

**Alton Coal Development, LLC**

463 North 100 West, Suite 1

Cedar City, Utah 84720

Phone (435) 867-5331 • Fax (435) 867-1192

# 3371

Q

October 7, 2009

Daron R. Haddock  
Department of Natural Resources  
Utah Division of Oil, Gas & Mining  
1594 West North Temple, Suite 1210  
Salt Lake City, UT 84114

***Re: Supplemental Information to Response of Technical Review (Task ID #3100) Coal Hollow Project, Kane County, Utah, C/025/0005***

Dear Mr. Haddock:

Representatives of Alton Coal Development, LLC (ACD) and the Division of Oil, Gas and Mining (UDOGM) met on October 1<sup>st</sup>, 2009 for a meeting and field visit related to the greater sage-grouse population located in the Alton area. Present at this meeting and field visit representing ACD was Patrick D. Collins, Steven L. Petersen and myself. Joe Helfrich was present for the UDOGM.

Based on discussions at this meeting, ACD has voluntarily agreed to make additional commitments to address UDOGM concerns related to the protection of the sage-grouse population near the proposed Coal Hollow Mine. Enclosed is revisions to Chapter 3 and Appendix 3-5 in the Coal Hollow Mine permit application (C/025/0005) that address the commitments made by ACD.

In addition, UDOGM representative Priscilla Burton has requested field notes taken during a subirrigation investigation that was conducted for a specific area on August 15, 2009. Though much of this investigation was on private land not under the control of ACD and was therefore mainly observational, some subsurface field data was gathered. The notes related to the gathering of subsurface data is enclosed as part of this submittal to address Ms. Burton's request.

Please let me know if there is any other assistance that we can provide.

Sincerely,

Chris McCourt

RECEIVED

OCT 08 2009

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DIV. OF OIL, GAS & MINING

# APPLICATION FOR COAL PERMIT PROCESSING

Permit Change  New Permit  Renewal  Exploration  Bond Release  Transfer

**Permittee:** Alton Coal Development, LLC

**Line:** Coal Hollow

**Permit Number:** C/025/0005

**Title:** Mining and Reclamation Plan - Supplemental Information for Technical Review 2 ( Task ID #3100) Revisions

**Description,** Include reason for application and timing required to implement:

These documents are supplemental to the submission made by ACD dated August 27, 2009.

**Instructions:** If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

- |   |   |
|---|---|
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ <input type="checkbox"/> increase <input type="checkbox"/> decrease. |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 2. Is the application submitted as a result of a Division Order? DO# _____  |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?                                     |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 4. Does the application include operations in hydrologic basins other than as currently approved?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 6. Does the application require or include public notice publication?   |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 7. Does the application require or include ownership, control, right-of-entry, or compliance information?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 9. Is the application submitted as a result of a Violation? NOV # _____   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 10. Is the application submitted as a result of other laws or regulations or policies?<br><i>Explain:</i> _____                                   |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 11. Does the application affect the surface landowner or change the post mining land use?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)                                |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 13. Does the application require or include collection and reporting of any baseline information?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?   |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 15. Does the application require or include soil removal, storage or placement?   |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 16. Does the application require or include vegetation monitoring, removal or revegetation activities?  |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 17. Does the application require or include construction, modification, or removal of surface facilities?   |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 18. Does the application require or include water monitoring, sediment or drainage control measures?  |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 19. Does the application require or include certified designs, maps or calculation?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 20. Does the application require or include subsidence control or monitoring?   |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 21. Have reclamation costs for bonding been provided?   |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?  |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 23. Does the application affect permits issued by other agencies or permits issued to other entities?   |

**Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you.** (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

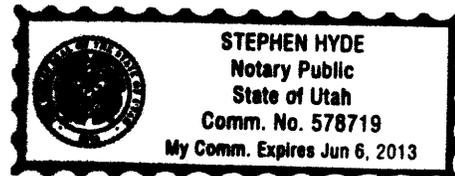
Chris McGowan  
Print Name

Stephen Hyde, Manager, 10-7-09  
Sign Name, Position, Date

Subscribed and sworn to before me this 07 day of October, 2009

Stephen Hyde  
Notary Public

My commission Expires: \_\_\_\_\_ }  
Attest: State of Utah 06/06, 2013 } ss:  
County of Iron



**For Office Use Only:**

Assigned Tracking Number:

Received by Oil, Gas & Mining

**RECEIVED**

**OCT 08 2009**

**DIV. OF OIL, GAS & MINING**

My Comm. Expires 01/01/2012  
Comm. No. 218212  
State of Ohio  
Notary Public  
STEPHEN WARD





**COLOR CODES FOR THE INFORMATION  
for  
CHAPTER 3 INSERTS**

October 7, 2009

- **THE DOGM DEFICIENCY** (8/27/09 Submittal to the Division)
- **ACD'S RESPONSE TO THE DEFICIENCY** (8/27/09 Submittal to the Division)
- **CHANGES MADE TO ACDs EXISTING MRP** (8/27/09 Submittal to the Division)
- **THE REDLINE/STRIKE-OUT VERSION SHOWING ALL CHANGES**  
(8/27/09 Submittal to the Division)
- **THE REDLINE/STRIKE-OUT VERSION SHOWING ALL CHANGES**  
[Current (10/7/09) Submittal to the Division]

From 2006 to date, biologists representing the Coal Hollow Project have been involved with a previously assembled team of biologists that have been studying the populations in the area. In 2007, the team captured, tookdrew blood samples for DNA analyses, and placed radio collars on several birds. For more details refer to **Appendix 3-3**.

In addition to studying the sage-grouse birds as described above, techniques to improve habitat for the birds isare currently being conducted. An effortA project conducted by the U.S. Department of Interior, Bureau of Land Management (BLM) and the State of Utah, Division of Wildlife Resources (DWR) was completed that removed many of the juniper trees that have encroached the valley by grinding them up by chipping (also called bull-hogging) equipment. These areas can be easily seen on the new *Vegetation Map, Drawing: 3-1*. -These areas are delineated as "SB (chipped)" on the map.

Because they provide perching structure for predatory species, single juniper trees scattered throughout sagebrush communities are known to discourage nesting by sage-grouse. To enhance sage-grouse nesting habitat within the permit area, juniper trees that have encroached some of the sagebrush communities in the valleys of the permit area have been removed by a track hoe using a large grapple claw. This equipment can pull the trees out of the ground, including the roots. To date, it has been estimated that over 10,000 juniper trees have been removed by this technique. In doing so, the technique causes d relatively minor impacts to the sagebrush component of the community.

There is a substantially larger sage-grouse lek located north of the project area. The lek, known as the Hoyt's Ranch Lek, has also been studied by state, federal and private biologists. It has been hypothesized that connectivity between the two leks, the Alton lek and the Hoyt's Ranch Lek, could greatly increase the chances of survival for the Alton birds. Therefore, intensive efforts have been made to open a corridor of these two leks by removing juniper and oak stands (see Appendix 3-5).

In addition to the habitat improvements mentioned above for sage-grouse, seed mixtures formulated to restore pasture lands disturbed by mining will include plant species that are used by the birds for food, cover and breeding. Moreover, onesome areas that is presentlyare currently dominated by grass species for domestic livestock use, will be seeded with plants that include species known to provide nesting habitat for sage-grouse such as big sagebrush and black sagebrush (see Postmining Land Use, Chapter 4, [for more detailed information]-see "Habitat Reclamation Plan" (Chapter 3); "Other Wildlife Enhancement Information" (Chapter 3); "Seed Mixtures" (Chapter 3); Drawing 3-7 (Chapter 3); "Postmining Land Use"(Chapter 4)].

322.230. Other Species or Habitats

As mentioned previously, raptor surveys have been conducted in the area by Coal Hollow project and DWR biologists. The 2006 through 2008 surveys show no golden eagle (*Aquila chrysaetos*) or bald eagle (*Haliaeetus leucocephalus*) nests within ½ mile of the permit area. In fact, the most recent survey indicated that there were no raptor nests located within ½ of the permit area (see Confidential File, Drawing 3-6). There was, however, one inactive red-tailed hawk (*Buteo jamaicensis*) nest located over one mile from the permit area, three inactive golden eagle nests, one active peregrine falcon (*Falco peregrinus*) nest and another inactive falcon nest located approximately two miles from the permit area.

To date, no other species or habitats have been identified through agency consultation or field studies that require special protection under state or federal law, however, if they are found through the permitting process, they will be appropriately addressed and monitored.

A vegetation map has been prepared that delineates the plant communities in the permit area. The map also shows adjacent areas including those plant communities that will be impacted by the proposed county road realignment (Drawing: 3-1).

322.300. Fish and Wildlife Service Review

Upon request, the State of Utah, Division of Oil, Gas & Mining (DOGGM) will provide the resource information required under R645-301-322 and the protection and enhancement plan required under R645-301-333 to the U.S. Fish and Wildlife Service Regional or Field Office for their review. This information will be provided within 10 days of receipt of the request from the Service.

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### 333. PROCEDURES TO MINIMIZE ADVERSE IMPACTS TO FISH & WILDLIFE

#### Section Preface

*In addition to the language in the main body of the MRP regarding sensitive species, three appendices (Appendix 3-1, Appendix 3-3 and Appendix 3-5) were prepared separately and have been included to address the sage-grouse in the Alton area. Each of these appendices was submitted in different submittals to the State of Utah, Division of Oil, Gas & Mining (DOG M). After each submittal, they were reviewed by the DOGM and other agencies, which provided comments. Accordingly, the comments were addressed and the next sage-grouse appendix was then written. In other words, the appendices were written in chronological order and each subsequent appendix was a result of comments from the previous one. Therefore, the last appendix written (**Appendix 3-5**) explains ACD's final mitigation plan for the sage-grouse in the Alton area. However, the previous Appendices (Appendix 3-1 and 3-3) remain in the MRP because they continue to provide valuable information regarding the natural history, previous work and process of addressing the sage-grouse issues in the Alton area.*

#### **Sage-Grouse Work**

The Coal Hollow Project will minimize disturbances and adverse impacts to fish and wildlife and related environmental values during coal mining and reclamation operations. The project will comply with the Endangered Species Act of 1973 during coal mining and reclamation operations. The location and operation of haul and access roads and support facilities will be placed to avoid or minimize impacts on important fish and wildlife species or other species protected by state or federal law. Enhancement of such resources will be achieved, where practicable. An example is provided below for sage-grouse habitat.

After consultation with appropriate agencies and biologists regarding habitats and sensitive species, the sage-grouse and its habitat were of greatest concern in the area. There has been a decreasing trend in the populations of this species since 1964 (see **Appendix 3.1** and **Appendix 3-3** for more details). There was a general consensus among the biologists and agencies consulted that due to the marginal habitat in the Alton Amphitheater area, the loss of habitat in recent years for nesting and brood-rearing and the relatively low population numbers in the area, that the local population of sage-grouse is vulnerable to elimination, regardless of mining activities proposed by the Coal Hollow Project. Accordingly, the following measures to minimize impacts and enhance habitat for this species have been proposed and are subject to further consideration by the operator and regulatory agencies.

Biologists representing the regulatory agencies, land managers, academia and the coal mine operator, the primary goals for the Alton sage-grouse population includes:

- Enhance current sage-grouse habitat by reducing juniper trees in the area and restoring desirable perennial plant species.
- Create a conservation area for the sage-grouse that will never be mined.
- Provide a corridor between north (Hoyt's Ranch) and south (Alton Sink Valley) populations to promote gene transfer and increase population numbers.
- Use decoys to shift breeding activities to alternate lek sites in Sink Valley.
- Restore the Alton lek site to its original ecological structure and function.
- Monitor sage-grouse distribution patterns at both Alton and Hoyts Ranch.
- Restore sagebrush communities disturbed by mining activities to enhance sage-grouse habitat.
- Control predators through cooperation with official state and/or federal predator control agencies and organizations

### **Sage-Grouse Short-Term Mitigation Plan**

The following information was taken directly from the "*Alton Sage-Grouse Habitat Assessment and Mitigation Plan*" (**Appendix 3-1**) and the followup document called "*Alton Sage-Grouse Habitat and Mitigation Plan*" (**Appendix 3-5**).

In addition to ensuring the protection of nearby grassland and shrubland for alternate breeding and nesting areas, mining activities will be minimized so that the lowest disturbance will be created during the breeding season at areas adjacent to the original lek. A lek area will be disturbed during mining activities that could potentially displace birds from typical mating activities. To encourage mating behavior during the breeding season, decoys and mating calls will be used to lure birds to nearby alternative sites positioned away from the disturbed area. Research has shown that birds will shift mating activities toward decoys and recorded bird calls. Both silhouette and 3-dimensional decoys (with bright white coloration) will be used to encourage sage-grouse mating activity (see **Appendix 3-5**).

After mining has been completed, reclamation specialists will return the original grade and valley form to pre-disturbance conditions. Reclamation will include seeding similar plant species with comparable plant composition, structure and function as those of the original plant community. In sites used by sage-grouse for breeding and roosting that had previous livestock grazing, livestock will be used post-reclamation to maintain similar vegetation characteristics as pre-mining conditions.

Intact sagebrush stands will be avoided for storing mined subsoil and topsoil piles when possible. Intact sagebrush sites will be cleared of all young juniper trees with the use of a compact excavator with a grappling claw or hand tools such as chainsaws. Trees will be removed from these stands. Juniper woodlands surrounding intact stands can be cut back to increase patch size and increase the amount of area that has the potential for nest site selection by hens.

## Sage-Grouse Long-Term Mitigation Plan

The following information was taken directly from the “*Alton Sage-Grouse Habitat Assessment and Mitigation Plan*” (Appendix 3-1), “*Sage-grouse Distribution and Habitat Improvement in Alton, Utah*” (Appendix 3-3) and “*Alton Sage-Grouse Habitat and Mitigation Plan*” (Appendix 3-5).

### Juniper Removal

A significant contribution that mining can provide for enhanced sage-grouse habitat is the removal of juniper from the Alton valley. The removal of trees during mining operations with subsequent reclamation activities will create conditions that promote grass, forb and eventually sagebrush establishment. Two years after juniper was removed from plots located in eastern Oregon, Bates et al. (2000) recorded a 200-300% increase in percent cover and production of herbaceous vegetation. Increased plant community vigor results from decreased competition with juniper for subsurface resources (water, nutrients) and space. As a result, transpiration rates and soil surface evaporation rates will decrease and higher soil moisture will be available for plant growth and survival. Based on anecdotal evidence, it is also possible that spring discharge will increase and seeps and springs may emerge that were lost with initial encroachment. This would provide more sites where birds would be able to obtain water during the summer and fall months.

Removing trees from extensive areas creates greater connectivity of suitable habitat. In 2005, the BLM cleared portions of the land to increase sagebrush habitat. This improvement was beneficial for improving relatively small site conditions, however, the amount of land treated was minimal compared to the level needed to sustain the sage-grouse population in the Alton area. In 2007, the Coal Hollow Project removed over 10,000 juniper trees that had encroached the sagebrush open areas. Other than during the mining process itself, any future tree removal treatments within the permit area will be completed outside the area's avian nesting season.

~~Long-term plans could include remove of hundreds of acres of juniper woodlands in a specific area adjacent to the Coal Hollow Project which would significantly increase conditions that are more suitable to sage-grouse nesting and post-nesting requirements.~~ Current plans have been designed to provide a corridor for the sage-grouse in the Alton to intermix with the larger population located to the north, called the Hoyt's Ranch Lek (see below). This landscape-level operation could greatly enhance sagebrush restoration objectives by the BLM that is currently limited by constrained budgets and manpower.

### Reestablishing Connectivity Between Alton and Hoyt's Ranch

Over time, juniper encroachment has likely been the primary factor in isolating the Alton sage-grouse population from nearby populations. There is a larger sage-grouse population located approximately 6 miles north of Alton. It is likely that migration once occurred between these populations allowing an exchange of individuals and genes between the two populations. Fragmentation of the landscape by juniper has likely resulted in minimal or no movement of birds between the two populations. Similarly, two populations that once occurred further south (near Kanab) have become locally extinct, likely due to the lack of connectivity with more northern populations. According to Fuhlendorf (2001), small populations of prairie chickens became disconnected from other larger populations with increased croplands and juniper invasion. These small populations became locally extinct due to the lack of migration and gene flow potential. Therefore, by reducing the degree of fragmentation caused by expanding juniper, the potential for migration and population sustainability is increased.

A plan has been made to establish connectivity ~~can be accomplished~~ by removing juniper and scrub oak trees from private land between the Alton and Hoyts Ranch populations. An area that is approximately 1,700 acres has been delineated that, with treatment, could provide connectivity between the two populations (**Appendix 3-5**). Funds have been earmarked by ACD to work with DWR and/or the landowners (Heaton Brothers, LLC) to provide technical and financial support to establish a migration corridor through the 1,700 acres. It is anticipated that this habitat improvement will create easier access for birds to travel more freely between the two populations.

Although ongoing, much of the corridor development work has been accomplished. A field visit that included a Division biologist, representatives from Heaton Brothers and ACD, and other independent biologists to this area to observe the progress of the project was conducted in late-September 2009. Additionally, preliminary field monitoring data from radio-collared sage-grouse suggest that the corridor is beginning to be used by the birds.

## Establishment of a Core Sage-Grouse Conservation Area

The east end of the valley maintains one of the few remaining intact sagebrush stands in the valley. This area is located northeast of the lek and provides sites for roosting during the mating season (see Drawings 3-1 and Drawing 3-1 and Drawing 3-5). This area will not be mined, rather, it will be preserved to create a harbor area for bird breeding, nesting, and brood rearing (Figure 3-1). Within this "Conservation Area", habitat will be protected ~~and enhanced~~ for sheltering displaced sage-grouse, especially during the breeding and brood-rearing seasons (~~see also Appendix 3-1~~). ~~All~~ Most of the juniper trees that encroached into sagebrush communities within the permit area ~~will have been~~ removed. This ~~will has been~~ accomplished by felling and removing individual juniper trees while minimizing the impacts to the sagebrush community (see "Juniper Removal" above). In addition to juniper, some Gambel oak (*Quercus gambelii*) ~~may trees have~~ also been removed (~~in particular along the eastern foothills~~) to expand the sagebrush community and provide greater suitable habitat for sage-grouse. In addition to juniper and oak removal, sagebrush treatments (mechanical) will be applied to reduce shrub cover and density in small areas (patches) if quantitative sampling in that area suggests that these parameters exceed optimal sage-grouse habitat requirements. Forb species that are known to be important sage-grouse forage will then be seeded to provide an additional food source for hens and chicks, primarily during the brood rearing period. Grasses will also be seeded to provide additional hiding cover and a potential source of insects for chick foraging. These treatments could initially be done in a few, relatively small areas to determine whether forb and grass densities actually do increase and if birds are observed using these areas for foraging. If successful, these treatments can then be used in other areas where benefits are expected. Conversely, if the results from preliminary vegetation sampling, along with the current research literature regarding sage-grouse habitat requirements, indicate that widespread treatments should be made to the existing sagebrush community, then this will be the course of action.

Maintaining optimal shrub cover for nesting, brood rearing, predator avoidance, roosting, and as a source of shelter will remain the highest priority for these sites.

### Predator Control Plan

Several species that prey on sage-grouse eggs, chicks and adults live in the Alton region including common ravens (*Corvus corax*), American crows (*Corvus brachyrhynchos*) and coyotes (*Canus latrans*). ACD will coordinate with the appropriate government agency to help implement a predator control program to enhance survival of the sage-grouse in the area. The operator will not conduct the predator control measures but will assist the appropriate agency with developing technical expertise to formulate a plan to implement such a program through the appropriate government agency.

# **ALTON SAGE-GROUSE HABITAT MITIGATION PLAN**

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**Appendix 3-5**

**October 2009**

**Steven L. Petersen, Ph.D.  
Patrick D. Collins, Ph.D.**

## Table of Contents

INTRODUCTION .....	2
PROPOSED MITIGATION AND MANAGEMENT PLAN.....	4
Reestablishing Connectivity Between Alton and Hoyts Ranch .....	4
Reduction of Juniper Trees Within Key Habitat in the Alton Area.....	7
Establishment of a Core Sage-Grouse Conservation Area .....	5
Restoration of Sagebrush Habitat .....	12
CONCLUSIONS & SUMMARY .....	15
REFERENCES .....	16

## INTRODUCTION

Alton, Utah is home to a greater sage-grouse (*Centrocercus urophasianus*) population that resides year-round within the Alton valley region. This population has persisted in this region for many generations in spite of significant habitat alterations and human-related impacts (e.g. farming, livestock, traffic). In addition to the resident sage-grouse population, shallow coal beds are present that can only be extracted using surface mining operations. Alton Coal Development, LLC (ACD) has developed a plan to remove these coal reserves while providing habitat conservation efforts and improvements that will enhance habitat conditions both during and after mining activities.

The sage-grouse population near Alton has been the subject of research over the past few years by biologists representing the [Utah Division of Wildlife Resources \(UDWR\)](#), the Bureau of Land Management (BLM), Southern Utah University (SUU) and ACD. [In previous versions of this appendix](#), Petersen (2006) described some of this research as well as provided a summary of ecological factors, historical considerations, biological requirements, and mitigation suggestions related to the sage-grouse population in the Alton area.

A follow-up report was prepared (Petersen 2007) as an update to the on-going research as well as habitat mitigation that has been conducted since 2006. In addition to reporting results of research and mitigation on the Alton sage-grouse population, information was also provided regarding another larger population (Hoyt's Ranch) located near the town of Hatch, Utah. Moreover, additional mitigation and habitat improvement ideas were proposed in that document.

Since that time, results from the current onsite sage-grouse research has been provided. Proposed mitigation and habitat restoration ideas have also been submitted for review by biologists from the State of Utah, Division of Oil, Gas & Mining (DOG M) and UDWR. Finally, ACD's mine plan has been finalized as a permit application for the regulatory agencies, thus providing more details about how the land in the Alton area will be disturbed, mined and later reclaimed.

After consultation with biologists representing the regulatory agencies, land managers, academia and the coal mine operator, the primary goals for the Alton sage-grouse population includes:

- Creating a corridor between north (Hoyt's Ranch) and south (Alton) populations for the purpose of promoting gene transfer and sustaining the Alton population during and after mining activities.
- Creating a conservation area for the sage-grouse that will not be mined.
- Enhancing current sage-grouse habitat by reducing juniper trees in the area and restoring desirable perennial plant species.
- Restoring sagebrush communities lands disturbed by mining activities to enhance sage-grouse habitat.
- Using decoys to shift breeding activities to alternate lek sites in Sink Valley.
- Restoring the Alton lek site to its original ecological structure and function.
- Monitoring sage-grouse distribution patterns at both Alton and Hoyts Ranch.
- Controlling predators through cooperation with official state and/or federal predator control agencies and organizations.
- Minimizing impacts to the birds from the mining activities.

The purpose of this report is to describe the habitat conservation and mitigation efforts that will be implemented to sustain the existing population and provide optimal habitat conditions after mining is complete. This plan includes 1) ~~efforts to~~ reestablishing connectivity with the nearby Hoyts Ranch sage-grouse population, thereby facilitating migration and reestablishment, 2) reducing juniper tree density in existing key habitats throughout the valley, 3) preserving a sage-grouse habitat "conservation area", and 4) restoring sagebrush habitats after topsoil has been replaced using a suite of shrub, perennial forb and perennial grass species. 5) establishing forbs that provide critical forage for hens and chicks during brood-rearing phases of their life cycle, and 6) to aid birds in shifting mating efforts from the original lek to alternative sites with comparable biotic and abiotic conditions.

## PROPOSED MITIGATION AND MANAGEMENT PLAN

### Reestablishing Connectivity Between Alton and Hoyts Ranch

The Alton sage-grouse population occurs at the southernmost extent of the range of the species. Historically, additional populations occurred further south toward the town of Kanab, Utah. However, these populations no longer exist in these areas, likely due to habitat loss and fragmentation (Connelly et al. 2004). In the Alton area, adequate sage-grouse nesting, brood rearing, and winter habitat are at low levels, limited primarily by habitat alteration and fragmentation by juniper encroachment and stand development. Other potential impacts include agricultural practices, urban development, and predation. Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*) invasion confines intact sagebrush stands throughout the valley limiting nest site and brood rearing habitat availability.

Habitat fragmentation between Hoyts Ranch and Alton has likely disrupted migration and gene flow between these two populations. Greater connectivity can facilitate more rapid recovery of the bird population after the disturbance and increase resistance with greater genetic diversity in the population. Recently, private land owners from Alton have been working to reestablish a migratory corridor between Hoyts Ranch and Alton by clearing juniper and Gambel oak (*Quercus gambelii*) and reseeded open areas with a seed mix consisting of perennial grasses and forbs. According to Nicki Frey, professor of wildlife biology at Utah State University, migration activities between the two leks has been observed since corridor development began (personal communication September 2009). The actual use of this corridor by sage-grouse for landing and resting will be assessed by monitoring birds that were radio-collared at Hoyts Ranch in spring 2009 or birds that will be collared at later dates. ~~Restoring connectivity can be accomplished by removing juniper trees between these two populations on both private and public land. Funds will be provided to hire crews to cut and remove trees. It is anticipated that this habitat improvement will create access for birds to migrate between the two populations.~~

## Establishment of a Core Sage-Grouse Conservation Area (reorganized)

The east end of the valley maintains one of the few remaining intact sagebrush stands in the valley. This area, which is approximately 72 acres in size, is located northeast of the lek and provides sites for roosting and potentially nesting and brood rearing during the breeding season (see Coal Hollow Project, Mining & Reclamation Plan, Vegetation Map, Drawing 3-1). This area will not be mined, rather, it will be preserved to create a harbor area for continued nesting and brood rearing habitat. Within this "Conservation Area", habitat will be protected and enhanced for sheltering displaced sage-grouse, especially during the breeding and brood-rearing seasons.

All juniper trees that encroached into this area's sagebrush community will be removed. Over 10,000 individual trees were cut and removed, subsequently reducing impacts to the sagebrush community (Figure 3). This will be accomplished by felling and removing individual juniper trees while minimizing the impacts to the sagebrush community. One The method for accomplishing this was is the use of a tract excavator. In 2007, an excavator was used to remove over 8,000 invading juniper trees from the conservation area ranging in size from 6-15' (Figure 3). Using this method, trees were can be rapidly extracted from the soil, piled, and burned. and immediately loaded into dump trucks and removed away from the site. In addition to juniper, Gambel oak (*Quercus gambelii*) was will also be removed (in particular along the eastern foothills) to expand the sagebrush community and provide greater suitable habitat for sage-grouse. Like juniper, oak serves as a potential perching site for hunting raptors and ravens, however, because of its high stem density and rapid resprout capability, extensive control of this species is not warranted.



Figure 3. Mechanical removal of juniper within the proposed conservation area.

In addition to juniper and oak removal, sagebrush treatments (mechanical) can be applied to reduce shrub density in small areas (patches) and to create a more diverse habitat. Within these areas, forb species that are known to be important sage-grouse food will be seeded and established to provide an additional food source for hens and chicks, primarily during the brood rearing period. Grasses will also be seeded to provide additional hiding cover and a potential source of insects for chick foraging. These treatments will initially be done in a few, relatively small areas to determine whether forb and grass densities actually do increase and if birds are observed using these areas for foraging. If successful, these treatments can then be used in other areas where benefits are expected. Maintaining optimal shrub cover for nesting, brood rearing, predator avoidance, roosting, and as a source of shelter will remain the highest priority for these sites. Shrub treatments will be designed to create a mosaic plant community pattern, reducing only those stands that have higher shrub cover than levels recommended by Connelly (2001) for nesting and brood rearing.

Along the western edge of the Conservation Area, a natural topographic terrace covered with perennial vegetation provides a partial visual and auditory barrier between birds in the conservation area and mining activities. Additional topsoil stockpiles, however, will not be placed to augment this barrier because of a concern that predators could use these as hunting perch sites.

~~In addition to the Conservation Area, much of these grasslands and upper sagebrush stands are located along an upper terrace that provides a partial visual barrier from mining activities that will occur in the valley bottom. To create a more distinct visual barrier, spoils from mining can be stockpiled at the ridgeline (up to 20' higher) further decreasing motion and sound within the Conservation Area created during mining activities.~~

#### Reduction of Juniper Trees Within Key Habitats of the Alton Area

Research continues to emphasize the importance of intact sagebrush habitats in providing the resources sage-grouse require throughout their life cycle. This includes the necessity of sagebrush (*Artemisia* spp.) as the primary source of cover, food, and breeding (Crawford et al. 2004, Connelly et al. 2004, Gregg et al. 1994). Connelly et al. (2004) suggest that productive sage-grouse nesting habitat includes sagebrush that has both horizontal and structural diversity with an understory dominated by native grasses and forbs which provide a food source of insects and forbs as well as concealment from predation (Connelly et al. 2000, Connelly et al. 2004). With an increase in juniper, sagebrush steppe communities rapidly decline (Miller et al. 2000, Connelly 2004). ~~Pinyon – Juniper forests have increased within sage-grouse habitat by as much as 18.9 million acres and continue to expand in the absence of fire (Miller et al. 2000). For example, in sites dominated by western juniper (*Juniperus occidentalis*), big sagebrush (*Artemisia tridentata*) cover can decline to less than 1% and the seasons of available succulent forbs is reduced with soil moisture depletion. Bates et al. (2000) found that 2 years following juniper removal, understory plant biomass was nearly nine times greater and perennial plant cover was three times greater than uncut juniper~~

~~understory vegetation. These data suggest that juniper woodlands suppress and fragment understory and intercanopy plant communities, including sites dominated by big sagebrush.~~

In the Alton area, evidence of widespread juniper impacts on the sagebrush – grassland ecosystem can be observed (Figure 1). cursory assessments of sagegrouse habitat conditions within the valley indicate that the cover, density and biomass of living sagebrush and herbaceous plants occurring in the intercanopy of these juniper woodlands is lower than in open sagebrush stands (Figure 2). Data collected from radio-collared birds confirms that these birds do not rely on juniper encroached sites for nesting and brood rearing (Frey 2008).



Figure 1. Intact sagebrush community being encroached by Utah juniper.



Figure 1. Juniper and pinyon dominated plant communities located 50m west of the country road between Alton and Sink Valley.

Follow up quantitative sampling was conducted in the pinyon-juniper and sagebrush communities of the Alton area (Collins, 2007a; Collins, 2007b). When comparing reference areas of these two communities (reference areas are those areas chosen to represent future revegetation success standards), the total living understory cover of the sagebrush area was 60.50% compared to 27.50% for the pinyon-juniper community. Additionally, the sagebrush understory cover was comprised of 38.51% forbs and grasses as opposed to only 10.44% in the pinyon-juniper community. Finally, woody species density in the sagebrush community consisted of 8,331 individuals per acre, of which over 90% were sagebrush plants. In the pinyon-juniper community the woody species density was estimated at 4,215 individuals per acre, many of which were pinyon pine and Utah juniper trees.

Within the past few years, ~~an attempt was made to improve~~ sage-grouse habitat was improved within the Alton region by removing juniper and pinyon pine trees using bullhogging technology. Following tree removal, radio collared birds were observed the next year utilizing these stands where they had not been found before (~~personal communication with Nicki Frey 2007~~). The primary benefit of this work was a reduction in trees that compete with sagebrush and herbaceous plant species while maintaining trees that could be used for roosting (primarily during hot summer months). Over time, shrub and herbaceous biomass production and plant

cover will likely increase compared to pretreatment levels, even though recovery of perennial plants has been slow. To improve nesting habitat, **tree removal has been important for returning disturbed communities to sagebrush dominated sites recommended for sage-grouse habitat** (Connelly 2004) ~~however, complete tree removal is recommended~~. Juniper provides perching sites for predatorial birds, obstructs the ability to observe predators from a distance, and impairs intercanopy and understory plant community structure. Furthermore, remaining trees provide a seed source for more rapid reinvasion in the intercanopy space which can lead to a more rapid exclusion of sage-grouse habitat in that area.

In southeast Oregon and northwest Nevada, over 1,200 nest sites were located from 1995 to 2003. The majority of sage-grouse nest sites occur in intact sagebrush and bitterbrush/sagebrush stands which lacked juniper trees. Western juniper occurs throughout the region and within 10 km of both leks, however, birds have never been observed nesting within juniper woodlands. In Canada, 90% of all identified nest sites occurred under sagebrush plants (Aldridge and Bingham 2002). In Colorado, birds nested 94% of the time under sagebrush (Petersen 1980). Other plant species that provided nest sites included greasewood, bitterbrush, rabbitbrush, horsebrush, snowberry, shadscale, mountain-mahogany, and basin wildrye. While sage-grouse nesting under juniper limbs or near juniper has been reported (i.e. Colorado), it is generally agreed that sage-grouse nest away from juniper stands, in particular closed or nearly closed canopy woodlands (Miller 2005). At a recent sage-grouse conference held in Mammoth Lakes, California (July 2008), a group of 4-5 sage-grouse biologists were questioned on their attitude about nesting habitat and juniper. The group unanimously stated that optimal nest site habitat is void of juniper trees. Complete juniper removal from sage-grouse habitat was identified as a primary objective for improving sage-grouse nesting habitat throughout the range of the species. Holloran (2008) also agreed that optimal habitat would include large-scale removal of juniper. In addition to nesting habitat, brood rearing habitat is also impacted as plant structure and forage availability are reduced and the potential for predation is increased with juniper encroachment.

According to Crawford et al. (2004), sage-grouse managers should understand that without purposeful habitat management such as juniper removal, sage-grouse habitat quality may decline. To improve habitat conditions in the Alton area, and to increase connectivity with the neighboring Hoyts Ranch population, large-scale juniper removal is recommended. With aggressive revegetation of native shrub species (e.g. *Artemisia* spp, *Purshia tridentata*), including the use of transplants to increase more rapid sagebrush establishment and establishment of herbaceous species (in particular sage-grouse forage species), habitat conditions can be improved to ensure greater habitat availability for nesting and brood rearing. Tree removal increases resources available for shrub and herbaceous plant establishment and growth. In the Alton area, it is likely that birds will identify adequate sites for roosting following tree removal, using sagebrush plants or juniper trees at the juniper woodland fringe. More significant is the long-term benefit from having greater area for hens to nest and raise their brood. While research is needed to provide further evidence of the impacts of juniper on sage-grouse habitat, an assessment from sage-grouse biologists and wildlife habitat biologists have concluded that juniper impacts are detrimental to sage-grouse nesting and brood rearing habitat.

~~Any future tree removal treatments will be completed outside the avian nesting season. This does not include any tree removal that will occur during the mining process. Juniper encroachment threatens sagebrush stands within the Alton area (Figure 2). In these areas, trees will be cut to prevent further encroachment and increase the likeliness of birds to use these sites for nesting and brood rearing. The extent of juniper removal will be determined with consultation from the Division of Wildlife Resources. This could result in the removal of a significant number of trees. Rather than removing intermittent trees, the objective will be to remove all trees and open a traveling corridor to link the two areas.~~

## Restoration of Sagebrush Habitat

After mining has been completed, reclamation specialists will return the original grade and valley form to approximate pre-disturbance conditions ~~or in some cases, better than pre-existing conditions with respect to sage-grouse habitat~~. An emphasis will be placed on restoring sagebrush ecosystems. Reclamation will include seeding similar plant species with comparable plant composition, structure and function as those of the original plant community. ~~In sites used by sage-grouse for breeding and roosting that had previous livestock grazing, livestock will be used post-reclamation to maintain similar vegetation characteristics as pre-mining conditions~~. Final reclamation seed mixtures have been formulated to include forb species critical for survival of hens and their chicks.

Seed mixes that will be used for reclamation consist of native shrub, grass and forb species that will provide cover and food for sage-grouse. Bareroot or containerized sagebrush and bitterbrush transplants will also be planted (in additional to sage-grouse preferred forb species) to enhance sagebrush ecosystem restoration (see Coal Hollow Project, Mining & Reclamation Plan, Chapter 3, Revegetation Seed Mixtures).

## Aiding in Shifting Mating Activities Away from the Historic Lek During Mining

Lekking occurs in the lowlands of Sink Valley (Figure 4). This area will be disturbed during mining, potentially displacing birds from typical mating activities. To encourage mating behavior during the breeding season, decoys and mating calls will be used to lure birds to nearby alternative sites positioned away from the disturbed area. Research has shown that birds will shift mating activities toward decoys and recorded bird calls (Eng et al. 1979). Both silhouette and 3-dimensional decoys (with bright white coloration) will be used to encourage sage-grouse mating activity. ACD will notify UDOGM, in writing, 30 days prior to beginning the decoying.

### Restoration of Lekking Habitat

The current lek is located in a low-growing pasture in the south end of the proposed mining area. The lek is dominated by perennial grasses and forbs. Following mining, this site will be seeded with similar perennial species occurring at the lek prior to disturbance. Several studies demonstrate the plant structure of greater sage-grouse leks. They are described as occurring in sparsely vegetated areas (surrounded by sagebrush communities) that provide escape and protection from predators (Gill 1965, Connelly et al. 1981, Connelly et al. 2000, Call and Maser 1985, Crawford et al. 2004). After mining, the Alton lek will be restored to resemble pre-disturbance conditions. Plant species will be seeded to most closely represent the original lekking environment. Depending on post-mining soil water conditions and the presence of dominated perennial grass species, vegetation growth of seeded species may exceed the height tolerated by displaying sage-grouse during the lekking period. Additionally, weedy species may occur that grow taller than conditions typical of sage-grouse lekking habitat. With excessive plant growth, sage-grouse may choose not to attend the lek for display.

If needed, the reduction of plant growth may be required to create “sparsely vegetated conditions” (Figure 4) within the lekking area, by reducing both living and decadent plant materials. In cases where grass growth at the restored lek exceeds this maximum height requirement, ACD will work with the DWR prior to any vegetation treatments to identify optimal methods for vegetation management on the lek.



Figure 4. Sage-grouse males displaying on the Sink Valley lek on March 30, 2006.

### Sage-grouse Monitoring

The mine will rely on the DWR to obtain accurate lek counts each spring and to assist the mine in monitoring sage-grouse population patterns during mining activities. ACD will include the DWR sage-grouse lek count data for Alton and Hoyts Ranch in the annual report. In March 2009, 15 sage-grouse (14 males, 1 female) were collared from the Hoyts Ranch area and are being monitored by seasonal technicians. The data collected from this activity will provide information regarding sage-grouse habitat use patterns and connectivity between these two neighboring populations. Monitoring will continue as long as the birds are living, the collars function, and additional birds can be trapped and collared for long-term monitoring objectives.

ACD will meet with UDOGM at least six months prior to mining the Sage Grouse lek area to discuss the potential for minimizing impacts to the birds while mining the lek.

### Predator Control

Predators are recognized as having a potentially significant contribution to population declines in reduced sage-grouse numbers within the Alton area. ACD will commit to coordinating with the appropriate government agency to help implement a predator control program. ACD will not conduct the actual predator control directly, but will assist the appropriate agency with developing plans and implementing this program.

## CONCLUSIONS & SUMMARY

Surface coal mining activities have been proposed south of the town of Alton, Utah. The southern-most sage-grouse lek is known to occur within the boundaries of the proposed mining. As a result of recent and on-going research on the known Alton sage-grouse populations, it is believed that if current land management practices and habitat fragmentation trends continue, this population will likely be extirpated from the area.

There are several activities that could be accomplished to preserve and even enhance the sage-grouse habitat in the Alton area. First, measures to minimize impacts to the birds from the mining activities must be implemented. Next, enhancement of sage-grouse habitat **has been achieved by removing juniper trees** that have encroached into sagebrush communities. Additionally, **juniper and Gambel oak have been removed north of Alton to create a migratory corridor** between the Alton and Hoyts Ranch sage-grouse populations. **This corridor allows for emigration into the Alton area, supplementing local populations and enhancing genetic diversity.** Recently, **sage-grouse were observed migrating between these two populations, likely a response to the greater connectivity provided corridor improvements (tree removal and habitat restoration).** A Conservation Area will be established that will not be mined within the Coal Hollow permit area. Restoration of lands disturbed by mining will be conducted that improves and increases the amount of sage-grouse habitat in the Alton area. **Decoys will be used to entice birds to shift breeding activities away from mining activities, collared birds will be monitored regularly, and ACD will work with state predator control specialists to reduce impacts to the population from the diverse group of predator species living in the Alton area.** All habitat enhancement and reclamation activities will be closely monitored throughout the life of the proposed mine.

## REFERENCES

- Aldridge, C.L. and R.M. Bingham. 2002. Sage-grouse nesting and brood habitat use in southern Canada. *Journal of Wildlife Management* 66:433-444.
- ~~Bates, J.D., R.F. Miller, and T.J. Svejcar. 2000. Understory dynamics in cut and uncut western juniper woodlands. *Journal of Range Management* 53:119-126.~~
- Call, M.W. and C. Maser. 1985. Wildlife habitats in managed rangelands: The Great Basin of southeastern Oregon: sage grouse. U.S.D.A. For. Serv., Gen. Tech. Rept. PNW-187.
- Collins, P.D. 2007a. Vegetation of the sagebrush/grass & meadow areas: 2006. Report In Coal Hollow Mining & Reclamation Plan (Appendix 3-3). Alton Coal Development, LLC. Cedar City, UT. 20p.
- Collins, P.D. 2007b. Vegetation sampling in the Coal Hollow project area: 2007. Report In Coal Hollow Mining & Reclamation Plan (Appendix 3-4). Alton Coal Development, LLC. Cedar City, UT. 37p.
- Connelly, J. W., W. J. Arthur, and O. D. Markham. 1981. Sage grouse leks on recently disturbed sites. *Journal of Range Management* 52:153-154.
- Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines to manage sage-grouse populations and their habitats. *Wildlife Society Bulletin* 28:967-985.
- Connelly, J.W., S.T. Knick, M.A. Schroeder, S.J. Stiver. 2004. Conservation assessment of greater sage-grouse and sagebrush habitats. Western Association of Wildlife Agencies.
- Crawford, J.A., R.A. Olsen, N.E. West, J.F. Mosley, M.A. Schroeder, T.D. Whitson, R.F. Miller, M.A. Gregg, and C.S. Boyd. 2004. Synthesis Paper: Ecology and management of sage grouse and sage grouse habitat. *Journal of Range Management* 57:2-19.
- Eng, R.L., E.J. Pitcher, S.J. Scott, and R.J. Greene. 1979. Minimizing the effects of surface coal mining on a sage grouse population by a directed shift of breeding activities, p. 464-468. In: G.A. Swanson (tech-co-ord), The mitigation symposium. U.S.D.A. Forest Service General Technical Report. RM-65.
- FEIS (Fire Effects Information System). 2009. Plant Species. Accessed May 19, 2009. <http://www.fs.fed.us/database/feis/>.

- Frey, N. 2008. Radio collar data set that consists of 3 years of bird monitoring data, available by request from Nicki Frey.
- Gill, R. B. 1965. Distribution and abundance of a population of sage grouse in North Park, Colorado. Thesis, Colorado State University, Fort Collins, USA.
- Gregg, M.A. J.A. Crawford, M.S. Drut, and A.K. DeLong. 1994. Vegetational cover and predations of sage grouse nests in Oregon. *Journal of Wildlife Management* 58:162-166.
- Holloran, M.J. 2008. Personal communication on August 14, 2008. Employee with Wyoming Wildlife Consultants, Inc. Completed Ph.D. from the University of Wyoming in 2005.
- Miller, R.F., T. Svejcar, and J.A. Rose. 2000. Western juniper succession in shrub steppe: Impacts on community composition and structure. *Journal of Range Management* 53:574-585.
- Miller, R.F., L.E. eddleman, R.F. Miller, F.B. Pierson, and T.J. Svejcar. 2005. Biology, ecology, and management of western juniper (*Juniperus occidentalis*). Oregon State University Agricultural Experiment Station. Technical Bulletin 152. 82p.
- Petersen, B.E. 1980. Breeding and nesting ecology of female sage grouse in North Park, Colorado. Unpublished Master of Science Thesis, Colorado State University, Fort Collins, Colorado.
- Petersen, S.L. 2006. Alton sage-grouse habitat assessement and mitigation plan. Report In Coal Hollow Mining & Reclamation Plan (Appendix 3-1). Alton Coal Development, LLC. Cedar City, UT. 27p.
- Petersen, S.L. 2007. Sage-grouse distribution and habitat improvement , Alton, Utah. Report In Coal Hollow Mining & Reclamation Plan (Appendix 3-3). Alton Coal Development, LLC. Cedar City, UT. 11p.

# Appendix 7-7: Exhibit 1

Subirrigation Investigation - Field Notes  
for  
Valley Area of Section 32 T39S, R5W  
and  
Southwest Corner of Section 29 T39S, R5W

By: Patrick D. Collins, Mt. Nebo Scientific, Inc.  
Robert E. Long, Long Resource Consultants, Inc.

**ALTON AREA FIELD NOTES**

Stop	1	UTM Zone	12	0371745 E. 4138165 N.	
		NAD	1927		
Notes: Upland area, no evidence of sub-irrigation. Correlate to soil pit 51.					
Horizon	Depth (cm)	Texture	CaCO3	Redox	Notes
A	0-20	SL	---	---	
Bt	20-35	CL	---	---	
Btk	35-55+	CL	10% fine carbonate masses	---	
Vegetation: Juar/Agcr Community (50:50)					

Investigator(s): R.E. Long, P.D. Collins

*Photo(s)*



**ALTON FIELD NOTES**

Stop	2	UTM Zone NAD	12 1927	0371819 E. 4138133 N.	
Notes: Concave area at similar elevation as stop 1; surface runoff water appears to have perched on clays when water ponds on surface. Correlate to soil pit 40.					
Horizon	Depth (cm)	Texture	CaCO3	Redox	Notes
A	0-10	CL			
Bt	10-28	C			
B	28-42	C		12% fine and medium distinct mottles	
Vegetation: Juar Community					

Investigator(s): R.E. Long, P.D. Collins

*Photo(s)*



**ALTON FIELD NOTES**

Stop	3	UTM Zone NAD	12 1927	0371953 E. 4137889 N.	
Notes:	This stop was at the south edge of an artesian well wet area. Soil moisture appears to be the result of water from adjacent artesian well perching in the heavy textured Bt horizon. Deeper moisture is likely result of underlying sandstone (described at stops 4 and 5).				
Horizon	Depth (cm)	Texture	CaCO3	Redox	Notes
A	0-15	SL		---	Dry
Bt	15-22	CL		6% faint fine mottles	Dry
C1	22-58	SCL	12% fine carbonate masses	---	Dry
C2	58-65	SL		2% faint fine mottles	Slightly moist
Vegetation: Cami/Agst/Juar Community (40:40:20)					

Investigator(s): R.E. Long, P.D. Collins

*Photo(s)*



**ALTON FIELD NOTES**

Stop	4	UTM Zone NAD	12 1927	0371937 E. 4137877 N.	
Notes: Surface runoff from the adjacent artesian well appears to perch at the surface on top of the subsoil.					
Horizon	Depth (cm)	Texture	CaCO3	Redox	Notes
A	0-8	SCL		4% distinct fine and medium mottles	Dark brown.
Bw	8-25	SCL		---	Yellowish brown.
Cr	25-36	SCL		---	Black weathered shale; slight effervescence.
2Cr	36-60	L	Carbonates disseminated throughout	---	White sandstone; violent effervescence.
2R	60+	---		---	Sandstone.
Vegetation: Carex sp. Community					

Investigator(s): R.E. Long, P.D. Collins

*Photo(s)*



**ALTON FIELD NOTES**

Stop	5	UTM Zone NAD	12 1927	371893 E. 4137839 N.	
Notes: Profile on east side of erosion cut. No evidence of soil mottles.					
Horizon	Depth (cm)	Texture	CaCO3	Redox	Notes
A & B	0-53	SL		---	Estimated 16% clay.
C1	53-80	---		---	Weathered Mancos shale
Cr	80-98	---			Weathered sandstone
R	98-106	---			Harder sandstone, augering more difficult
Vegetation: Artr/Brin Community (on channel bank)					

Investigator(s): R.E. Long, P.D. Collins

*Photo(s)*

