75 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 8.44 | 51,459 | 1.181 | 9.97 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 51,459 | 1.181 | 31.90 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 80 | pound | 1 | $18.00 | | | | |
| Topdress N[2] | $450 | ton | 437 | pound | 1 | 98.33 | | | | |
| Topdress App | $6 | acre | | | 1 | 6.00 | 122.33 | 14,420 | 0.331 | 40.49 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 100 | pound | 1 | $16.00 | | | | |
| Seeding | $14.00 | acre | | | 1 | 14.00 | 30.00 | 14,420 | 0.331 | 9.93 |
| In Crop Spraying: | | | | | | | | | | |
| Harmony Extra | $16.00 | ounce | 0.5 | ounce | 1 | $8.00 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 14.07 | 51,459 | 1.181 | 16.62 |
| Harvesting: | | | | | | | | | | |
| Combine | $28.00 | acre | | | 1 | $28.00 | 28.00 | 5,937 | 0.136 | 3.82 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 90 | bushel | 20% | $108.00 | 108.00 | 51,459 | 1.181 | 127.58 |
| Pole Footprint | $6.00 | bushel | 90 | bushel | | $540.00 | 540.00 | 214 | 0.005 | 2.65 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 214 | 0.005 | 0.98 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND LONG SPAN MONO-POLE IN FIELD INTERIOR** | | | | | | | | | | **$266.61** |

Estimated Spring Wheat Yield: 90 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 210 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/15/07.

**Attachment IRR-5**

# Irrigated Farming

## H-Poles Perpendicular to Field Edge (Layout E)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Disc, Offset | $13.00 | acre | | | 2 | $26.00 | $26.00 | 1,136 | 0.026 | $0.68 |
| Toobar | $10.00 | acre | | | 2 | 20.00 | 20.00 | 1,136 | 0.026 | 0.52 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 1 | $2.69 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 1 | 0.75 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 8.44 | 1,136 | 0.026 | 0.22 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 1,136 | 0.026 | 0.70 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 80 | pound | 1 | $18.00 | | | | |
| Topdress N[2] | $450 | ton | 437 | pound | 1 | 98.33 | | | | |
| Topdress App | $6 | acre | | | 1 | 6.00 | 122.33 | 1,136 | 0.026 | 3.19 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 100 | pound | 1 | $16.00 | | | | |
| Seeding | $14.00 | acre | | | 1 | 14.00 | 30.00 | 1,136 | 0.026 | 0.78 |
| In Crop Spraying: | | | | | | | | | | |
| Harmony Extra | $16.00 | ounce | 0.5 | ounce | 1 | $8.00 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 14.07 | 1,136 | 0.026 | 0.37 |
| Harvesting: | | | | | | | | | | |
| Combine | $28.00 | acre | | | 1 | $28.00 | 28.00 | 1,136 | 0.026 | 0.73 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 90 | bushel | 20% | $108.00 | 108.00 | 1,136 | 0.026 | 2.82 |
| Pole Footprint | $6.00 | bushel | 90 | bushel | | $540.00 | 540.00 | 1,136 | 0.026 | 14.08 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 1136 | 0.026 | 5.22 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND H-POLES PERPENDICULAR TO FIELD EDGE** | | | | | | | | | | **$41.81** |

Estimated Spring Wheat Yield: 90 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 210 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/15/07.

**Attachment IRR-6**

# Irrigated Farming

## H-Poles Perpendicular to Field Edge & Splitting Property Line (Layout F)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft[2] | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Disc, Offset | $13.00 | acre | | | 2 | $26.00 | $26.00 | 420 | 0.010 | $0.25 |
| Toobar | $10.00 | acre | | | 2 | 20.00 | 20.00 | 420 | 0.010 | 0.19 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 1 | $2.69 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 1 | 0.75 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 8.44 | 420 | 0.010 | 0.08 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 420 | 0.010 | 0.26 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 80 | pound | 1 | $18.00 | | | | |
| Topdress N[2] | $450 | ton | 437 | pound | 1 | 98.33 | | | | |
| Topdress App | $6 | acre | | | 1 | 6.00 | 122.33 | 420 | 0.010 | 1.18 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 100 | pound | 1 | $16.00 | | | | |
| Seeding | $14.00 | acre | | | 1 | 14.00 | 30.00 | 420 | 0.010 | 0.29 |
| In Crop Spraying: | | | | | | | | | | |
| Harmony Extra | $16.00 | ounce | 0.5 | ounce | 1 | $8.00 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 14.07 | 420 | 0.010 | 0.14 |
| Harvesting: | | | | | | | | | | |
| Combine | $28.00 | acre | | | 1 | $28.00 | 28.00 | 420 | 0.010 | 0.27 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 90 | bushel | 20% | $108.00 | 108.00 | 420 | 0.010 | 1.04 |
| Pole Footprint | $6.00 | bushel | 90 | bushel | | $540.00 | 540.00 | 420 | 0.010 | 5.21 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 420 | 0.010 | 1.93 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND H-POLES PERPENDICULAR TO FIELD EDGE & SPLITTING PROPERTY LINE** | | | | | | | | | | **$23.34** |

Estimated Spring Wheat Yield: 90 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 210 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/15/07.

**Attachment IRR-7**

# Irrigated Farming

## H-Poles Parallel to Field Edge (Layout G)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acre | Overlap Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Disc, Offset | $13.00 | acre | | | 2 | $26.00 | $26.00 | 233 | 0.005 | $0.14 |
| Toobar | $10.00 | acre | | | 2 | 20.00 | 20.00 | 233 | 0.005 | 0.11 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 1 | $2.69 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 1 | 0.75 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 8.44 | 233 | 0.005 | 0.05 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 233 | 0.005 | 0.14 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 80 | pound | 1 | $18.00 | | | | |
| Topdress N[2] | $450 | ton | 437 | pound | 1 | 98.33 | | | | |
| Topdress App | $6 | acre | | | 1 | 6.00 | 122.33 | 233 | 0.005 | 0.65 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 100 | pound | 1 | $16.00 | | | | |
| Seeding | $14.00 | acre | | | 1 | 14.00 | 30.00 | 233 | 0.005 | 0.16 |
| In Crop Spraying: | | | | | | | | | | |
| Harmony Extra | $16.00 | ounce | 0.5 | ounce | 1 | $8.00 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 14.07 | 233 | 0.005 | 0.08 |
| Harvesting: | | | | | | | | | | |
| Combine | $28.00 | acre | | | 1 | $28.00 | 28.00 | 233 | 0.005 | 0.15 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 90 | bushel | 20% | $108.00 | 108.00 | 233 | 0.005 | 0.58 |
| Pole Footprint | $6.00 | bushel | 90 | bushel | | $540.00 | 540.00 | 233 | 0.005 | 2.89 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 233 | 0.005 | 1.07 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND H-POLES PARALLEL TO FIELD EDGE** | | | | | | | | | | **$18.51** |

Estimated Spring Wheat Yield: 90 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.
[2]Applying a total of 210 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/15/07.

**Attachment IRR-8**

# Irrigated Farming

## H-Poles in Field Interior (Layout H)

| Operation | Cost | Unit | Rate/ac | Unit | No. of App | Cost/Ac | Oper. Total Cost | Overlap Ft$^2$ | Overlap Acres | Overlap Cost/Pole |
|---|---|---|---|---|---|---|---|---|---|---|
| Post Harvest: | | | | | | | | | | |
| Disc, Offset | $13.00 | acre | | | 2 | $26.00 | $26.00 | 6,982 | 0.160 | $4.17 |
| Toobar | $10.00 | acre | | | 2 | 20.00 | 20.00 | 16,160 | 0.371 | 7.42 |
| Post Harvest/Preplant Spraying | | | | | | | | | | |
| Roundup (RT3) | $21.50 | gallon | 16 | ounce | 1 | $2.69 | | | | |
| Ammonium sulfate | $6.00 | gallon | 16 | ounce | 1 | 0.75 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 8.44 | 54,940 | 1.261 | 10.64 |
| Wildoat Control: | | | | | | | | | | |
| Fargo | $1.00 | pound | 15 | pound | 1 | $15.00 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | | | | |
| Incorp w/ Heavy Harrow | $7.00 | acre | | | 1 | 7.00 | 27.00 | 54,940 | 1.261 | 34.05 |
| Fertilizer: | | | | | | | | | | |
| Banded w/ Seed[1] | $450 | ton | 80 | pound | 1 | $18.00 | | | | |
| Topdress N[2] | $450 | ton | 437 | pound | 1 | 98.33 | | | | |
| Topdress App | $6 | acre | | | 1 | 6.00 | 122.33 | 16,160 | 0.371 | 45.38 |
| Planting: | | | | | | | | | | |
| Seed | $16.00 | cwt | 100 | pound | 1 | $16.00 | | | | |
| Seeding | $14.00 | acre | | | 1 | 14.00 | 30.00 | 16,160 | 0.371 | 11.13 |
| In Crop Spraying: | | | | | | | | | | |
| Harmony Extra | $16.00 | ounce | 0.5 | ounce | 1 | $8.00 | | | | |
| LV-6 (2,4-D) | $20.00 | gallon | 6 | ounce | 1 | 0.94 | | | | |
| Surfactant | $16.50 | gallon | 1 | ounce | 1 | 0.13 | | | | |
| Application | $5.00 | acre | | | 1 | 5.00 | 14.07 | 54,940 | 1.261 | 17.74 |
| Harvesting: | | | | | | | | | | |
| Combine | $28.00 | acre | | | 1 | $28.00 | 28.00 | 6,982 | 0.160 | 4.49 |
| Crop Loss: | | | | | | | | | | |
| Quality/Quanity in Overlap | $6.00 | bushel | 90 | bushel | 20% | $108.00 | 108.00 | 54,940 | 1.261 | 136.21 |
| Pole Footprint | $6.00 | bushel | 90 | bushel | | $540.00 | 540.00 | 393 | 0.009 | 4.87 |
| Weed Control Around Pole: | | | | | | | | | | |
| Herbicide | $200 | acre | | | 1 | $200.00 | 200.00 | 393 | 0.009 | 1.80 |
| Labor & Equipment | $50 | hour | 0.25 | hour | 1 | $12.50 | 12.50 | | | 12.50 |
| **ANNUAL COST OF FARMING AROUND H-POLES IN FIELD INTERIOR** | | | | | | | | | | **$290.41** |

Estimated Spring Wheat Yield: 90 bu/ac

[1]Banding 11-52-0 or 18-46-0 with seed.

[2]Applying a total of 210 actual units of nitrogen per acre.

Compiled by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 6/15/07.

# APPENDIX O:
# POTENTIAL WIND FARM MITIGATION MEASURES ADAPTED FROM PROGRAMMATIC EIS - BLM WIND ENERGY DEVELOPMENT ON BLM LANDS IN THE WESTERN U.S.

**Potential Wind Farm Mitigation Measures**
**Adapted from the BLM Programmatic EIS for**
**BLM Wind Energy Development on BLM Lands in the Western U.S.**

The previous evaluations identified a number of potential impacts that could occur during the construction, operation, and decommissioning of a wind energy facility. A variety of mitigation measures could be implemented at wind energy projects to reduce potential impacts, and these are described in the following sections. In addition, monitoring during the various phases of wind energy development could be utilized to identify potential concerns and actions to address those concerns. Monitoring data could be used to track the condition of resources, to identify the onset of impacts, and to direct responses to address those impacts. The following sections identify measures that may be appropriate for mitigating potential impacts associated with new wind energy projects.

The discussion of potential measures to reduce impacts is heavily adapted from the final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-administered lands in the Western United States located at http://windeis.anl.gov/documents/fpeis/. Potential measures have been refined to address conditions found in the vicinity of the MATL line. Because this discussion is general in nature due to the lack of detailed plans on the wind farms, site-specific and species-specific issues associated with individual wind energy development projects are not assessed in detail. Rather, the range of possible impacts on resources present in the study area is identified. This section considers only indirect cumulative impacts of the transmission line that could be associated with wind farm development.

## 1.0 Land Use and Infrastructure

A variety of mitigation measures could be implemented to reduce potential land use impacts. These measures include:

- Wind energy projects could be planned to mitigate or minimize impacts to other land uses.

- Federal and state agencies, properties owners, and other stakeholders could be contacted as early as possible in the planning process to identify potentially sensitive land uses and issues;

- The U.S. Department of Defense would be consulted regarding the potential impact of a proposed wind energy project on military operations in order to identify and address any concerns;

- The FAA required notice of proposed construction would be made as early as possible to identify any air safety measures that would be required;

- To plan for efficient land use, necessary infrastructure requirements could be consolidated whenever possible, and current transmission and market access could be evaluated;

- Restoration plans could be developed to ensure that all temporary use areas are restored.

- Wind farm developers could work with affected landowners to reduce interference with existing land uses.

### 1.1 Land Use and Infrastructure - Transportation

Potential impacts from transportation activities related to site monitoring and testing, construction, operation, and decommissioning of typical wind energy development projects are expected to be low, provided appropriate planning and implementation actions are taken. The following measures to mitigate transportation impacts address the expected major activities associated with future wind energy development projects and general safety standards.

- Generally, roads could be required to follow natural contours and be reclaimed. Roads could be designed to an appropriate standard no higher than necessary to accommodate their intended functions.

- Existing roads could be used to the maximum extent possible, but only if in safe and environmentally sound locations. If new access roads are necessary, they could be designed and constructed to the appropriate standard no higher than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles). Abandoned roads and roads that are no longer needed could be recontoured and revegetated.

- A transportation plan could be developed by project sponsors, particularly for the transport of turbine components, main assembly cranes, and other large pieces of equipment. The plan could consider specific object sizes, weights, origin, destination, and unique handling requirements and could evaluate alternative transportation approaches (e.g., barge or rail). In addition, the process to be used to comply with unique state requirements and to obtain all necessary permits could be clearly identified.

- A traffic management plan could be prepared by the project sponsors for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan could incorporate measures such as informational signs, flaggers when equipment may result in blocked throughways, and traffic cones to identify any necessary changes in temporary lane configuration. Signs could be placed along roads to identify speed limits, travel restrictions, and other standard traffic control information. To minimize impacts on local commuters, consideration could be given to limiting construction vehicles traveling on public roadways during the morning and late afternoon commute time.

- Project personnel and contractors could be instructed and required to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions, to ensure safe and efficient traffic flow.

- During construction and operation, traffic could be restricted to the roads developed for the project. Use of other unimproved roads could be restricted to emergency situations.

## 2.0 Geology and Soils

The potential for impacts to geologic resources and soils would occur primarily during construction and decommissioning. The following mitigation measures could reduce impacts:

- The size of disturbed land could be minimized as much as possible. Existing roads and borrow pits could be used as much as possible.

- Topsoil removed during construction could be salvaged and reapplied during reclamation. Disturbed soils could be reclaimed as quickly as possible or protective covers could be applied.

- Erosion controls that comply with state standards could be applied. Practices such as jute netting, silt fences, and check dams could be applied near disturbed areas.

- On-site surface runoff control features could be designed to minimize the potential for increased localized soil erosion. Drainage ditches could be constructed where necessary but held to a minimum. Potential soil erosion could be controlled at culvert outlets with appropriate structures. Catch basins, drainage ditches, and culverts could be cleaned and maintained regularly.

- Operators could identify unstable slopes and local factors that can induce slope instability (such as groundwater conditions, precipitation, earthquake activities, slope angles, and dip angles of geologic strata). Operators also could avoid creating excessive slopes during excavation and blasting operations. Special construction techniques could be used where applicable in areas of steep slopes, erodible soil, and stream channel/wash crossings.

- Borrow material could be obtained only from authorized and permitted sites.

- Access roads could be located to follow natural contours of the topography and minimize side hill cuts.

- Foundations and trenches could be backfilled with originally excavated materials as much as possible. Excavation material could be disposed of only in approved areas to control soil erosion and to minimize leaching of hazardous constituents. If suitable, excess excavation materials may be stockpiled for use in reclamation activities.

## 3.0 Engineering and Hazardous Materials (Safety also)

The following mitigation measures could be used to deal with hazardous materials during all activities associated with a wind energy project:

- The project sponsor could keep a comprehensive listing of the hazardous materials that would be used, stored, transported, or disposed of during activities associated with site monitoring and testing, construction, operation, and decommissioning of a wind energy project.

- Project sponsors could develop a hazardous materials management plan addressing storage, use, transportation, and disposal of each hazardous material anticipated to be used at the site. The plan could identify all hazardous materials that would be used, stored, or transported at the site. It could establish inspection procedures, storage requirements, storage quantity limits, inventory control, nonhazardous product substitutes, and disposition of excess materials. The plan could also identify requirements for notices to federal and local emergency response authorities and include emergency response plans.

- Project sponsors could develop a waste management plan identifying the waste streams that are expected to be generated at the site and addressing hazardous waste determination procedures, waste storage locations, waste-specific management and disposal requirements, inspection procedures, and waste minimization procedures. This plan could address all solid and liquid waste that may be generated at the site.

- Project sponsors could develop a spill prevention and response plan identifying where hazardous materials and wastes are stored on site, spill prevention measures to be implemented, training requirements, appropriate spill response actions for each material or waste, the locations of spill response kits on site, a procedure for ensuring that the spill response kits are adequately stocked at all times, and procedures for making timely notifications to authorities.

- Project sponsors must develop a storm water management plan under Montana DEQ regulation for the site to ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion.

- If pesticides are to be used on the site, an integrated pest management plan could be developed to ensure that applications will be conducted in accordance with state and federal regulations. Pesticide use could be limited to nonpersistent, immobile pesticides and could only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

- Secondary containment could be provided for all on-site hazardous materials and waste storage, including fuel. In particular, fuel storage (for construction vehicles and equipment) could be a temporary activity occurring only for as long as is needed to support construction and decommissioning activities. Fuel storage facilities could be removed from the site after these activities are completed.

- Wastes could be properly containerized and removed periodically for disposal at appropriate off-site permitted disposal facilities.

- In the event of an accidental release to the environment, the operator could document the event, including a root cause analysis, appropriate corrective actions taken, and a characterization of the resulting environmental or health and safety impacts. Documentation of the event could be provided to DEQ as required.

- Any wastewater generated in association with temporary, portable sanitary facilities could be periodically removed by a licensed hauler and introduced into an existing municipal sewage treatment facility. Temporary, portable sanitary facilities provided for construction crews could be adequate to support expected on-site personnel and could be removed at the completion of construction activities.

The following mitigation measures dealing with health and safety could be implemented where appropriate during all phases associated with a wind energy project:

- All construction, operation, and decommissioning activities could be conducted in compliance with applicable federal and state occupational safety and health standards (e.g., OSHA's Occupational Health and Safety Standards, 29 CFR Parts 1910 and 1926, respectively (DOL 2001, 2003).

- A safety assessment could be conducted to describe potential safety issues and the means that would be taken to mitigate them, including issues such as site access, construction, safe work practices, security, heavy equipment transportation, traffic management, emergency procedures, and fire control.

- A health and safety program could be developed to protect workers during construction, operation, and decommissioning of a wind energy project. The program could identify all applicable federal and state occupational safety standards, establish safe work practices for each task (e.g., requirements for personal protective equipment and safety harnesses; OSHA standard practices for safe use of explosives and blasting agents; and measures for reducing occupational EMF exposures), establish fire safety evacuation procedures, and define safety performance standards (e.g., electrical system standards and lighting protection standards). The program could include a training program to identify hazard training requirements for workers for each task and establish procedures for providing required training to all workers. Documentation of training and a mechanism for reporting serious accidents to appropriate agencies could be established.

- Electrical systems could be designed to meet all applicable safety standards (e.g., National Electrical Code [NEC] and IEC and National Electric Safety Code).

- For the mitigation of explosive hazards, workers could be required to comply with the OSHA standard (1910.109) for the safe use of explosives and blasting agents (DOL 1998).

- Measures could be considered to reduce occupational EMF exposures, such as backing the generator with iron to block the electric field, shutting down the generator when working in the vicinity, and/or limiting exposure time while the generator is running (Robichaud 2004).

- The project health and safety program could also address protection of public health and safety during construction, operation, and decommissioning of a wind energy project. The program could establish a safety zone or setback for wind turbine generators from residences and occupied buildings, roads, ROWs, and other public access areas that is sufficient to prevent accidents resulting from hazards such as blade failure and ice throw during the operation of wind turbine generators. It could identify requirements for temporary fencing around staging areas, storage yards, and excavations during construction or decommissioning activities. It could also identify measures to be taken during the operations phase to limit public access to facilities (e.g., permanent fencing could be installed around electrical substations, and turbine tower access doors could be locked to limit public access).

- Operators could consult with local authorities regarding increased traffic during the construction phase, including an assessment of the number of vehicles per day, their size, and type. Specific issues of concern (e.g., location of school bus routes and stops) could be identified and addressed in the traffic management plan.

- If operation of the wind turbines is expected to cause significant adverse impacts to nearby residences and occupied buildings from shadow flicker, low-frequency sound, or EMF, site-specific recommendations for addressing these concerns could be incorporated into the project design (e.g., establishing a sufficient setback from turbines).

- The project could be planned to minimize EMI (e.g., impacts to radar, microwave, television, and radio transmissions) and comply with FCC regulations. Signal strength studies could be conducted when proposed locations have the potential to impact transmissions. Potential interference with public safety communication systems (e.g., radio traffic related to emergency activities) could be avoided.

- In the event an installed wind energy development project results in EMI, the operator could work with the owner of the impacted communications system to resolve the problem. Potential mitigation may include realigning the existing antenna or installing relays to transmit the signal around the wind energy project. Additional warning information may also need to be conveyed to aircraft with onboard radar systems so that echoes from wind turbines can be quickly recognized.

- The project could be planned to comply with FAA regulations, including lighting requirements, and to avoid potential safety issues associated with proximity to airports, military bases or training areas, or landing strips.

- Operators could develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.

## 4.0 Electric and Magnetic Fields – no measures.

## 5.0 Water Resources

Potential water resource impacts would mostly occur during the site construction and decommissioning phases. Mitigation measures that could reduce such impacts include:

- The amount of cleared and disturbed lands could be minimized as much as possible. Existing roads and borrow pits could be used as much as possible.

Topsoil removed during construction could be salvaged and reapplied during reclamation. Disturbed soils could be reclaimed as quickly as possible or protective covers could be applied.

- Operators could identify unstable slopes and local factors that can induce slope instability (such as groundwater conditions, precipitation, earthquakes, slope angles, and dip angles of geologic strata). Operators also could avoid creating excessive slopes during excavation and blasting operations. Special construction techniques could be used where applicable in areas of steep slopes, erodible soil, and stream channel/wash crossings.

- Erosion controls that comply with state standards could be applied. Controls such as jute netting, silt fences, and check dams could be applied near disturbed areas.

- Operators could gain a clear understanding of the local hydrogeology. Areas of groundwater discharge and recharge and their potential relationships with surface water bodies could be identified.

- Operators could avoid creating hydrologic conduits between two aquifers during foundation excavation and other activities.

- Proposed construction near aquifer recharge areas could be closely monitored to reduce the potential for contamination of the aquifer. This may require a study to determine localized aquifer recharge areas.

- Foundations and trenches could be backfilled with originally excavated material as much as possible. Excess excavated material could be disposed of only in approved areas.

- Existing drainage systems could not be altered, especially in sensitive areas such as erodible soils or steep slopes. When constructing stream or wash crossings, culverts or water conveyances for temporary and permanent roads could be designed to comply with county standards, or if there are no county standards, to accommodate the runoff of a 10-year storm. Potential soil erosion could be controlled at culvert outlets with appropriate structures. Catch basins, roadway ditches, and culverts could be cleaned and maintained regularly.

- On-site surface runoff control features could be designed to minimize the potential for increased localized soil erosion. Drainage ditches could be constructed where necessary but held to a minimum. Potential soil erosion could be controlled at culvert outlets with appropriate structures. Catch basins, drainage ditches, and culverts could be cleaned and maintained regularly.

- Pesticide use could be limited to nonpersistent, immobile pesticides and could only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

## 6.0 Wetlands and Floodplains

Wind energy development typically occurs on ridges and other elevated land where wetlands and surface bodies are not likely to occur; however, access roads and transmission lines may cross lands where these features may be more common. As a result, wetland and aquatic biota could be affected during construction of the wind energy project and its associated facilities.

- Construction activities may adversely affect wetlands and aquatic biota through (1) habitat disturbance, (2) mortality or injury of biota, (3) erosion and runoff, (4) exposure to contaminants, and (5) interference with migratory movements. Except for the construction of stream crossings for access routes or the unavoidable location of a transmission line support tower in a wetland, construction within wetlands or other aquatic habitats would be largely prohibited.

- The overall impact of construction activities on wetlands and aquatic resources would depend on the type and amount of aquatic habitat that would be disturbed, the nature of the disturbance (e.g., grading and filling, or erosion in construction support areas), and the aquatic biota that occupy the project site and surrounding areas.

- Avoid construction of stream crossings could directly impact aquatic habitat and biota within the crossing footprint.

## 7.0 Vegetation

The following measures could be implemented through weed control plans required by county weed boards to minimize the potential establishment of invasive vegetation at a wind energy development site and its associated facilities:

- Operators would develop a plan for control of noxious weeds and invasive plants acceptable to the county weed board, which could occur as a result of new surface disturbance activities at the site. The plan could address monitoring, weed identification, the manner in which weeds spread, and methods for treating infestations. The use of certified weed-free mulching could be required.

- If trucks and construction equipment are arriving from locations with known invasive vegetation problems, a controlled inspection and cleaning area could be established to visually inspect construction equipment arriving at the project area and to remove and collect seeds that may be adhering to tires and other equipment surfaces.

- Access roads and newly established power lines could be monitored regularly for invasive species establishment, and weed control measures could be initiated immediately upon evidence of invasive species introduction.

- Fill materials that originate from areas with known invasive vegetation problems could not be used.

- Certified weed-free mulch could be used when stabilizing areas of disturbed soil.

- Habitat restoration activities and invasive vegetation monitoring and control activities could be initiated as soon as possible after construction activities are completed.

- All areas of disturbed soil could be reclaimed using weed-free native shrubs, grasses, and forbs.

- Pesticide use could be limited to nonpersistent, immobile pesticides and could only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

- Access roads, utility and transmission line corridors, and tower site areas could be monitored regularly for invasive species establishment, and weed control measures could be initiated immediately upon evidence of invasive species introduction.

## 8.0 Wildlife

Mitigation measures that could minimize raptor fatalities at wind energy development projects include:

- Raptor use of the project area could be evaluated, and the project could be designed to minimize or mitigate the potential for raptor strikes. Scientifically rigorous raptor surveys could be conducted; the amount and extent of baseline data required could be determined on a project-specific basis.

- Areas with a high incidence of fog, mist, low cloud ceilings, and low visibility could be avoided.

- Turbine locations could be configured in order to avoid landscape features (including prairie dog colonies and other high-prey potential sites) known to attract raptors.

- Turbine arrays could be configured to minimize avian mortality (e.g., orient rows of turbines parallel to known bird movements).

- Underground or raptor-safe transmission lines could be used to reduce collision and electrocution potential.

- A habitat restoration plan could be developed that avoids or minimizes negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species (e.g., avoid the establishment of habitat that attracts high densities of prey animals used by raptors).

- Road cuts, which are favored by pocket gophers and ground squirrels, could be minimized.

- Either no vegetation or native plant species that do not attract small mammals could be maintained around the turbines.

- Tubular supports rather than lattice supports could be used, with no external ladders and platforms.

- The minimum amount of pilot warning and obstruction avoidance lighting specified by the FAA could be used, and the FAA could be consulted.

- Operators could determine if active raptor nests (i.e., raptor nests used during the breeding season) are present. Buffers could be provided to avoid disturbance of nesting raptors.

- Areas with high bird use could be avoided through micro-siting alternatives (e.g., at the Foote Creek Rim project, turbines were located slightly away from the rim edge of a flat top mesa [Strickland et al. 2001a]).

Measures that have been suggested for management of sage grouse and their habitats may apply to sharp-tailed grouse (e.g., Paige and Ritter 1999; Connelly et al. 2000; Montana Sage-Grouse Work Group 2003). The measures that have pertinence to wind energy development projects include:

- Identify and avoid both local (daily) and seasonal migration routes.

- Consider grouse and sage habitat when designing, constructing, and utilizing project access roads and trails.

- Avoid, when possible, siting energy developments in breeding habitats.

- Adjust the timing of activities to minimize disturbance to grouse during critical periods.

- When possible, locate energy-related facilities away from active leks or near grouse habitat.

- When possible, restrict noise levels to 10 dB above background noise levels at the lek sites.

- Minimize nearby human activities when birds are near or on leks.

- As practicable, do not conduct surface-use activities within crucial sage-grouse wintering areas from December 1 through March 15.

- Maintain sagebrush communities on a landscape scale.

- Provide compensatory habitat restoration for impacted sagebrush habitat.

- Avoid the use of pesticides at grouse breeding habitat during the brood-rearing season.

- Develop and implement appropriate measures to prevent the introduction or dispersal of noxious weeds.

- Avoid creating attractions for raptors and mammalian predators in grouse habitat.

- Consider measures to mitigate impacts at off-site locations to offset unavoidable grouse habitat alteration and reduction at the project site.

## 9.0 Fish – no measures.

## 10.0 Threatened, Endangered, and Candidate for Listing Species

If federally listed species are present in the project vicinity, the project sponsor is encouraged to contact the USFWS.

A variety of site-specific and species-specific measures may be appropriate to mitigate potential impacts to special status species if present in the project area. Such measures may include:

- Field surveys could be conducted to verify the absence or presence of the species in the project area and especially within individual project footprints.

- Project facilities or lay-down areas could not be placed in areas documented to contain or provide important habitat for those species.

## 11.0 Air Quality

The potential for adverse air quality impacts during the site monitoring and testing and operation phases would be limited. The greatest potential impacts would occur during the construction and decommissioning phases. Generation of fugitive particulates from vehicle traffic and earthmoving activities would need to be controlled. Typical measures (ABC Wind Company, LLC undated; PBS&J 2002) that could be implemented to control particulates and other pollutants include these:

- Mitigation measures for areas subject to vehicular travel

Access roads and on-site roads could be surfaced with aggregate materials, wherever appropriate.

Dust abatement techniques could be used on unpaved, unvegetated surfaces to minimize airborne dust.

Speed limits could be posted (e.g., 25 mph) and enforced to reduce airborne fugitive dust.

- Mitigation measures for soil and material storage and handling

Workers could be trained to handle construction material to reduce fugitive emissions.

Construction materials and stockpiled soils could be covered if they are a source of fugitive dust.

Storage piles at concrete batch plants could be covered if they are a source of fugitive dust.

- Mitigation measures for clearing and disturbing land

Disturbed areas could be minimized.

Dust abatement techniques could be used as earthmoving activities proceed and prior to clearing.

- Mitigation measures for earthmoving

Dust abatement techniques could be used before excavating, backfilling, compacting, or grading.

Disturbed areas could be revegetated as soon as possible after disturbance.

- Mitigation measures for soil loading and transport

If practicable, soil could be moist while being loaded into dump trucks.

Soil loads could be kept below the freeboard of the truck.

Drop heights could be minimized when loaders dump soil into trucks.

Gate seals could be tight on dump trucks.

Dump trucks could be covered before traveling on public roads.

- Mitigation measure for blasting

Dust abatement techniques could be used during blasting.

## 12.0 Audible Noise

The following mitigation measures could reduce potential noise impacts:

- Proponents of a wind energy development project could take measurements to assess the existing background noise levels at a given site and compare them with the anticipated noise levels associated with the proposed project.

- Noisy construction activities (including blasting) could be limited to the least noise-sensitive times of day (daytime only between 7 a.m. and 10 p.m.) and weekdays.

- Whenever feasible, different noisy activities (e.g., blasting and earthmoving) could be scheduled to occur at the same time since additional sources of noise generally do not add a significant amount of noise. That is, less-frequent noisy activities would be less annoying than frequent less-noisy activities.

- All equipment could have sound-control devices no less effective than those provided on the original equipment. All construction equipment used could be adequately muffled and maintained.

- All stationary construction equipment (i.e., compressors and generators) could be located as far as practicable from nearby residences.

- If blasting or other noisy activities are required during the construction period, nearby residents could be notified in advance.

## 13.0 Socioeconomics – no measures.

## 14.0 Paleontological and Cultural Resources

To mitigate or minimize potential paleontological resource impacts, the following mitigation measures could be adopted:

- Operators could determine whether paleontological resources exist in a project area on the basis of the sedimentary context of the area, a records search for past paleontological finds in the area, and/or a paleontological survey.

- A paleontological resources management plan could be developed for areas where there is a high potential for paleontological material to be present. Management options may include avoidance, removal of the fossils, or monitoring. If the fossils are to be removed, a mitigation plan could be drafted identifying the strategy for collection of the fossils in the project area. Often it is unrealistic to remove all of the fossils, in which case a sampling strategy can be developed. If an area exhibits a high potential but no fossils were observed during surveying, monitoring could be required. A qualified paleontologist could monitor all excavation and earthmoving in the sensitive area. Whether the strategy chosen is excavation or monitoring, a report detailing the results of the efforts could be produced.

- If an area has a strong potential for containing fossil remains and those remains are exposed on the surface for potential collection, steps could be taken to educate workers and the public on how to report these resources to the landowner.

- To mitigate or minimize potential impacts to cultural resources, the following mitigation measures could be adopted. On state or federal lands, some measures could be required.

- Where a wind farm would be located on state or federal lands, agencies with permitting authority could consult with Native American governments early in the planning process to identify issues and areas of concern regarding the proposed wind energy development. Aside from the fact that consultation is required under the National Historic Preservation Act (NHPA), consultation is necessary to establish whether the project is likely to disturb traditional cultural properties, affect access rights to particular locations, disrupt traditional cultural practices, and/or visually impact areas important to the Tribe(s).

- The presence of archaeological sites and historic properties in the area of potential effect could be determined on the basis of a records search of recorded sites and properties in the area and/or an archaeological survey. The State Historic Preservation Officer (SHPO) is the primary repository for cultural resource information, and the State DNRC offices and most BLM Field Offices also maintain this information for lands under their jurisdiction.

- Archaeological sites and historic properties present in the area of potential effect could be reviewed by an agency and/or a project sponsor to determine whether they meet the criteria of eligibility for listing on the NRHP. Cultural resources listed on or eligible for listing on the NRHP are considered “significant” resources.

- When any ROW application includes remnants of a National Historic Trail, is located within the viewshed of a National Historic Trail’s designed centerline, or includes or is within the viewshed of a trail eligible for listing on the National Register of Historic Places (NRHP), the operator could evaluate the potential visual impacts to the trail associated with the proposed project and identify appropriate mitigation measures.

- If cultural resources are present at the site, or if areas with a high potential to contain cultural material have been identified, a cultural resources management plan could be developed by a regulatory agency and/or a project sponsor. This plan could address mitigation activities to be implemented for cultural resources found at the site. Avoidance of the area is always the preferred mitigation option. Other mitigation options include archaeological survey and excavation (as warranted) and monitoring. If an area exhibits a high potential, but no artifacts are observed during an archaeological survey, monitoring by a qualified archaeologist could be required during all excavation and earthmoving in the high-potential area. A report could be prepared documenting these activities. The CRMP also could (1) establish a monitoring program, (2) identify measures to prevent potential looting/vandalism or erosion impacts, and (3) address the education of workers and the public to make them aware of the consequences of unauthorized collection of artifacts and destruction of property on public land.

- Periodic monitoring of significant cultural resources in the vicinity of development projects may help curtail potential looting/vandalism and erosion impacts. If impacts are recognized early, additional actions can be taken before the resource is destroyed.

- Unexpected discovery of cultural resources during construction could be brought to the attention of the responsible authorized officer or landowner immediately. Work could be halted in the vicinity of the find to avoid further disturbance to the resources while they are being evaluated and appropriate mitigation measures are being developed.

- Wind farm developers could inform construction workers and site operators of appropriate measures to avoid damage to or destruction of cultural resources.

## 15.0 Visuals

The potential for impacts to visual resources soils could occur during all phases of wind energy development. The following mitigation measures could reduce impacts (NWCC 2002; AusWEA 2002; Gipe 1998, 2002; NYSDEC 2000):

- Turbine arrays and the turbine design could be integrated with the surrounding landscape. To accomplish this integration, several elements of design need to be incorporated.

- The operator could provide visual order and unity among clusters of turbines (visual units) to avoid visual disruptions and perceived “disorder, disarray, or clutter” (Gipe 2002).

- To the extent possible given the terrain of a site, the operator could create clusters or groupings of wind turbines when placed in large numbers; avoid a cluttering effect by separating otherwise overly long lines of turbines, or large arrays; and insert breaks or open zones to create distinct visual units or groups of turbines.

- The operator could create visual uniformity in the shape, color, and size of rotor blades, nacelles, and towers (Gipe 1998).

- The use of tubular towers is recommended for visual unity. Truss or lattice-style wind turbine towers with lacework, pyramidal, or prism shapes could be avoided. Tubular towers present a simpler profile and less complex surface characteristics and reflective/shading properties.

- Components could be in proper proportion to one another. Nacelles and towers could be planned to form an aesthetic unit and could be combined with particular sizes and shapes in mind to achieve an aesthetic balance between the rotor, nacelle, and tower (Gipe 1998).
- Color selections for turbines could be made to reduce visual impact (Gipe 2002) and could be applied uniformly to tower, nacelle, and rotor, unless gradient or other patterned color schemes are used.

- The operator could use nonreflective paints and coatings to reduce reflection and glare. Turbines, visible ancillary structures, and other equipment could be painted before or immediately after installation. Uncoated galvanized metallic surfaces could be avoided because they would create a stronger visual contrast, particularly as they oxidize and darken.

- Commercial messages on turbines and towers could be avoided (Gipe 2002).

- The site design could be integrated with the surrounding landscape.

- To the extent practicable, the operator could avoid placing substations or large operations buildings on high land features and along "skylines" that are visible from nearby sensitive view points. The presence of these structures could be concealed or made less conspicuous. Conspicuous structures could be designed and constructed to harmonize with desirable or acceptable characteristics of the surrounding environment (Gipe 2002).

- The operator could bury power collection cables or lines on the site in a manner that minimizes additional surface disturbance.

- Commercial symbols (such as logos), trademarks, and messages could be avoided on sites or ancillary structures of wind energy projects. Similarly, billboards and advertising messages could be avoided (Gipe 1998, 2002).

- Site design could be accomplished to make security lights nonessential. Such lights increase the contrast between a wind energy project and the night sky, especially in rural/remote environments, where turbines would typically be installed. Where they are necessary, security lights could be extinguished except when activated by motion detectors (e.g., only around the substation) (Gipe 1998).

- Operators could minimize disturbance and control erosion by avoiding steep slopes (Gipe 1998) and by minimizing the amount of construction and ground clearing needed for roads, staging areas, and crane pads. Dust suppression techniques could be employed in arid environments to minimize impacts of vehicular and pedestrian traffic, construction, and wind on exposed surface soils.

- Disturbed surfaces could be restored as closely as possible to their original contour and revegetated immediately after, or contemporaneously with construction. Action could be prompt to limit erosion and to accelerate restoring the preconstruction color and texture of the landscape.

- The wind development site could be maintained during operation. Inoperative or incomplete turbines cause the misperception in viewers that “wind power does not work” or that it is unreliable.

- Inoperative turbines could be completely repaired, replaced, or removed. Nacelle covers and rotor nose cones could always be in place and undamaged (Gipe 1998).

- Wind energy projects could evidence environmental care, which would also reinforce the expectation and impression of good management for benign or clean power. Nacelles and towers could also be cleaned regularly (yearly, at minimum) to remove spilled or leaking fluids and the dirt and dust that would accumulate, especially in seeping lubricants.

- Facilities and off-site surrounding areas could be kept clean of debris, “fugitive” trash or waste, and graffiti. Scrap heaps and materials dumps could be prohibited and prevented. Materials storage yards, even if thought to be orderly, could be kept to an absolute minimum. Surplus, broken, disused materials and equipment of any size could not be allowed to accumulate (Gipe 2002).

- A decommissioning plan could be developed, and it could include the removal of all turbines and ancillary structures and restoration/reclamation of the site.

## 16.0 Mitigation during Site Monitoring and Testing

Site monitoring and testing would generally result in only minimal impacts to ecological resources. The following mitigation measures may ensure that ecological impacts during this stage of the project would be minimal:

- Existing roads could be used to the maximum extent feasible to access a proposed project area.

- If new access roads are necessary, they could be designed and constructed to the appropriate standard.

- Existing or new roads could be maintained to the condition needed for facility use.

- The area disturbed during the installation of meteorological towers (i.e., the tower footprint and its associated lay-down area) could be kept to a minimum.

- Individual meteorological towers could not be located in or near sensitive habitats or in areas where ecological resources known to be sensitive to human activities are present.

- Installation of meteorological towers could be scheduled to avoid disruption of wildlife reproductive activities or other important behaviors (e.g., during periods of grouse nesting).

## 17.0 Mitigation during Plan of Development Preparation and Project Design

Mitigation measures may be considered during preparation of the project design to ensure that the siting of the overall wind energy development project and of individual facility structures, as well as various aspects of the design of individual facility structures, do not result in unacceptable impacts to ecological resources. The following measures could be incorporated into the siting of the wind development project:

- Operators could identify important, sensitive, or unique habitat and biota in the project vicinity and site, and design the project to avoid (if possible), minimize, or mitigate potential impacts to these resources. The design and siting of the facility could follow appropriate guidance and requirements from other resource agencies, as available and applicable.

- The operators could contact appropriate agencies early in the planning process to identify potentially sensitive ecological resources that may be present in the area of the wind energy development.

- The operators could conduct surveys for federal- and state-protected species and other species of concern within the project area.

- Operators could evaluate avian and bat use (including the locations of active nest sites, colonies, roosts, and migration corridors) of the project area by using scientifically rigorous survey methods (e.g., see NWCC 1999).

- The project could be planned to avoid (if possible), minimize, or mitigate impacts to wildlife and habitat.

- Discussion could be held with the appropriate agency biologists regarding the occurrence of sensitive species or other valued ecological resources in the proposed project area.

- Existing information on species and habitats in the project area could be reviewed.

The amount and extent of necessary preproject data would be determined on a project-by-project basis, based in part on the environmental setting of the proposed project location. Methods for collecting such data may be found in NWCC (1999) and California Energy Commission (2007).

**17.1 Mitigating Habitat Impacts.** The following measures could be considered during project siting to minimize potential habitat disturbance:

- If survey results indicate the presence of important, sensitive, or unique habitats (such as wetlands and sagebrush habitat) in the project vicinity, facility design could locate turbines, roads, and support facilities in areas least likely to impact those habitats.

- Habitat disturbance could be minimized by locating facilities (such as utility corridors and access roads) in previously disturbed areas (i.e., locate transmission lines within or adjacent to existing power line corridors).

- Existing roads and utility corridors could be utilized to the maximum extent feasible.

- New access roads and utility corridors could be configured to avoid high quality habitats and minimize habitat fragmentation.

- Site access roads and utility corridors could minimize stream crossings.

- A habitat restoration management plan could be developed that identifies vegetation, soil stabilization, and erosion reduction measures and requires that restoration activities be implemented as soon as possible following facility construction activities.

- Individual project facilities could be located to maintain existing stands of quality habitat and continuity between stands.

- The creation of, or increase in, the amount of edge habitat between natural habitats and disturbed lands could be minimized.

- To minimize impacts to aquatic habitats from increased erosion, the use of bridges or fill ramps rather than stream bank cutting could be designated for all stream crossings by access roads.

- Stream crossings could be designed to provide in-stream conditions that allow for and maintain uninterrupted movement and safe passage of fish.

**17.2 Mitigating Site/Wildlife Interactions.** To reduce the potential use of site facilities by perching birds, to reduce the potential for collisions with project facilities, and to reduce the potential for electrocution, the following measures could be considered during the design of individual facility structures:

- Locations that are heavily utilized by migratory birds and bats could be avoided.

- Permanent meteorological towers, transmission towers, and other facility structures could be designed to discourage their use by birds for perching or nesting.

- The use of guy wires on permanent meteorological towers could be avoided or minimized.

- Electrical supply lines could be buried in a manner that minimizes additional surface disturbance. Overhead lines could be used in cases where the burial of lines would result in further habitat disturbance.

- Power lines could be configured to minimize the potential for electrocution of birds, by following established guidelines (e.g., APLIC [2006], APLIC and USFWS ~2O05]).

- Operators could consider incorporating measures to reduce raptor use of the project site into the design of the facility layout (e.g., minimize road cuts and maintain nonattractive vegetation around turbines).

- Turbines and other project facilities could avoid locations in areas with known high bird usage; in known bird and/or bat migration corridors or known flight paths; near raptor nest sites; and in areas used by bats as colonial hibernation, breeding, and maternity/nursery colonies, if site studies show that they would pose a high risk to species of concern.

- Wind energy projects could avoid locations in areas with a high incidence of fog and mist.

- To reduce attraction of migratory birds to turbines and towers, the need for or use of sodium vapor lights at site facilities could be minimized or avoided.

- Turbines could be configured to avoid landscape features known to attract raptors, if site studies show that placing turbines there would pose a significant risk to raptors.

**17.3 Mitigating Habitat Disturbance.** To mitigate habitat reduction or alternation during construction, the following measures may be implemented:

- The size of all disturbed areas could be minimized.

- Where applicable, the extent of habitat disturbance could be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.

- Habitat restoration activities could be initiated as soon as possible after construction activities are completed.

**17.4 Mitigating Disturbance and Injury of Vegetation and Wildlife.** These measures may be applicable to mitigate the disturbance or injury of biota during construction:

- In consultation with staff from natural resource management agencies, construction activities could be scheduled to avoid important periods of wildlife courtship, breeding, nesting, lambing, or calving.

- All construction employees could be instructed to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship, nesting) seasons. In addition, any pets could not be permitted on site during construction.

- Buffer zones could be established around raptor nests, bat roosts, and biota and habitats of concern, if site studies show that proposed facilities would pose a significant risk to avian or bat species of concern.

- Noise-reduction devices (e.g., mufflers) could be maintained in good working order on vehicles and construction equipment.

- Explosives could be used only within specified times and at specified distances from sensitive wildlife or surface waters as established by local, state and federal management agencies.

- The use of guy wires on permanent meteorological towers could be avoided.

**17.5 Mitigating Erosion and Fugitive Dust Generation.** Measures to minimize disturbance of ecological resources from erosion and fugitive dust may include:

- Erosion controls that comply with county, state, and federal standards could be applied. Controls such as jute netting, silt fences, and check dams could be applied near disturbed areas.

- All areas of disturbed soil could be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities could be undertaken as early as possible on disturbed areas.

- Dust abatement techniques could be used on unpaved, unvegetated surfaces to minimize airborne dust.

- Construction materials and stockpiled soil could be covered if they are a source of fugitive dust.

- Erosion and fugitive dust control measures could be inspected and maintained regularly.

**17.6 Mitigating Fuel Spills.** To minimize potential impacts to ecological resources from accidental fuel spills, the following mitigation measures may be implemented:

- All refueling could occur in a designated fueling area that includes a temporary berm to limit the spread of any spill.

- Drip pans could be used during refueling to contain accidental releases.

- Drip pans could be used under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.

- Spills could be immediately addressed per the appropriate spill management plan, and soil cleanup and soil removal initiated if needed.

## 18.0 Mitigation during Operation

**18.1 Mitigating Fuel Spills and Exposure to Site-Related Chemicals.** The following measures may be implemented to minimize the potential for exposure of biota to accidental spills:

- Drip pans could be used during refueling to contain accidental releases.

- Pesticide use could be limited to nonpersistent, immobile pesticides and herbicides and could only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.

- Spills could be immediately addressed per the appropriate spill management plan, and soil cleanup and removal initiated, if needed.

**18.2 Mitigating Site/Wildlife Interactions.** Measures to mitigate these interactions were identified for inclusion in wind farm location and design. The following measures may further reduce the potential for bird collisions, primarily through reducing the attractiveness of the facility to birds:

- Taller vegetation (i.e., shrub species) could be encouraged along powerline transmission corridors to minimize foraging in these areas by raptors to the extent local conditions will support this vegetation.

- Areas around turbines, meteorological towers, and other facility structures could be maintained in an unvegetated state (e.g., crushed gravel), or only vegetation that does not support wildlife use could be planted.

- All unnecessary lighting could be turned off at night to limit attracting migratory birds.

- Employees, contractors, and site visitors could be instructed to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. In addition, pets could be controlled to avoid harassment and disturbance of wildlife.

- Observations of potential wildlife problems, including wildlife mortality, could be reported to wildlife management agencies.

## 19.0 Mitigation during Decommissioning

The measures identified to mitigate construction impacts are applicable to decommissioning activities and may include:

- All turbines and ancillary structures could be removed from the site.

- Topsoil from all decommissioning activities could be salvaged and reapplied during final reclamation.

- All areas of disturbed soil could be reclaimed using weed-free native shrubs, grasses, and forbs.

- The vegetation cover, composition, and diversity could be restored to values commensurate with the ecological setting.

Following removal of the project facilities, implementation of appropriate habitat restoration activities could restore disturbed areas to pre-project conditions.