

# Final Report

## 1. Introduction / Summary

On August 25, 1997 a Decision Memo was signed by Frank A Hayes, District Ranger, on the Clifton Ranger District, Apache-Sitgreaves National Forest that would begin the Coal Creek Corridor Enhancement Project (CCCEP), along State Highway 78 (Hwy 78).

Coal Creek is situated in the southeastern corner of the Apache National Forest on the Clifton Ranger District in east-central Arizona along Hwy 78 near the Arizona / New Mexico Stateline. Within the CCCEP area, two major drainages, Coal and White Mule Creeks, cross Hwy 78 at four locations. Three of these crossings are on the upper portion of the Coal Creek watershed, and one is near the confluence of White Mule and Coal Creek canyons. Original construction of these crossings provided for low flow movement under the roadway and created a low water crossing in high water events. Increased traffic, concerns for motorist safety, visual aesthetics, and a desire to re-establish natural flow gradients within the watershed brought Forest Service and Arizona Department of Transportation (ADOT) personnel together to discuss enhancements for the corridor.

Original discussions about development of the CCCEP originated between the District Ranger and the ADOT Three-Way Maintenance Org. concerning maintenance and visual esthetic issues. Over the period from 1993 until the analysis was completed, project goals and objectives expanded to include those included in the environmental analysis and captured below.

The completion of the CCCEP would occur over several years and consist of the following phases:

1. Highway 78 realignment and culvert battery re-construction.
2. Cottonwood and Willow Planting
3. Under-story removal and Prescribed Burning
4. Corridor Fencing
5. Proper planned rest/grazing guidelines for the livestock permittee on the Blackjack allotment which would enable recovery of the riparian corridor.

In 1996, Forest Service riparian specialists, soil scientists, and hydrologists conducted initial culvert battery assessments with photo points, and subsequently completed a hydrologic gradient analysis, flow determinations and calculations for ADOT.

**Photo 1. Soil Scientist Chris Nelson measuring gradient in White Mule Creek**



In 1997 the Forest Service and ADOT partnered together and began work to realign Hwy 78 and re-construct four culvert batters within the Coal Creek corridor. In the fall of 1998 the highway alignment and culvert re-construction was completed and an initial phase of cottonwood and willow plantings had begun. Over the next few years under-story thinning and prescribed fire treatments were carried out within the corridor and adjacent watersheds.

In 2001 the Clifton Ranger District submitted a grant application to Arizona Department of Environmental Quality (ADEQ) to request funding to complete the final phase of the CCCEP, approximately 4 miles of fence construction and the installation of one cattle guard. In February of 2002, the Clifton Ranger District was awarded a grant from ADEQ for \$34,390 to complete the fencing of the Coal Creek Corridor. In the summer of 2004 a contract was let to begin fencing 4 miles of the Coal Creek Corridor. In November of 2004 the contracted fencing was completed. In January of 2005, as part of a cooperative agreement, five water gaps and 12 gates were installed by the Blackjack Allotment range permittee.

Over the course of 7 years in cooperation with ADOT, ADEQ, Blackjack Allotment Grazing Permittee and the Apache-Sitgreaves National Forest the Coal Creek Corridor Enhancement Project has been completed

## II. Public Involvement and Coordination

Coordination with forest users began during scoping of the project in 1995, and throughout all phases of the project. ADOT has been recognized through presentations made by District personnel at ADOT annual functions. News clips in ADOT news and local papers were included during initial culvert realignment operations. Following completion of this phase, a brass plaque imbedded into a large boulder was placed at the Coal Creek Campground, commemorating partners in this venture.

Photo 2. Coal Creek Partner Plaque



Photo 3. Coal Creek Plaque



Forest visitors have been continually reminded of the project during public announcements about thinning and prescribed burn projects and most recently when fuelwood permits have been issued for removal of wood in this section of Coal creek and along the fenced corridor.

Future plans for public involvement and awareness include:

1. Summary article with local news papers on completion of the final phase of the corridor enhancement project using ADEQ funds.
2. Science field trips this April and May with local schools to conduct turbidity measurements, plant and animal identifications, and confirmation and identification of the Chiricahua leopard frog population.
3. Use of Eagle Scouts to conduct baseline monitoring and photo retake of all photo points established prior to and immediately following culvert placement.

*III. Project Goals and Objectives*

Primary objectives for the CCCEP were to improve effectiveness of the culvert crossings for both motorist safety and in allowing natural flow regimes to occur within the affected watersheds.

Secondary objectives would include reduced erosion, reduced maintenance, improved visual aesthetics, improved wildlife habitat conditions, and improved riparian conditions in Coal Creek and White Mule Creek, improved forest health and reducing vehicle collisions with livestock and wildlife. Secondary objectives would be achieved primarily through understory thinning and prescribed burning. Additionally the entire corridor (4 miles) would be fenced to exclude livestock so desired conditions could be reached and sustained.

#### IV. Project Outcomes / Results

##### a. Highway Realignment

One section of Highway 78 within the corridor was re-aligned for motorist safety and to align culvert battery with natural gradient of Coal Creek. The realignment consisted of straightening the S-curve near Coal Creek Campground.

**Photo 4. Original S-curve at Coal Creek Campground**



**Photo 5. S-Curve re-alignment at Coal Creek Campground**



0. Culvert Re-Construction

Original culvert batteries shown below provided for low flow movement under the roadway and created a low water crossing in high water events. The original culvert batteries do not allow for normal high-runoff events to carry down canyon without depositing aggregate material and overtopping both side ditches and the roadway. These conditions create costly and unsightly maintenance work for ADOT, and often result in the highway being closed for several days each year.

Photo 6. Original Culvert Battery at Coal Creek (1997)



Photo 7. Construction of Culvert Battery at White Mule (1998)





s. Headwall and Sidewall Construction

Following culvert battery placement and road realignment, ADOT Three-Way Maintenance personnel supervised and completed headwall and sidewall construction. Sidewall construction involved placing three tiers of rock gabion baskets, set one complete tier below the culvert depth. Headwalls consisted of rock-masonry wall construction both upstream and downstream on each culvert battery. This latter work was supervised and completed entirely by ADOT Three-Way Maintenance personnel, over a period of 1 year from completion of the culvert battery placement.

**Photo 8. Sidewall Construction with Gabion baskets**



**Photo 9. Headwall Construction**



**Photo 10. Completed Culvert Battery at White Mule**



**Photo 11. Culvert Battery at Coal Creek with Willow Plantings (2005)**



d. Site Rehabilitation

Rehabilitation of the sites disturbed in the Highway realignment and culvert reconstruction consisted of mulching and seeding by ADOT.

**Photo 12. Initial Mulching (1998)**



**Photo 13. Grass growth after mulching**





e. Willow and Cottonwood Plantings

After the culvert re-construction, ADOT and the Forest Service utilized a backhoe to dig trenches parallel to Coal Creek and White Mule creek upstream from the re-constructed culvert batteries. Cottonwood and Willow poles were placed in the trenches and covered.

**Photo 14. Planting Willows and Cottonwoods (1998)**



**Photo 15. ADOT and Forest Service Planting Willows and Cottonwoods (1998)**



In 2003, additional cottonwood and willow poles were planted to supplement previous plantings in 1998. The plantings in 1998 had a 50% success rate. In 2003 planting success is estimated at 80% or better. Initially, planting occurred directly above and in some cases below culvert batteries. Over the last few years volunteer patches of willows have been documented in the stream corridor below culvert batteries.

**Photo 16. Willow and Cottonwood Planting Success at White Mule (2005)**



#### f. Prescribed Burning & Thinning

To improve forest health, wildlife habitat, visual aesthetics, and motorist safety prescribed burning and under-story treatments (thinning) was implemented within the Coal Creek Corridor. In 2000 approximately 25 acres within the corridor was thinned, removing sapling and pole sized (3 – 6”) vegetation. In 2002 approximately 165 acres within the corridor were treated with low to moderate fire intensity. In 2004 an additional 45 acres of thinning was completed within the corridor. To complement the under-story thinning and fencing operations and benefit to the public the Clifton District offered local forest users the opportunity for paid firewood collection within the corridor.

**Photo 17. Thinning in Coal Creek Corridor**



**Photo 18. Prescribed Fire within Corridor**



a. Corridor Fencing

In 1997, working cooperatively with the Blackjack Grazing Allotment Permittee, Deryl and Sharon Bingham, the Forest Service incorporated a plan to rest the Coal Creek Corridor within the Permittee's Annual Operating Plan for grazing. Within the allotment annual operating plan, the corridor could be grazed during winter months of Dec-Feb only. On at least two occasions, administrative actions were taken to ensure that livestock were removed and the corridor was rested during critical spring-summer-fall growing seasons. Corridor has been rested since 1997. A cooperative agreement was made with the permittee to completely rest the Coal Creek Pasture until the CCCEP could be completed.

In 2001, the Forest Service submitted a grant application to ADEQ for funding to fence the 2.2 mile Coal Creek Corridor. In February of 2002 an ADEQ grant for \$34,390 was awarded to the Clifton Ranger District to complete the Fencing and final phase of the Coal Creek Corridor Enhancement Project.

In November of 2004 the fencing was completed by Dillon Fencing and Contracting. Additionally, the permittee agreed to contribute labor to install 12 gates and five water-gaps within the corridor. This work was completed in January 2005.

A standard 4 wire fence consisting of 3 strands of barbed wire and 1 smooth bottom wire was strung between 2.5" steel angle iron corner and line brace posts at ¼ mile intervals with intermediate T-post spacing at 16 ft. All steel post were cemented in place.

Deryl Bingham, Blackjack Allotment permittee, as part of his contribution to the Coal Creek Corridor Enhancement Project installed 12 wire gates and five break-away wire water-gaps. Additionally, the permittee will re-construct ½ mile of existing fence from the New Mexico / Arizona State line to the new fence in the southeastern section of the corridor.

**Photo 19. Fence Segment of Coal Creek Corridor**





Photo 20. Wire Gate



Photo 21. Water Gap



## V. Riparian Enhancement and TE & S Species

Initial fish surveys in Upper Coal creek by biologists in 1994, while not locating native fish, did confirm the presence of native leopard frogs, species unknown. This notable observation was used as one of the objectives for establishing the fenced corridor, to aid in recovery efforts and ensuring a mechanism for long-term management of livestock grazing effects.

Although native frog populations had not been documented as part of the Arizona Game and Fish elemental occurrence data base for upper Coal Creek area including the corridor, the District pursued application for non-game heritage funds to construct the corridor fencing in 1998. Even upon appeal in the application process, the grant was denied as this was not considered leopard frog habitat, and Chiricahua leopard frogs were not known to inhabit this area on the Forest.

When the Corridor project was initiated with culvert placement, there was virtually no perennial flow, and only intermittent flow adjacent to the Coal Creek campground. No leopard frogs were documented at this location, and no historical data base records existed for this area.

Since completion of culvert placement and gradient re-establishment, a minimal number of flows have occurred re-setting gradient conditions within the corridor, most notable within the White Mule drainage between the culvert battery and the confluence with Coal creek below the campground. Even during very dry winters in 2000-2003, wetland and riparian herbaceous vegetation began to develop below this confluence. Most recently, volunteer willows have expanded their occupancy of the corridor (from 2 miles upstream) initially becoming established at the confluence of the two drainages.

Photo 22. Downstream from Crossing 2 in 1997



Photo 23. Downstream from Crossing #2 in 2005



This short ½ mile stretch of Coal creek below culvert battery #2 became perennial during 2002, even with drought conditions during winter months. Field inspections for additional thinning needs during 2003 revealed the presence of native leopard frogs in this stretch of perennial stream. Initial field observations during that summer by District bio-technicians indicated that these were likely Chiricahua leopard frogs, *Rana chiricahuaensis*. A subsequent survey, late in that summer confirmed Chiricahua leopard frog presence. Field observations in October 2004 during corridor fence construction noted leopard frogs in abundance downstream from crossing #2 in Coal Creek. Chiricahua leopard frogs were re-confirmed in 2004.

Photo 24. Chiricahua Leopard Frog captured near crossing #2



Photo 25. Chiricahua Leopard Frog found near crossing #2



## VI. Project Learning

### Lessons Learned:

1. Allow time for recovery to occur. Expect big things to happen.
2. Increase level of photo point monitoring
3. Increase amount of publicity and involvement in local schools

## VII. Recommendations for the Future

1. Increase on site monitoring for water quality
2. Expect substantial improvements, in some cases significant, and set monitoring standards accordingly
3. Establish monitoring standards based on expected funding levels for permanent workforce.
4. Conduct Induced Meandering workshop and Rosgens stream Classification analysis for establishing baseline for in-stream supplemental structural work to compliment re-establishment of drainage.

## VIII. Project Monitoring

1. Original baseline hydrologic analysis and photo point establishment of drainage conditions and culvert battery locations. 1995-96.
2. Photo points during Highway realignment, culvert battery construction, sidewall/headwall construction, and rehabilitation. 1997-98.
3. Photo points during initial and second level riparian plantings. 2001 and 2003.
4. Photo points during prescribed burning and thinning projects. 2000-2004
5. Water quality and cross-sectional sampling. 2005.



In February of 2005 (3) baseline water quality monitoring points were established within Coal Creek and White Mule Creek. WQ1 was placed upstream from the culvert battery at White Mule, WQ2 was placed upstream from the culvert battery at Coal Creek campground and WQ3 was placed approximately 1/8 of mile below the confluence of White Mule and Coal Creek. Parameters measured were Dissolved Oxygen, Temperature and Turbidity.

Annual water quality measurements will be collected to compare against baseline information. A macro-invertebrate sample was attempted via kick net however none were found. We plan to refine the collection method and resample spring 2005. Photo Points were established at each monitoring site and will be re-visited on an annual basis.

**Table 1. Baseline water quality parameters**

Site	Dissolved Oxygen	PH	Temp (°C)	Turbidity (NTU)
WQ1	10.09	5.82	10.2	7.36
WQ2	10.99	5.85	7.3	14.0
WQ3	12.11	5.94	5.3	8.88

## *IX. Funding and Expenditure Summary*

### *a. ADOT*

A bulk Arizona Department of Transportation's contributions were primarily in highway re-alignment, road re-surfacing, site rehabilitation and culvert battery and headwall construction. ADOT has been involved in the project from the beginning to end and has also shared planning, design and subsequent riparian planting. More recently ADOT provided and constructed the cattleguard for the corridor fence west of White Mule Creek. ADOT's overall share in the Coal Creek Corridor Enhancement is 86%.

### *b. ADEQ*

Arizona Department of Environmental Quality contribution completed the final and critical fencing phase of the Enhancement Project. Grant monies obtained from ADEQ paid for 4 miles of fencing on both sides of Highway 78 and stretches from a cattle guard at White Mule Creek and ending at the New Mexico State Line. In addition, ADEQ authorized the Forest Service to utilize remaining grant monies to purchase water quality testing equipment. ADEQ's share of the Enhancement Project is 6%.

### *c. Forest Service*

The Forest Service has contributed monies for planning, design, construction, materials, labor and administrative support throughout the project lifetime. Specific projects include, site rehabilitation, riparian planting, under-story thinning, prescribed fire and fence contract administration. Forest Service's share of the Enhancement Project is 6%.

**Table 2. Cooperator Expenditures for each Phase of CCCEP**

Project Phase	FS	ADOT	ADEQ	Permittee	Volunteer	Total Value
Project Planning, Design and Monitoring	\$6,300	\$2,300				\$8,600
Culvert Construction	\$880	\$325,000				\$325,880
Highway Reroutes & Rehabilitation	\$3,400	\$175,000				\$178,400
Culvert Headwall Construction	\$660	\$7,300				\$7,960
Riparian Plantings & Structures (2 Years)	\$5,500	\$1,800				\$7,300
Thinning	\$6,000	0			\$6,000	\$12,000
Prescribed Fire	\$4,500	0				\$4,500
Fence Construction	\$9,000	0	\$37,043	\$2,400		\$48,443
Totals to Date	\$36,240	\$511,400	\$37,043	\$2,400	\$6,000	\$593,083
Percent Contribution	6%	86%	6%	0.4%	1%	100%

d. Grazing Permittee

Deryl Bingham, Blackjack Allotment Permittee, through an agreement with the Forest Service contributed labor to construct gates and water gaps within the contracted portion of the corridor fence and re-constructed ½ mile of existing fence to complete the project. Approximately 16 days of labor is the permittee’s contribution. His share of the Enhancement project is 0.4 %.

e. Volunteers

Two volunteers contributed labor to complete approximately 15 acres of thinning within the Coal Creek Corridor. Current values of thinning based on recent Forest Service Contracts places an approximate value of \$400.00 per acre for the volunteer work completed. Volunteers were local dedicated land stewards of Greenlee County. Volunteer’s Share of Enhancement Project is 1%.

Expenditure Summary

Administrative supplies: Flagging and wire stake flags were purchased to mark fence lines, gate and water-gap placements for the contractor.

Fence Materials and Supplies: After the fence line, gates and water-gaps were delineated, it was discovered that 10 additional fence line and gate braces were needed. Cement and hardware for line braces were also purchased.

Fence ROW Clearing: Initially the Fence Right of Way was to be cleared using forest personnel, however time restriction did not allow for this so ADEQ funds were use to pay two independent local contractors to clear Segment A & B Fence ROW’s.

Fence Contractor Payments: Three Progress Payments were paid to Dillon Fencing and Contracting totaling the original contract agreement of \$24,114.00.

Additional Contractor Payments: A modification to the original contract was made to account for the installation of the additional 10 braces and for the rental of an air hammer and generator needed for t-post and brace installation.

Contractor Brushing: Additional fence brushing was required to complete fence installation. This work was completed by Dillon Contracting.

Monitoring Equipment: An HACH 2100P Portable Turbid-meter, Oakton PD 300 handheld pH/Dissolved Oxygen/Temperature Meter, Cannon Power-shot A95 digital camera, HOBO temperature loggers and Macro-invertebrate Kick net was purchased with a remainder of ADEQ monies to collect initial baseline water quality measurements.

**Table 3. Expenditure Descriptions for ADEQ Funds\***

<b>Expenditure Description</b>	<b>Date</b>	<b>Amount</b>
Admin Supplies	9/9/2004	118.28
Fence ROW Clearing	10/9/2004	2,800.00
Fence Materials / Supplies	10/13/2004	1,526.80
Fence Contractor Payments	Oct 4 – Nov 25	24,114.00
Additional Contractor Payments	12/9/2004	907.74
Contractor Brushing	12/9/2004	180.00
Monitoring Equipment	12/15/2004	4,426.40
<b>Total</b>		<b>\$34,103.02</b>
<b>Remaining ADEQ Funds</b>		<b>\$286.98</b>

\* Receipts in Appendix B

## *X. Special Recognition*

The Coal Creek Corridor Enhancement Project is the product of effective communication and positive cooperation among multiple partners. The following agencies and individuals together made the CCCEP a success.

### *Forest Service*

**Tom Subirge – Forest Riparian Specialist**  
**Chris Nelson – Forest Soils Scientist**  
**Carolyn Hanrahan – Forest Hydrologist**  
**Frank Hayes – District Ranger (1991- 2005)**  
**Bob Csargo – District Biologist (1995-98)**  
**Ron Gutierrez – District Fire Management Officer (1995-2002)**  
**Tom Palmer – District Fuels, Range, and Recreation positions (1998-2005)**  
**Robert Whitten – District Range Technician (1998-2003)**

### *Arizona Department of Transportation*

**Ron Casper - Safford District Engineer**  
**Hollis Jones – Safford District Maintenance Superintendent (retired)**  
**Ray Bennett – Three Way Maintenance Supervisor (retired)**  
**Wayne Baber – Three Way Maintenance Supervisor**  
**Jim Moser – Safford District Maintenance Engineer (retired)**  
**Bob Quinn – Three Way Maintenance Lead Crew (retired)**  
**David Perez – Three-Way Maintenance technician**

### *Arizona Department of Environmental Quality*

**Rebecca Followill**

### *Clifton Ranger District*

**Deryl Bingham – Blackjack Allotment Permittee**

### *Volunteers*

**Frank Hayes, Jr.**  
**Mary Hayes**  
**Frank Hayes**  
**Tom Palmer**  
**Terrol Lunt and Members of the Duncan LDS Father-sons gathering.**  
**Nacarrate Family Reunion**

### *Contractors*

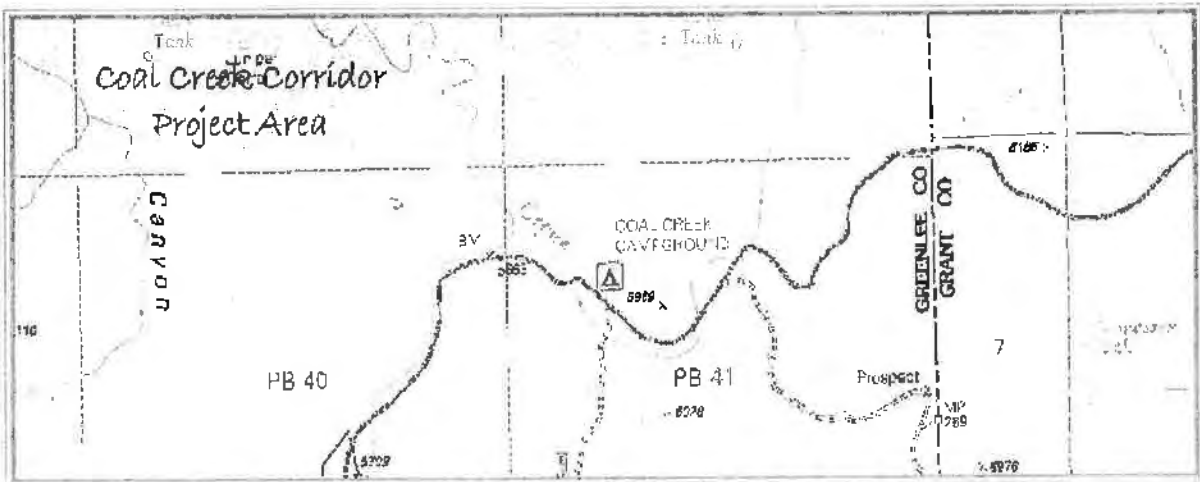
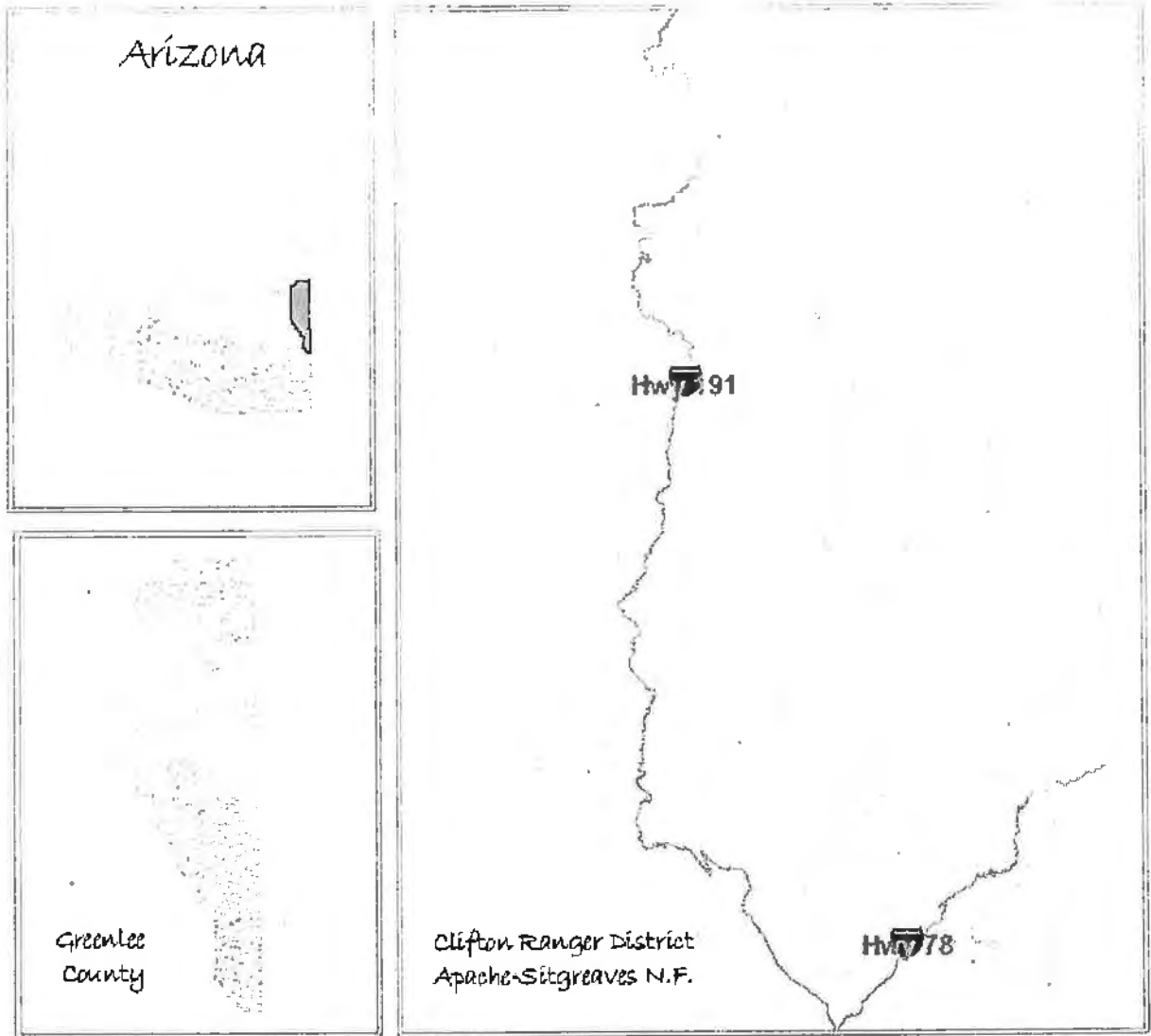
**Dillon Contracting and Fencing, Debbie, Paul, Scott Dillon (Colorado)**  
**Twig Winkle and Nick Ewing (Tule and 6K6 Ranch)**  
**Eagle Creek Outfitters (Bob Corhel and Steve Wagely)**



Appendix A  
MAPS

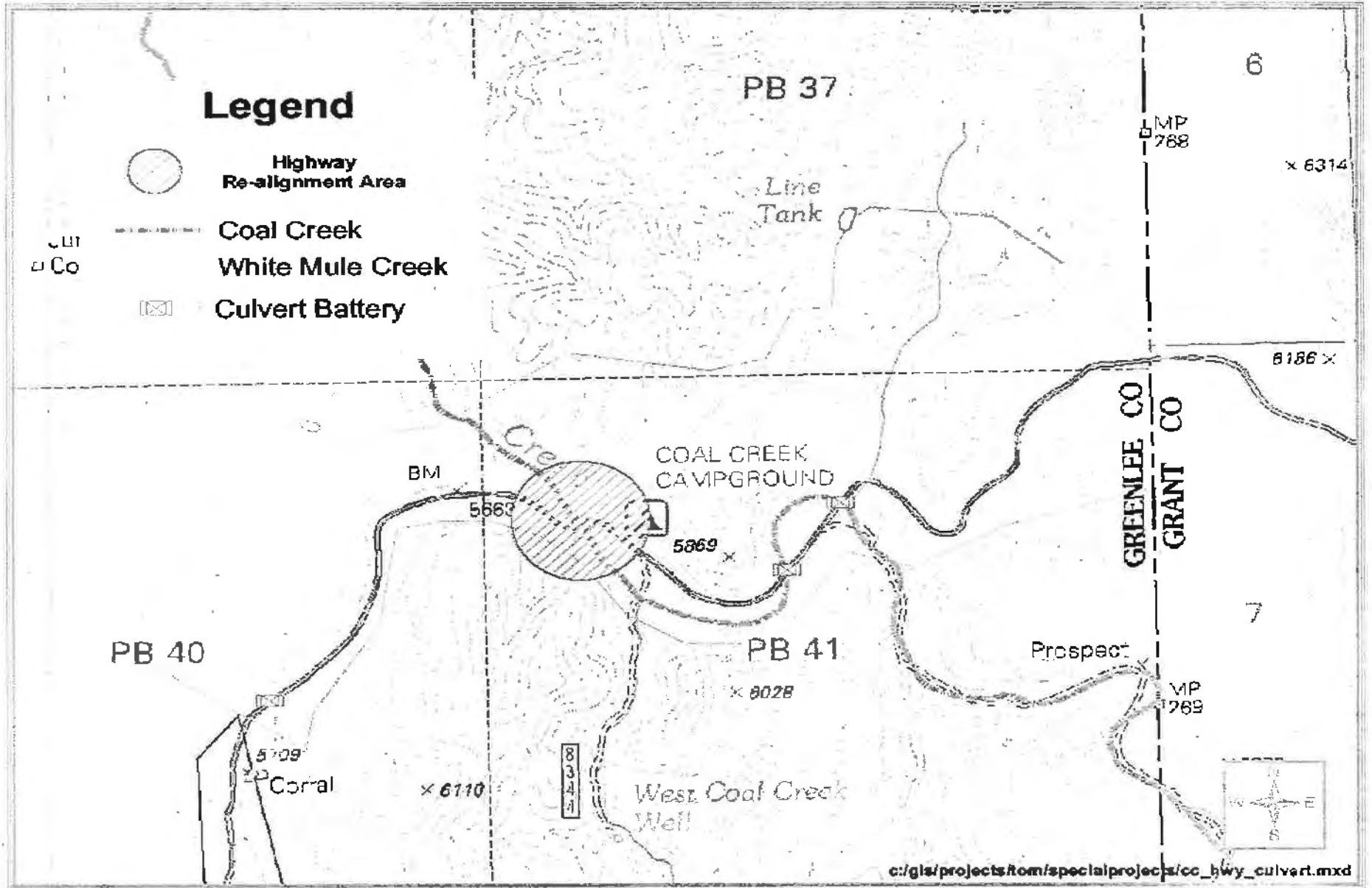
- 1: Orientation / Project Location
- 2: Highway Realignment and Culvert Battery Locations
- 3: Prescribed Fire and Thinning Locations
- 4: Leopard Frog Location and Baseline Monitoring Points
- 5: Corridor Fence Location

Orientation / Project Location  
Map 1

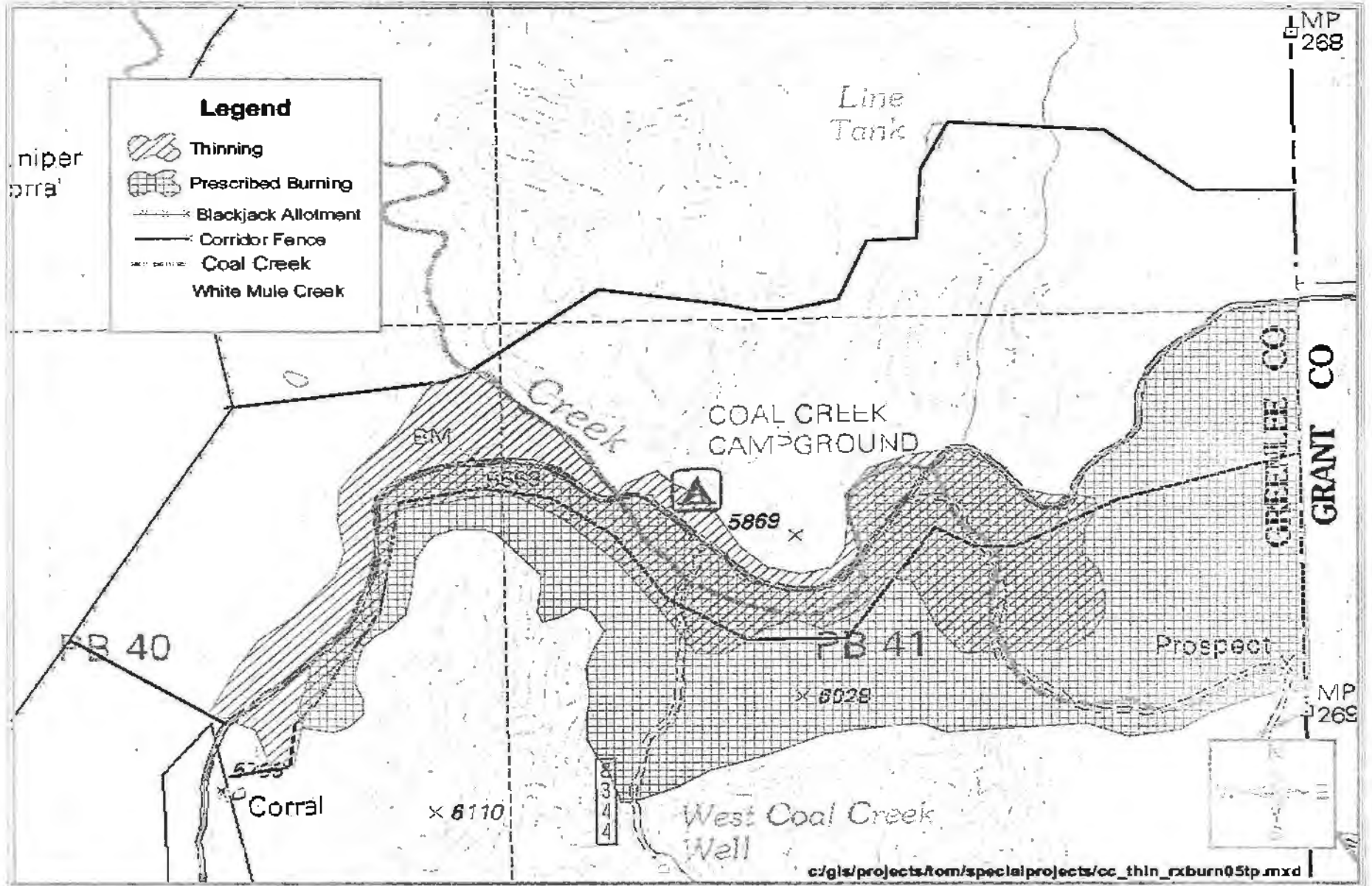


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Highway Re-alignment / Culvert Battery Location  
Map 2

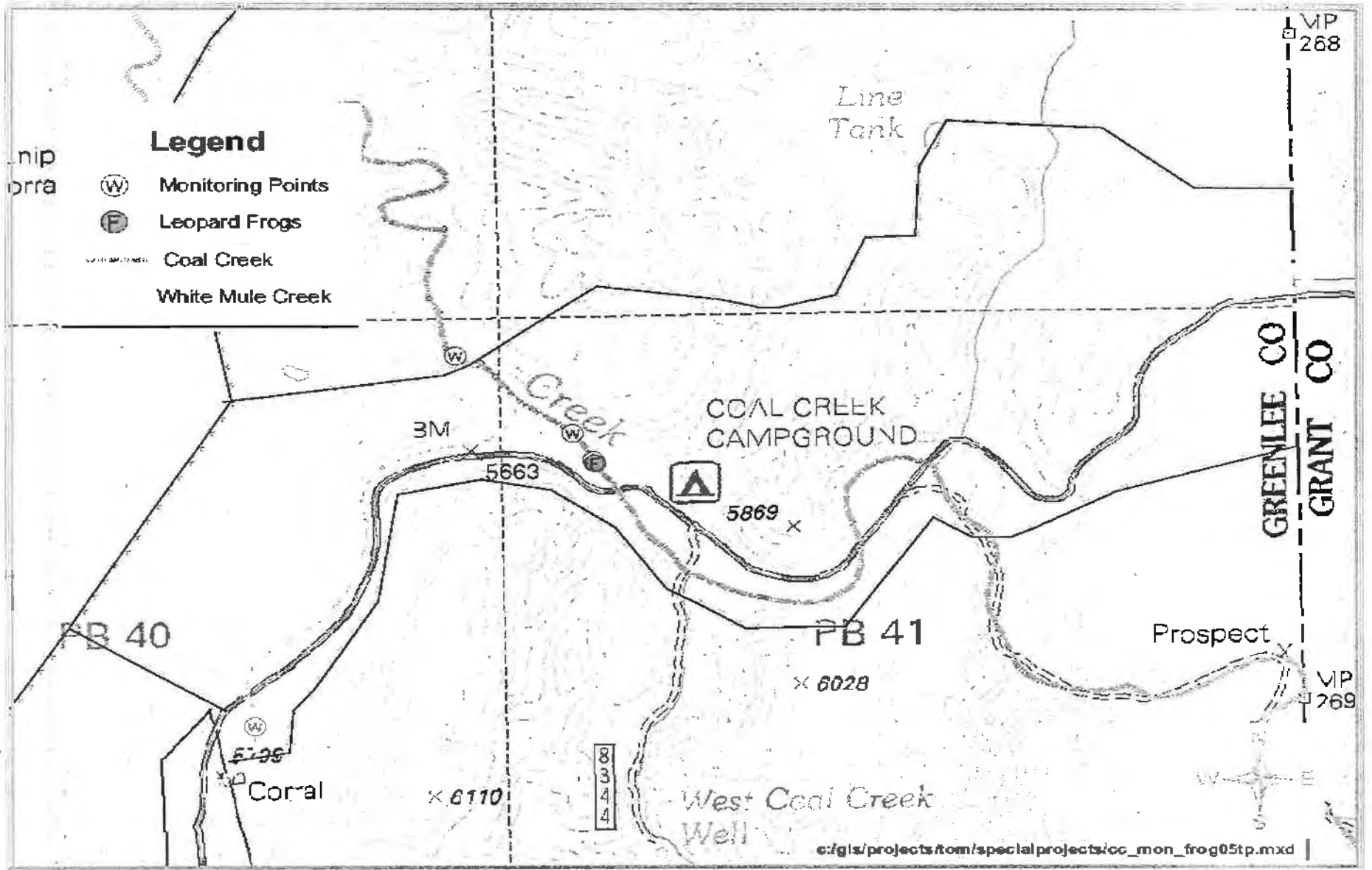


Prescribed Fire / Thinning Locations  
Map 3





Leopard Frog / Monitoring Point Locations  
Map 4



Corridor Fence / Gate / Water-Gap Locations  
Map 5

