# *National Award*

Castle Gate Holding Company
Castle Gate Mine
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**Hardscrabble Canyon**
**Castle Gate Mine**
**Excellence in Surface Coal Mining Reclamation Award**
**2003 Nomination**

## *Nomination*

Castle Gate Holding Company has exceeded the regulatory requirements in its reclamation of Hardscrabble Canyon. Their extra efforts are deserving of recognition. The Permittee recognized the necessity of revising the reclamation and mining plan even though they had an approved reclamation plan which satisfied regulatory requirements. The Permittee took the initiative to sample the coal refuse and soil and reworked the engineering drawings to:

- Increase substitute topsoil cover from nine to twenty two inches.
- Preserve an historic rock wall created by Italian craftsmen at the turn of the century.
- Protect large cottonwoods and oaks in the drainage
- Recreate aesthetic details including cliffs, escarpments, and rockfalls that blend with the natural surroundings.
- Regrade Goose Island, an area that had already received Phase I bond release, and Dog Flat, an area that had been reclaimed ten years prior, to satisfy their own desire for a more perfect landscape.

## *Setting*

The Castle Gate Mine Complex is located approximately 10 miles north of Price, Utah and 110 miles southeast of Salt Lake City in the Wasatch Plateau coal fields in Carbon County. In general, the area is mountainous and dissected by numerous steep canyons with ground surface elevation varying between 6,000 and 9,500 feet. Elevations in the disturbed area are approximately 6700 to 7000 feet.

The climate in the area is semi-arid, with annual precipitation averaging 14.8 inches. The majority of the precipitation occurs as snowfall. Rainfall is typically brief, high-intensity thunderstorms. Much of the precipitation is lost to runoff, evaporation, and sublimation, minimizing the amount of water available for plant growth. Summer high temperatures range from $60^{o}$ to $85^{o}$F and winter lows typically vary from $10^{o}$ to $20^{o}$F. The average frost-free period in this area ranges from approximately 60 to 120 days.

Intensive mining has occurred in Hardscrabble Canyon since the 1880's, when Teacum Pratt opened the first operation for stocker coal. Among these mining operations were several mines, a coal cleaning plant, bathhouses, offices, a warehouse, and truck loading facilities. There are approximately 39 acres of Title V permitted disturbance in the canyon. All disturbances were created pre-SMCRA but continuously used until 1989

when Price River Coal Company closed the mines. The disturbed areas associated with the Castle Gate Holding Company's permit are in Hardscrabble Canyon, Sowbelly Gulch, and at Adit No. 1 in Price Canyon.

***Regrading***

Because the site was disturbed before 1977, there was no consideration for how highwalls and cut slopes were to be reclaimed. It was impossible to completely backfill all highwalls and cut slopes, Castle Gate Holding Company and the contractor did remarkable work to make the remaining cuts and highwalls look natural and blend into the existing landscape. All available material on-site was used to backfill the highwall and cut slopes to a concave slope configuration. Coal debris, coal refuse and any acid- and/or toxic-forming material exposed or excavated during reclamation grading were removed and used as backfill against the highwall, cut slopes, and excavated trenches. This material was then covered with four feet of overburden and substitute soils. Some upper areas of the highwall and selected cut slopes remain and blend into the exiting cliffs in the natural environment. Large rocks have been placed at the bottom of two of these areas, and they look like natural rock falls.

The approved backfilling and grading plan called for 20,000 $yds^3$ of cut and fill material to generate the reclamation topography shown in the plan. However, by the end of the reclamation 93,700 $yds^3$of cut and fill material had been moved and placed, exceeding even the Permittee's expectation of 61,000 $yds^3$.

During regrading, the Permittee found coal refuse in large quantities throughout the canyon. Apparently coal refuse was used as readily available fill material during pre-SMCRA mining. In fact, some of the natural cliffs were buried under refuse and sidecast spoil to create pads for buildings. During regrading, the Permittee directed the contractor, to re-expose these cliffs to match the natural exposed sandstone outcrops. Other areas were graded to blend into and complement adjacent rock outcrops. Numerous large rocks were uncovered during regrading, and many of these were used to make rock piles that have been adopted as habitat by birds and small mammals, particularly in No. 4 Mine canyon and the fan portal highwall areas. These techniques have created a diverse landscape that is capable of supporting a varied assemblage of wildlife species.

A coal preparation plant operated in Hardscrabble Canyon until 1979. Refuse from the operation was placed at the intersection of two tributaries blocking the flow path to the main ephemeral stream. This area, known as "Goose Island," was reclaimed in 1984. Although Phase I bond release was granted in 1985 the Permittee did additional regrading work in 1999 to improve the drainage. In the process of improving the drainage more soil material was spread on several problem areas.

Notably, a side canyon called "Dog Flat" had been filled up to about fifty feet deep with refuse. Dog Flat was a large flat area with a very steep drop to the main part of Hardscrabble Canyon. The area was originally reclaimed in 1987, which left the refuse in Dog Flat. But, later the Permittee decided reclamation would be much better if the

canyon was restored to a more natural configuration. About 15,000 cubic yards of refuse was removed from the canyon and graded into other parts of Hardscrabble Canyon. This exposed a natural rock outcrop that blends very well with the surrounding area. The drainage could function more naturally using bedrock grade controls to drop the channel 75 feet from Dog Flat down to the main drainage in Hardscrabble Canyon.

Utah regulations require the operator to establish a channel capable of conveying the runoff from a 100-year, 6-hour precipitation event. Instead, in the main drainage of Hardscrabble Canyon the Permittee built a channel capable of carrying the flow from a 100-year, 24-hour storm at an additional cost of about $26,000 (1998 dollars). The Permittee feels the long-term benefits outweigh the additional costs. In addition, the channel was extended farther up the canyon than required in the original designs. This was done to better link two sections of the channel but resulted in having to move a few extra thousand cubic yards of coal waste. The operator was able to preserve several fully grown cottonwoods and oaks by realigning the channel from the position originally proposed.

The drainages in both the Hardscrabble and Dog Flat canyons use a buried channel design. This design starts with a well rip rapped over designed channel. The channel is then covered with growth material and seeded. This design closely matches ephemeral drainages in the undisturbed area.

A 75 foot section of Italian rock wall masonry was retained in the area of the upper bath house. The masonry is similar to other rock walls found in Carbon County that were constructed around the turn of the 20$^{th}$ century by Italian craftsmen. The rock wall is considered an enhancement to the postmining land use, since the people of Carbon County are very proud of their mining heritage and do not want all traces of coal mining remove from these sites. The remaining masonry will serve to remind those who pass through Hardscrabble Canyon of that heritage.

***Soil***

The site was disturbed before 1977, so no topsoil was salvaged or available for reclamation. Initial soil investigations identified enough substitute topsoil to cover the entire area with an average of nine inches of soil. However, the Permittee, the contractor (Minchey Digging), and the Division worked together to identify and test existing soils and overburden material to use as additional substitute topsoil with final soil placement depth averaging 22 inches. The natural rock content of these substitute soils was retained and incorporated into the reclaimed surface.

The contractor dug 11 pits to find the material, and the Permittee paid for soil tests to ensure the material was suitable. Analytical results of the coal samples showed the coal material to be single grained with a loamy sand to sandy loam texture. Because of the water limiting conditions of coal and coal-waste material, vegetation regeneration would have been severely restricted if the coal material had not been buried under four

feet of soil. The contractor located and placed approximately 48,000 cubic yards of soil material. This was 28,000 cubic yards more than discussed in the revised plan.

During reclamation, additional sources of substitute soils were located and approved for reclamation use. Some soil was found to have very high salt concentrations and was buried at least four feet deep. Within the area of the old scalehouse, high saline-sodic soils were encountered. Mitigating efforts were employed to utilize these soils during reclamation. The higher salt affected soils were buried under deeper fills and lesser salt affected soils. Mitigating efforts included incorporating hay into the upper layers of soil to help improve aeration and water holding capacity.

***Revegetation and Erosion Control***

Rather than wrapping the site with hundreds of feet of silt fence, Castle Gate Holding Company choose to use structure-free sediment control measures. This was done by gouging the entire area with numerous (about 2 - 3000 per acre) continuous basins about two feet wide, four feet long, and two feet deep. This extreme surface roughening technique is more effective at controlling sediment and promoting vegetation establishment than any other method in arid environments. The contractor was excellent at building these roughened mini-basins.

Several other erosion control measures were implemented to help reduce soil loss from the reclaimed slopes. These include the following:

- Ripping of the re-graded surface prior to placement of growth media or "topsoil"
- Incorporation of hay into the growth media
- Deep gouging of the growth media
- Seeding and establishing vegetation
- Addition of surface mulch (straw) following seeding
- Anchoring the mulch with wood fiber hydromulch and tackifier.

After the graded areas were gouged, the seed was applied by hand broadcasting methods. The site was then mulched with a combination of straw mulch and hydromulch to help reduce erosion. The disturbed area was planted with 5,000 tublings, 1,700 No.1 gallon and 120 No. 2 gallon containerized shrubs. The planted species were: serviceberry, chokecherry, current, Mountain mahogany, bitterbrush, Woods rose, cottonwood, snowberry, elderberry, and Rocky Mountain maple.

Within the disturbed area, there are some areas with native vegetation and a few areas along the ephemeral drainage with nearly full-grown cottonwoods. The Permittee and contractor altered the original grading plans in order to leave as many of these areas as possible.

***Land Use and Vegetation Success***

The pre- and postmining land uses are wildlife habitat and grazing. The main access road in Hardscrabble Canyon was regraded and then reestablished as a 10 to 12 foot wide dirt road for the postmining land use. A local rancher uses the road to trail his livestock to the top of the plateau where he leases grazing rights. The mining and reclamation plan contains information and letters documenting this ownership and use.

The Utah Division of Wildlife Resources classifies the area as critical elk winter range. Elk feed mainly on grasses so particularly tall grasses above the winter snow are important for the postmining vegetation. Grasses are also important for grazing. During site inspections, numerous deer and elk have been seen in the area. Although grasses dominate the vegetation cover, there is a good mix of forbs and shrubs. In general, the plant species that have become established are more desirable for wildlife forage than the species in adjacent undisturbed areas. The dominant species in surrounding undisturbed areas are Salina wild rye and sagebrush. Sagebrush is used extensively by wintering big game; Salina wild rye is tough and not very palatable. By contrast, the dominant species in the reclaimed area are all rated as having fair or better palatability. One common species in the reclaimed area is Great Basin wild rye, a tall grass that is very desirable for wintering elk. In addition, the two dominant grasses (thickspike wheatgrass, *Elymus lanceolatus*, and western wheatgrass, *Elymus smithii*) and one dominant forb (pacific aster, *Aster chilensis*) are rhizomatous and very effective at controlling erosion.

The reclaimed area has a line of mature cottonwoods along the channel and some small patches of oak that were saved from grading operations. Numerous shrubs and oaks have been planted along the channel and elsewhere, and while these have not yet matured to where they are providing wildlife cover, this will eventually happen.

The mining and reclamation plan contains baseline vegetation cover data from 1981 for two undisturbed areas in an adjacent canyon. A comparison of the (2001) cover values between the reclaimed area and these undisturbed areas show the reclaimed area has statistically more cover (44.82%) than the adjacent canyon grass-sage reference area (38.9%) and greater than 90 percent of the cover in the adjacent canyon's mixed brush reference area (47.7%). Cover from introduced species was minor; 5.19 percent and relative cover was 11.58 percent.

When noxious weeds were found the Permittee worked actively to eradicate them. The Utah Coal Rules allow continued efforts to control these weeds through the entire period of extended responsibility for successful revegetation.

Some minor rills are still evident but no signs of accelerated erosion are present. This is due to several factors including some of the reclamation practices the Permittee used.

***Bond Release***

The Goose Island refuse area of Hardscrabble Canyon was graded and seeded in 1984 (8.79 acres) and transplants were planted in 1985. Phase I bond release was given later in 1985. Limited regrading was done in this area in 1999. Phase I bond release was approved for Hardscrabble No. 3 and No. 4 Mine areas (27.7 acres) on February 14, 2001. The substation (0.26 acres) was reclaimed in 2002 and was not included in the Phase I bond release area.

All of Utah's coal mines require a 10 year period of liability. Phase II bond release is granted when vegetation is established and additional contributions of suspended solids are not leaving the site. Utah has accepted vegetation establishment to be met when the vegetative cover meets the final bond release standards for vegetative cover. The Division has approved the Phase II bond release application and has sent it to OSM for concurrence prior to releasing the bond.

Reclamation at Hardscrabble Canyon is not only a model for how pre-law sites in Utah should be reclaimed; the area is also a model for post-law mines sites. Castle Gate Holding Company spent more money than anticipated for this project to achieve long term restoration of the canyon watershed with its ephemeral stream channels. The costs will be repaid in lower long term maintenance and rapid revegetation of the site, leading to a prompt Phase II bond release. The postmining land uses of wildlife habitat and grazing have been achieved and enhanced, and the stream and runoff channels have been reconfigured and built to be stable, achieving better downstream water quality.

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**Photo 1. Goose Island refuse area prior to reclamation.**

**Photo 2. Goose Island refuse area after reclamation.**

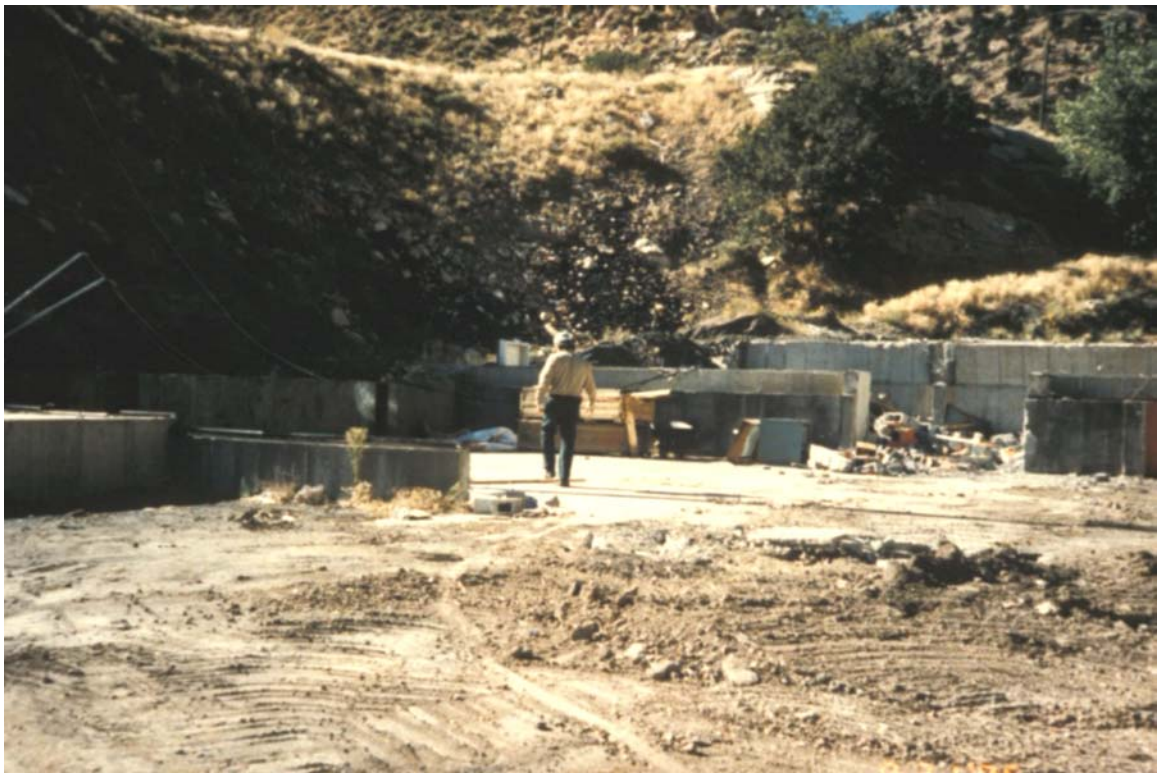

**Photo 3. Coal waste was 50 feet deep in the Dog Flat side canyon.**

**Photo 4. Coal refuse removed and ephemeral drainage restored in the Dog Flat Canyon.**

**Photo 5. This belt line is from the No. 4 Mine.**

**Photo 6. The No. 4 Mine canyon was reclaimed before the Permittee revised the reclamation plan; some areas in the canyon were reworked.**

**Photo 7. This photo was taken up canyon from the No. 3 Mine prior to reclamation.**

**Photo 8. This photo was taken up canyon from the No. 3 Mine after reclamation.**

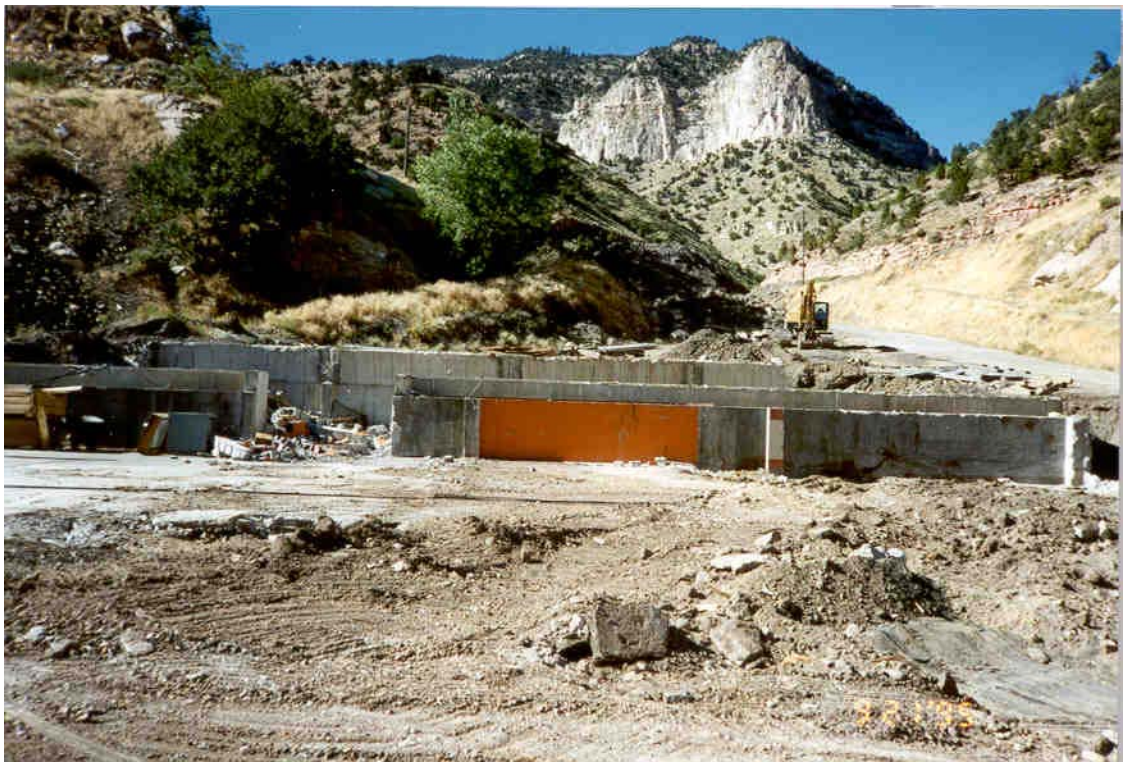

**Photo 9. The facilities area photo was taken during demolition. The main channel was reestablished and the road realigned for the postmining land use.**

**Photo 10. The ephemeral channel was reestablished using the "buried channel" concept.**

**Photo 11. Italian rock wall masonry was retained in the area to remind us of the mining heritage.**

**Photo 12. Retained cut slopes blend well into the natural rock cliffs in the area.**

**Photo 13. Hydromulching a retained cut slope in the No. 4 Mine area of Hardscrabble Canyon.**

**Photo 14. Large rocks were spread on the surface for visual effects and to provide flora and fauna with a microhabitat.**

**Photo 15. The Division of Wildlife Resources classifies the area as critical elk winter range.**

**Photo 16. Although grasses dominate the vegetation cover, there is a good mix of forbs and shrubs.**