TEXAS WESTMORELAND COAL COMPANY

Jewett Mine

DS E-11 Civil Structure

Reclamation Award Application

Limestone, Leon, and Freestone Counties

Jewett, Texas
January 2016

NOMINATION: Coal

THE MINE

Texas Westmoreland Coal Company's (TWCC) Jewett Mine operations is located seven miles west of the intersection of U.S. Highway 79 and FM 39. The mine occupies a stretch of land 7.5 miles at its widest point, spanning 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 276 full-time personnel. The Jewett Mine currently operates three 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 140 to 240 feet and are being excavated by three Marion 8200 and one Marion 8750 draglines. Suitable Plant Growth Material (SPGM) is excavated ahead of the draglines utilizing one Caterpillar 6060 shovel, two Komatsu PC2000 excavators and a mixed fleet of Caterpillar and Komatsu end dumps ranging in size from 100- to 200-ton capacities.

To date, approximately 15,528 acres of the Jewett Mine have been disturbed, of which, 13,708 acres are currently in various stages of reclamation. Since 2004, 5,252.4 acres have been initiated in the Extended Responsibility Period (ERP). Approval of Phase III release from performance bond obligations has been obtained on 5,120.8 acres and an additional 560.3 acres have received Phase II release. Currently, one multiphase bond release applications totaling 497.3 acres are under review with the Railroad Commission of Texas (RCT) and a similar package is proposed for submittal in 2016

EXECUTIVE SUMMARY

In 2009, Texas Westmoreland Coal Company (TWCC) embarked on a mission to not only improve the stream restoration efforts at the Jewett Mine, but to build a process that would be recognized as the premier stream restoration program in the US. This ambitious effort stemmed from the awareness being placed on the growing emphasis across the country relating to the overall stream function and stability.

Reclamation activities at the Jewett Mine, including stream restoration, have been underway since the late 1980's. Although the previously constructed streams functioned well, they did not include several components of a naturally functioning stream system. In 2009, the Office of Surface Mining, Reclamation and Enforcement (OSMRE) began review and evaluation of the *Stream Protection Rule*. This document initiated the process for considering a different approach to restoring stream sites by implementing the general principles of geomorphic reclamation.

The overall process outlined in this report is a collaborative effort between several sources including the regulating agencies providing oversight the mine reclamation, engineering and environmental consultants and the Jewett Mine personnel. As with all best practice process, excellence begins with planning and design. Planning includes the gathering of baseline data of the impacted stream channel and is a vital step in the process. To account for premine baseline stream conditions such as habitat quality and species composition, qualitative surveys are conducted on local, similar type tributaries. The design component is initiated from this data and ensures that the final design mimics channel functions found in the local setting. Significant advancements achieved through the use of innovative technologies such as Envirogrid and Carlson's Natural regrade software, have resulted in final streams that exhibit increased geo-fluvial characteristics and require far less reinforced structures.

Enhanced revegetation efforts utilizes several other "best practice techniques" such as hydro mulching utilizing grasses native to the immediate area, the planting of high quality hardwood species and the use of specialized irrigation to ensure a high success rate in any condition. The Jewett Mine has paved a new path forward with respect to stream restoration by studying the stream channel prior to disturbance, developing a plan that mimics the original system and transitioning that plan into an effective means of construction. By this, the Jewett Mine is confident that it is living one of their core values - environmental excellence.

PLANNING AND DESIGN

Historically, final stream channel designs at the Jewett Mine were very limited in natural aspect. These designs exhibited linear channels, with virtually no sinuosity, and typically addressed elevation changes with rip rap, concrete reinforced riprap or concrete-reinforced drop structures. Thought was not given to attempting to match the post mining stream conditions utilizing effective or innovative reclamation techniques to resemble the premine conditions. Today, TWCC has improved its initial and final design capabilities through revised and more comprehensive initial planning and the use of Carlson's Natural Regrade software. Several concepts and elements from the *Summary of the OSM Stream Protection Rule* were evaluated and utilized by the Jewett Mine staff for each individual stream channel to be restored following lignite removal. Using the GeoFluv™ design methodology for landform design, this software has allowed TWCC to prepare several iterations of a stream channel restoration project design before any dirt is moved. Further planning involves TWCC engineers and operations department in developing efficient, productive material handling plans and schedule the proper reclamation equipment for reclamation and construction activities. This design methodology results in a more natural, sinuous channel and landscape that is similar to premine stream conditions.

During the final design process, onsite conditions are examined by generating a surface model called a triangulated irregular network (TIN) of the existing post mining topography. This model is then compared to the original premining topography model (TIN) to determine soil quantities. Carlson's civil design and natural regrade package are utilized at this stage to compute and enhance the proposed design. Several design modifications can then be evaluated to maximize productivity and match soil moving operations with the right equipment. To account for premine baseline stream conditions such as habitat quality and species composition, qualitative surveys are conducted. A thorough and comprehensive revision application can then be prepared and submitted for approval by the Railroad Commission of Texas (RCT). Once approved, these final designs are then scheduled for construction based on the regrade compliance timeline and equipment availability.

DS – E11 DESIGN AND CONSTRUCTION

Prior to designing this structure, TWCC conducted field observations of the watershed, soils, vegetation and the general topography to be affected by this structure. The review supported there were no pipelines, occupied dwellings, or cemeteries within the projected vicinity of this structure. The

watershed that this structure is located in encompasses less than 640 acres and is not considered intermittent. Furthermore, it was deemed this structure would not adversely affect any wetlands, cultural resource sites, prime farmland, or endangered/protected species.

In order to provide stability and manageable surfaces conducive to the general topography of the area, a series of three permanent drop structures were designed to manage the flow from this watershed in the E West mining area. According to the reclamation contours, there was an approximate 21-foot elevation difference and 1,000' of length for the proposed drainage. This elevation difference and channel length were the challenge in protecting the channel from erosion. The channel between the drops had varying slopes and methods of erosion protection. Three sections of the channel that have 10- 15% slopes were protected with a rock-filled cell confinement material, EnviroGrid. The remainder of the channel has a 0.25% slope and was designed to include an underlay of EnviroGrid 6" EGA 30 with Bermuda grass establish to the crest of the defined channel.

The vertical drop structures were enhanced by the addition of features developed by a landscape architect. The concrete faces were designed to be covered with flagstone to give the appearance of a natural rock waterfall, while maintaining the structural integrity of concrete. Large native stone boulders were strategically designed within the channel to assist with energy dissipation of the expected flow rates. In the basin area below the drop structures, a 1 foot deep pool was also created dissipate channel flow.

RCT regulations require that a permanent diversion which drains a watershed with less than 640 acres be able to pass runoff generated by a 10 year – 6 hour storm event. In Exhibit 1, the watershed amounting to 65 acres is located within portions of Areas D and E West reclaimed mine areas. The watershed also includes drainage from the north and south sides of State Highway 164. The majority of the watershed was considered as Soil Type C – Pasture (Fair) with a portion being SH 164. The resulting overall worst case curve number for this watershed was determined to be 80 CN. For sizing purposes, all three structures were designed based on the flow occurring at the lower downstream drop structure.

The DS E-11 Permanent Drop Structures consist of three vertical drop structures. DS E-11A has a 5 foot vertical drop while DS E-11B and DS E-11C both have 7.5 foot vertical drops. All of these structures have a 10 foot bottom width with 3(h):1(v) side slopes and extend 5.5 feet beyond the vertical drop. 2" rock riprap was placed within the cells of the EnviroGrid beginning at the exit of each structure to assure a non-erosive transition from the structure to the channel. These Permanent Drop Structures have been designed to safely pass the peak discharge of 94.50 cfs from the 10-year, 6-hour storm event.

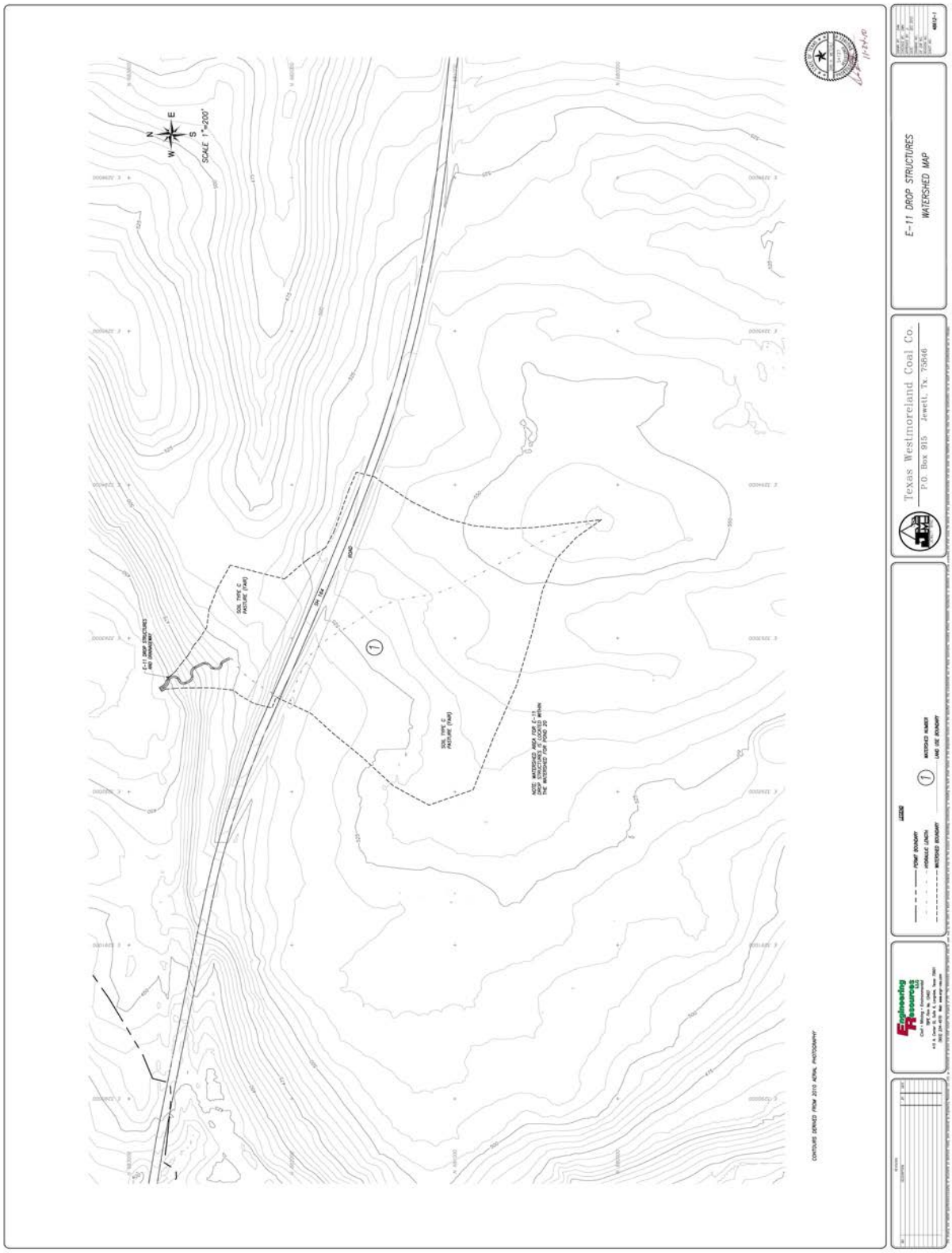
E-11 DROP STRUCTURES
WATERSHED MAP
Texas Westmoreland Coal Co.
P.O. Box 919 Jewett, Tx. 75846
SCALE 1"=200'
N
S
E
W
ROAD
SOIL TYPE C
PASTURE (TAM)
CONTOURS DERIVED FROM 2010 AERIAL PHOTOGRAPHY

Exhibit No. 1

Figure No. 1 – Final concrete construction of the middle vertical drop structure.

Revegetation & Management

Figure No. 2 – Applying hydro mulch near the middle vertical drop structure.

In conjunction with advancement in design and construction, TWCC has enhanced the revegetation process of streams at the Jewett Mine by utilizing native species and improved planting methods. Due to previous stream designs which exhibited increased slopes and highly erodible soils, Bermuda grass is often the primary herbaceous species utilized for revegetation due to its quick establishment and increased ground cover potential. TWCC transitioned from the placed sod to beyond the crest of this channel utilizing hydro mulch methodology. The hydro mulching process of applying seed, mulch, and a tactifier to the soil provides an alternative revegetation method where steep slopes inhibit planting by conventional means. This process allows for quicker seed germination, adds organic matter and retains soil moisture. Both native trees and shrubs were planted along the slopes and crests of this structure. Woody species selection was based on factors including flooding tolerance, specific planting zones for semi-flooded to perennially flooded riparian zones, mast production and growth rate.

Figure No. 3 – Herbaceous and woody vegetation planted along channel.

IN CLOSING

At the Jewett Mine, the stream restoration process has undergone a complete renaissance from conception to implementation. All streams, drainage channels, and tributaries are treated with a respect for the natural and sustaining functions of the stream process. The Jewett Mine staff takes great pride in the development of the overall stream restoration and looks to find better ways to incorporate even more process improvements. The design aspect of the process is layered with checks and balances to ensure that the best possible plan is developed and the construction of the stream channel boasts the best available technologies both during and after the basic channel is formed. With a renewed approach made feasible through developments in technology, ongoing science and determined attitudes, the future land reclamation within the Jewett Mine will serve as an example of how excellence can be accomplished.

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