

2013

Advanced Reforestation Practices



Texas Westmoreland Coal Company
Jewett Mine
Texas Railroad Commission / Interstate
Mining Compact Commission 2013
Reclamation Awards Application
January 2013

I. Nomination: Coal

II. General Description

Texas Westmoreland Coal Company's (TWCC) Jewett Mine is located seven miles west of the intersection of U.S. Highway 79 and FM 39 as shown in Exhibit 1, *Jewett Mine Location Map*. The mine occupies a stretch of land spanning 7.5 miles, from Interstate Highway 45 southwest to the eastern shore of Lake Limestone crossing portions of Limestone, Leon, and Freestone counties. Currently, 31,000 acres account for two adjoining mining permit areas. The larger of the two, Permit 32F, totals approximately 21,500 acres spanning southward from State Highway 164 to FM 1512. The remaining 9,500 acres of Permit 47A run south from Interstate Highway 45 where it meets permit 32F just north of State Highway 164. The mine has been in operation since 1985 and employs approximately 400 full-time personnel. The Jewett Mine currently operates four open pits that supply lignite to the Limestone Electric Generating Station. The Jewett Mine is the second largest in Texas and produces approximately four to five million tons of lignite each year, representing 14% of the total annual coal production in Texas. The active pits range from a depth of 20 to 200 feet and are being excavated by three Marion 8200 and one Marion 8750 draglines. Suitable Plant Growth Material (SPGM) is pre-benched ahead of the draglines utilizing two Komatsu PC2000 excavators and a mixed fleet of Caterpillar 777F, 777D and 785 end dumps.

To date, approximately 12,000 acres of the Jewett Mine is in various stages of the reclamation process. Since 2004, 5,189.3 acres have been initiated in the Extended Responsibility Period (ERP). Approval of Phase III release from performance bond obligations has been obtained on 2,034.8 acres and additional 2,382.2 have received Phase II release. Currently two multiphase bond release applications totaling 2,115.2 acres are under review with the Commission and a similar package is proposed for submittal in 2013.

III. Reclamation

Background

Establishing forested areas through large scale plantings within reclaimed soils in Texas can be very difficult and in most cases, requires several years of replanting to achieve desired success rates. This is most often attributed the droughty Texas climate, the obstacles of revegetation in reclaimed soils and herbivory from native and invasive species alike. Since 2009, the Texas Westmoreland Coal Company's (TWCC) Jewett Mine has been proactive in the establishment of woody stocked areas including upland woodlands and riparian forests by addressing these issues and beyond through a focus on species and age diversification, site specific planting arrangements, native material selection, soil additives for increased moisture retention, establishment irrigation and feral hog population control.

Woody plant material

Woody stocked areas of upland and bottomland sites at the Jewett Mine possess diverse stands of hardwood species. Diversity is emphasized by TWCC to provide a variety of different cover types and food sources for wildlife. Species such as American beautyberry and wax myrtle provide low growing cover for ground-nesting birds and fruits which provide vital nutrition. While Southern red oaks and Willow oaks provide upper canopy cover and mast production for white tailed deer and wild turkey. Once mature, these areas will become habitats of increased stability unlike many of the surrounding forests which were historically logged out and have consequently become less diverse, and overrun with

lower quality fast growing species, such as Blackjack oak, Winged-elm, Black willow and Cottonwood. These less diverse forests are more susceptible to catastrophic events such as disease and drought.

Since water velocity and volumes in streams and creeks fluctuate, TWCC realize that in order for woody shrubs and trees to survive they would need to plant larger stock to withstand the force of the water flow. By planting



various size trees, from 1 gallon to over 30 gallon material, in addition to over twelve different hardwood species on a given project, these riparian areas look more established upon completion and encourage animal reintroduction into the ecosystem more quickly. After the woody stock is planted, supplemental water is provided to the plant material for two growing seasons. After two years the roots have typically established to the point that irrigation is no longer necessary and the irrigation systems are removed.

Herbaceous plant material

Initial stabilization of the soil in the riparian areas at TWCC is achieved by the root systems of herbaceous material. TWCC has worked extensively to reduce the need for traditional geotextile materials such as concrete drop structures, grouted rip-rap, and concrete Fabriform drops by replacing them with natural erosion control matting and hydromulching. Additionally herbaceous material is selected that have large root masses to provide the greatest stability rating for protection against erosion.



Planting arrangements and stock size

Site specific planting arrangements are also used by TWCC to maximize survival and mimic a naturally developed landscape. Within bottomland sites, seasonally flooded and perennially flooded tree planting zones are developed with specific species in mind. The planting of various sizes of woody material (small plugs to 65 gallon material) also helps to achieve a more natural ecosystem in far less time than a



typical planting of seedlings. Increasing the time needed for establishment facilitates the bond release and ERP process. The use of species which are native to the Post Oak Savannah Ecoregion ensures that woody materials are well suited to the local climate conditions and provide the types of food and cover native wildlife are adapted to utilizing. Additionally, the incorporation of larger stock within these areas also facilitates the development of understory species which typically rely on a mixed level of canopy cover rather than full sun to develop and thrive.

Irrigation System & moisture retention methods

There are several different circumstances at the Jewett mine where irrigation measures are utilized to enhance establishment and minimize mortality. Factors such as topography, water source availability, water requirements for specific species of plants, site access, and wind exposure are taken into consideration. When irrigating woody plants and trees, a temporary, above ground PVC pipe system is typical. After the plant locations are identified, a combination of $\frac{3}{4}$ " and 2" pipe is linked together with

an adjustable bubbler placed at each tree which allows water to flow from 0-1 gallon/minute. Each zone usually contains about fifty trees with a single connection tie-in point. This allows for the watering of approximately fifty trees in ten minutes. In 2010, 5,700 trees with over 14.1 miles of pipe were irrigated at the Jewett Mine. In 2011 and 2012 the number of trees irrigated increased to almost 9,500 with about 23.5 miles of pipe. We have transported water from groundwater wells throughout the mine site to the tree mts using trucks or tractors equipped with various size nurse trailers. Irrigating herbaceous plant material at the Jewett Mine presents another set of challenges and opportunities. Most native grasses planted via hydromulch yield higher germination rates and added erosion protection. Moisture is critical during the first week to ten days after planting. As previously mentioned, topography, water source location and access determine the type of irrigation method used.



Those include:

- Temporary above ground PVC pipe with impact heads. Water is either hauled to the site with a nurse trailer and tractor, or tied directly to a pressurized well.
- A nurse trailer with custom nozzles used to broadcast water over the recently planted area.
- A Nelson Big Gun water cannon set on a movable tripod.

As a steward to the environment, TWCC has also begun the process of advancing our irrigation program through the use of solar powered water pumps. Once installed, these mobile pumping systems will facilitate with the watering of newly planted areas within the reclamation progresses while reducing costs associated with hauling water to these remote tree sites. When planting larger trees, TWCC also utilizes rice hull ash mixed in with the soil used to back fill around the root balls. This by-product of the rice industry aids in the retention of moisture given the high sand content throughout most of the mine.

Feral hog control

Herbivory from wildlife species is a typical factor when dealing with the reestablishment of vegetation in a reclamation setting, yet the impacts from feral hogs in recent years has resulted massive losses across the state. The Jewett Mine minimizes these impacts by trapping feral hogs. As many as 800 hogs have been removed from the mine in one annual year which has resulted in greatly reduced losses in newly planted areas as well as in established vegetation.

IV. Accomplishments

Survivability and Biodiversity

With the implementation of more aggressive irrigation practices at the Jewett Mine, TWCC has seen survival rates of woody plant material increase substantially. Of the two riparian areas that have utilized irrigation, Mine Creek achieved a success rate of 80.9% after two full growing seasons. Wilkerson Branch saw a 64.8% of the woody stock live after the first year. Both of these numbers are significantly higher than previous years where non-irrigated tree mts could typically see a success rate below 20%. TWCC has emphasized planting larger and varying size containers of trees. The benefits are a shorter time-frame for the area to mature, reintroduction of wildlife back into the ecosystem more quickly, and less mortality due to erosion. The major drawback is the initial cost of the material and labor needed to install it. At TWCC, we view irrigation as an investment into the woody and herbaceous material that we plant. We can plant fewer trees, maintain higher stem counts through bond release, and spend less money on erosion repairs and replanting with irrigation methods that stabilize soils and achieve stocking rates more efficiently and effectively usually



after the first installation. An added cost savings is achieved through the reuse of most materials from project to project and year after year.

Not be overlooked is the added benefit of biodiversity within the ecosystems. Irrigation has allowed us to plant more species of herbaceous and woody plant material than we have ever before. Native material even needs supplemental water to help establishment. In 2010 we planted 11 different species



of hardwood trees along Mine Creek. (Table 1.1 on Page 7) They include: Bald Cypress, River Birch, Willow Oak, Overcup Oak, Live Oak, Red Oak, Bur Oak, Chinquapin Oak, Water Oak, Cedar Elm, and Pecan. Herbaceous material included natives such as Little Blue Stem, Switchgrass, Eastern Gammagrass, Virginia Wildrye, Green Sprangletop, and

Indian Grass. In 2011 we expanded the species diversity to sixteen woody species with the addition of American Elm, Green Ash, American Beautyberry, Wax Myrtle, and Buttonbush. (Table 1.2 on Page 7) We see two major benefits of species diversification. The more species of grasses, understory, and canopy trees, the less susceptible the ecosystem is to widespread damage due to disease and predation. Also, the more variety of plant material in an ecosystem, the more species of animals will utilize the area for food, shelter, or transportation corridors. Establishment of so many different species of plants is greatly increased because of our irrigation practices.

The Future

At the Jewett Mine, we have seen too much success with utilizing irrigation systems for both herbaceous and woody plants to not continue this practice. In early 2013, we have already begun the planting of two more riparian areas, E6 drainage and the lower region of Wilkerson Branch. It will include planting 10,725 containerize trees that will be irrigated. Hydromulching temporary and native grasses are a daily practice on the mine, and we will continue to irrigate those areas as well. The scale of the



irrigation practices have forced us to look at other cost saving and less labor intensive ways to irrigate these areas.

In 2013, TWCC will be installing our first solar powered reclamation water well on the mine. Unlike any other wells we have on site, this well is designed specifically to facilitate with our post-mine reclamation watering needs. The well pump will be powered by several large solar panels set adjacent to the well. We decided to use solar power because of the remote location of the well from an existing power source. Also, TWCC believes that the long-term cost of traditional power sources (electric, gas/diesel) versus solar would be more expensive. Solar power on the mine site might seem counterintuitive, but we believe in select situations renewable energy is the appropriate power source both financially and environmentally.

Our first solar powered reclamation well will be located along the lower end of Wilkerson Branch before it feeds into pond 33. The system will have a traditional three phase Grundfos submersible pump. Solar panels will be positioned adjacent to the well location and for maximum sun exposure. There will be a 3,000 gallon storage tank with a float valve which is then tied back to the



pump to ensure the tank remains full. Multiple discharge points will allow us to utilize the solar pumping system to operate the remote control valves being installed on the 1650 containerize trees planted in January-February of this year. At the same solar well system, we can load water directly into our nurse trailers or hydromulchers instead of traveling to the closest available water source several miles away. Both these applications of the system will save TWCC money since it will greatly reduce the time necessary to water trees and obtain water for hydromulching.

We will be installing electric remote control valves on some of our irrigation zones that will be tied directly to our solar powered reclamation well. This system will operate on a preset watering schedule powered by 9V batteries and will require no additional manpower or equipment after it is installed. We will continue to monitor the trees weekly to insure no disease infestation, feral hog damage, and that the watering quantity is appropriate for the current climatic conditions. This technological advancement will allow TWCC to continue to maintain a high survivability rate for a growing number of woody plant materials in a cost efficient manner.



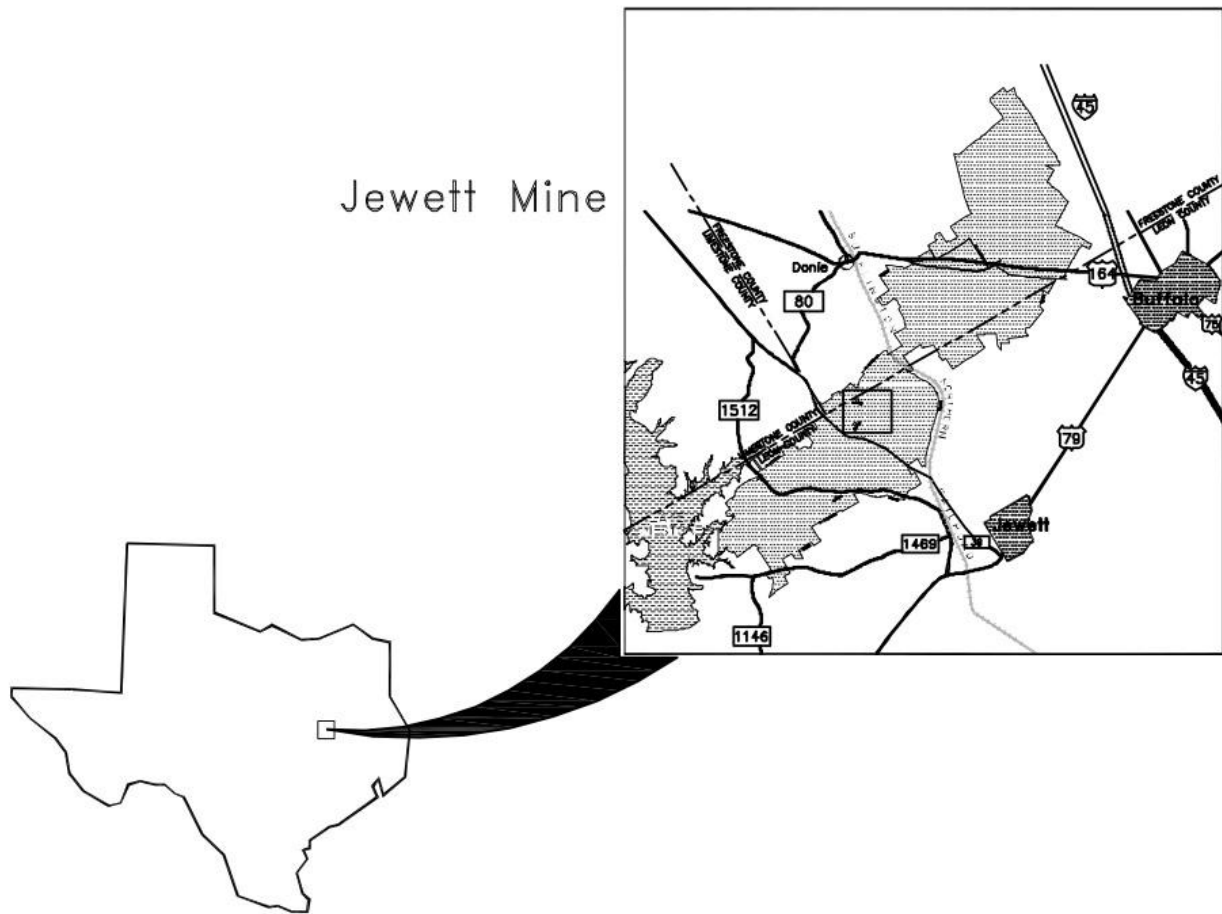
Table 1.1

MINE CREEK				
Trees inventory at Fall 2012 (2 years after planting)				
Species	Alive	Dead	Total Found	% Found Alive By Species
Bald Cypress	549	219	768	71.48%
River Birch	579	128	707	81.90%
Willow Oak	1048	103	1151	91.05%
Overcup Oak	339	35	374	90.64%
Live Oak	190	46	236	80.51%
Red Oak	244	36	280	87.14%
Bur Oak	206	70	276	74.64%
Chinquapin Oak	149	73	222	67.12%
Water Oak	60	10	70	85.71%
Cedar Elm	314	96	410	76.59%
Pecan	132	86	218	60.55%
Total	3810	902	4712	80.86%
*** Initial planting were all containerize from 1 - 30 gallon				

Table 1.2

WILKERSON BRANCH					
TREES inventory at fall 2012 (1 year after planting)					
SPECIES	TOTAL PER SPECIES	DISTRIBUTION %	Dead	Alive	Percent survivability
BUR OAK	208	6.00%	42	166	80%
CHINQUAPIN OAK	281	9.50%	59	202	72%
OVERCUP OAK	200	4.10%	30	170	85%
SOUTHERN RED OAK	364	7.50%	62	302	83%
WATER OAK	200	4.10%	90	110	55%
WILLOW OAK	200	4.10%	106	94	47%
LIVE OAK	500	10.30%	127	373	75%
RIVER BIRCH	400	8.20%	76	324	81%
BALD CYPRESS	208	4.00%	18	190	91%
CEDAR ELM	148	4.80%	53	95	64%
AMERICAN ELM	850	15.00%	383	467	45%
PECAN	100	2.10%	64	36	36%
GREEN ASH	851	15.00%	400	451	53%
AMERICAN BEAUTYBERRY	100	2.10%	43	57	57%
WAX MYRTLE	50	1.10%	23	27	54%
BUTTONBUSH	200	2.10%	114	86	43%
TOTAL NUMBER OF TREES	4860	100.00%	1690	3150	overall success rate 64.8%
Initial Planting					
GROUPINGS:	LINERS	1-3 GALLON	5-7 GALLON	30 GALLON	
PERCENT	48%	30%	17%	5%	
TOTAL QUANTITIES	2344	1458	815	243	
*** mostly liner material that wasn't irrigated					

Location Map



V. Contact Information

J. Denny Kingsley, P.E.
Texas Westmoreland Coal Company
PO Box 915
4336 FM 39 South
Jewett, Texas 75846
Office: (903) 626-6390
Fax: (903) 626-6826
Cell: (903) 229-1754