APPENDIX D1-LAND USE

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APPENDIX D1- LAND USE

D1 LAND USE

The primary land uses in Crook County are grazing land, timberland, fish and wildlife habitat, pastureland, industrial commercial (oil and gas production) and cropland. More intensive agricultural uses are precluded by low precipitation and soil limitations. Other land uses such as residential and industrial developments have historically been insignificant. More recently, methane development has been a significant industrial use bringing increased activity and new jobs to the area.

D1.1 Past Land Use

Determination of Pre-mining Land Use

The Primary land uses within the permit area for the 20 years prior to mining have been hay harvesting , livestock grazing and wildlife use.

D1.2 Present Land Use

There were three pre-mining land uses within the permit area. The principal land use is agricultural with hay harvesting and livestock/wildlife grazing as the predominate uses. The other identified land use is recreational with the potential for hunting in the area.

Grazing Land

The lands within the permit area are part of the Creoll Ranch ranching operations. A portion of the 600 acres in the permit area is harvested for hay. Grazing is also conducted after hay harvesting or in years of poor hay production.

Wildlife Habitat

Wildlife can utilize the entire permit area. The area has limited topographic diversity therefore vegetation diversity is limited which limits the range of fauna found on the permit area. There are no trees within the permit area and minimal shrubs. Water resources are also limited within the permit area. Whitetail deer, mule deer, antelope and elk have been observed utilizing the area in the past.

Recreational

Pre-mining recreational uses of the permit area included primarily hunting. All of the lands In the are

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privately owned with limited access. The State lands within and adjacent to the area are open to the public but have limited or no access other than across private land which limits public recreational use.

Transportation

Interstate 90 and Rifle Pit Road (Crook County road) are the only public roads near the permit area. Interstate 90 borders the western limits of the permit area and Rifle Pit Road is located along the northern permit boundary.

D1.3 Post-mining Land Use Capabilities

The post-mining land use capabilities are the same as the pre-mining capabilities. The affected areas are very limited in size so their disturbance will have little or no impact on the current land uses in the area. CROELL Redi-Mix will reclaim the lands to hay lands and grazing lands that will support the same use as pre-mining lands.

D1.4 Areas Unsuitable for Mining

There are no areas designated unsuitable for mining within the permit area.

D1.5 Areas Prohibited to Mining

There are no areas prohibited to mining within the permit area.

D1.6 List of Persons Consulted

Information presented herein was compiled by Environmental Solutions, Inc. from the various baseline reports completed for this permit application and other public sources.

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APPENDIX D2 - HISTORY OF THE PERMIT AREA

D2.1 Ranching

As indicated by the pre-mining land use described in Section D 1, sparse population characterizes the modern history of Crook County and an economy based primarily on ranching. The lands within the permit area are owned by one private ranch operation.

As discussed in the cultural resources report presented in Appendix D3, there were no recorded homesteads identified within the permit area.

D2.2 Industry

The permit area has no history of other industrial activities.

D2.3 Recreation

Recreational activities, including hunting, hiking, and camping, are significant recreational activities in Crook County. Hunting and hiking activities available to the public are limited within the permit area and controlled by the private surface owner controlling the access.

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APPENDIX D3 – CULTURAL RESOURCES

D3.1 Introduction

A Class III cultural resource survey was conducted within the affected areas in 2007. The purpose of the survey was to search for, locate, and evaluate all remains of archaeological, paleontological, and historical materials on the lands to be mined. The surveys were conducted using methods standard at the time of the survey. Evaluations were based upon the National Register of Historic Places criteria.

A 2007 file search indicated that no previous survey was conducted within the permit area. Two previously recorded historic roads are within the file search area.

D3.2 Survey Findings

ACR Consultants, Inc. recorded five isolated finds and six isolated resources but no sites during the survey. Results of the survey where submitted to WDEQ/LQD by ACR in 2007. LQD submitted the report to the Wyoming State Historic Preservation Office (SHPO) for approval. A SHPO stipulation of that approval requires the permit holder to halt all mining activities and report any unanticipated archeological discoveries identified during mining to LQD and the SHPO.

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APPENDIX D4 - CLIMATOLOGY

APPENDIX D4 CLIMATOLOGY

The climate in the area is semi-arid, with a mean annual precipitation in Sundance of about 18.82 inches. June (3.24 inches) and May (2.77 inches) are the wettest months, and January and February (0.74 and 0.72 inches) are the driest. Potential evapotranspiration, at approximately 31 inches (NOAA 1969), exceeds annual precipitation. Site elevations over the permit area range from about 4380 feet to 4520 feet msl.

D4.1 TEMPERATURE

Daily temperature has been recorded at the Sundance station (Index No. 8705, Division No. 06) for a 77 year period (1926-2003). This data is reported by NOAA in the Climatological Data Annual Summary for Wyoming. Table D4-1 presents a summary of precipitation data from the site for the year 2007.

The mean of the average hourly temperature recorded in Sundance over the period of record is 43.8 °F. July is the warmest month with a mean temperature of 69.2 F; January is the coldest (19.10 F). The frost-free period is 100 to 125 days.

D4.2 SURFACE WIND

Wind speeds are highest in the winter and spring and are predominantly from the west and southwest. Winter gusts often reach 30 to 40 mph. During periods of strong wind, dust may affect air quality across the region.

Local wind speed and direction data is collected nearby at the Inyan Kara weather station operated by WyDOT. This site is located on I-90 west of Sundance Data files for the Inyan Kara site are available from 1994 – 2002. Current weather conditions are also available on-line for this site. Table D4-2 summarizes the wind speed and wind direction data for the year 2001.

D4.3 PRECIPITATION

Daily precipitation has been recorded at the Sundance station (Index No. 8705, Division No. 06)

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for an 80 year period (1923-2003). This data is reported by NOAA in the Climatological Data Annual Summary for Wyoming. Table D4-3 presents a summary of precipitation data from the site. An average of 17.82 inches of precipitation is received. Some snowfall data is also available. The average annual snowfall is 74.3 inches, with March as the highest snowfall month (12.1 inches) with December being the next highest (10.0 inches). In Sundance, about one-third of the moisture received each year is from snow.

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Table D4-1

Average Hourly Temperature by Month, NOAA Sundance station, 2003

	Average Hourly Temperature, °F, 2003	Departure from Normal, °F	Long Term Average Temperature, °F
January	27.80	8.70	19.10
February	21.70	-2.40	24.10
March	30.60	-2.00	32.60
April	47.40	5.30	42.10
May	53.20	0.80	52.40
June	59.00	-3.40	62.40
July	74.30	5.10	69.20
August	74.50	6.50	68.00
September	55.10	-2.20	57.30
October	51.20	5.60	45.60
November	27.10	3.20	23.90
December	28.30	6.80	21.50
Total	45.90	2.10	43.80

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Table D4-2

Annual Wind Speed Class and Direction, Percentage of Total Observations, WyDOT Inyan Kara Weather Station, 2001 [1]

Wind Direction	Wind Class A (0-4 mph)	Wind Class B (4-7.4 mph)	Wind Class C (7.4-12 mph)	Wind Class D (12-19 mph)	Wind Class E (19-25.8 mph)	Wind Class F (>25.8 mph)	Total
N	0.85%	0.72%	1.12%	0.75%	0.13%	0.01%	3.57%
NNW	0.48%	0.39%	0.28%	0.19%	0.02%	0.00%	1.37%
NW	1.74%	1.55%	0.98%	0.39%	0.06%	0.00%	4.73%
WNW	1.25%	1.46%	1.53%	0.83%	0.34%	0.08%	5.49%
W	2.25%	3.50%	5.08%	1.01%	0.11%	0.01%	11.96%
WSW	1.70%	2.66%	3.29%	0.22%	0.03%	0.01%	7.91%
SW	2.36%	4.00%	7.45%	2.29%	0.36%	0.04%	16.49%
SSW	0.92%	1.09%	3.35%	3.00%	1.21%	0.27%	9.84%
S	1.36%	1.16%	2.14%	2.12%	0.80%	0.17%	7.75%
SSE	0.73%	0.48%	0.64%	0.41%	0.12%	0.02%	2.39%
SE	1.03%	0.69%	0.54%	0.33%	0.06%	0.01%	2.65%
ESE	0.60%	0.36%	0.27%	0.09%	0.01%	0.00%	1.34%
E	1.32%	0.98%	0.71%	0.31%	0.06%	0.02%	3.40%
ENE	1.15%	0.98%	1.31%	0.94%	0.28%	0.03%	4.69%
NE	1.67%	1.66%	2.66%	2.17%	0.64%	0.08%	8.89%
NNE	1.18%	1.13%	2.28%	2.19%	0.60%	0.14%	7.52%
Total	20.57%	22.80%	33.64%	17.26%	4.82%	0.90%	100.00%

[1] Based on 26,717 observations from January 1, 2001 to December 31, 2001

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Table D4-3

Annual Precipitation by Month, NOAA Sundance station, 2003

	2003 Amount, inches	Departure from Normal, inches	Long Term Average, inches
January	1.52	0.83	0.69
February	2.50	1.82	0.68
March	0.86	-0.11	0.97
April	2.08	-0.21	2.29
May	1.18	-1.58	2.76
June	3.13	0.06	3.07
July	1.39	-0.74	2.13
August	0.29	-1.36	1.65
September	1.00	-0.31	1.31
October	1.31	-0.25	1.56
November	0.90	0.20	0.70
December	0.72	-0.01	0.73
Total	16.88		18.54

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APPENDIX D5- GEOLOGY AND OVERBURDEN ASSESSMENT

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ADDENDA

Map

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APPENDIX D5 - GEOLOGY AND OVERBURDEN ASSESSMENT

D5.1 INTRODUCTION

Croell Redi-Mix, Inc., of Sundance, Wyoming, currently operates a sand-and-gravel Limited Mining Operation (LMO), also known as an "ET" (Ten Acre Exemption), Permit #1396. The LMO is called "Roger's Pit" and is located in Crook County approximately six miles east of Sundance and immediately south of Interstate 90. Another LMO, 1462ET, has since been established by another operator and will also be incorporated into this permit area. Croell Redi-Mix proposes to expand the ET operations to a "regular mine" (WDEQ/LQD Form 1, Mining Permit). The permit area expansion (permit area) consists of approximately 570 acres located in portions of Sections 25, 26, and 35, T.52N., R.62W. Please refer to the Introduction Section of the permit application package for the complete legal descriptions of the lands included within the proposed project area.

The following text provides a description of the geology and an overburden assessment of the proposed permit area. This section was prepared by Jim Nyenhuis, Certified Professional Soil Scientist, who also conducted the baseline Order 1 soil survey of the permit area and prepared the Appendix D7 soils report. Information provided on Map D5-1 and other guidance was provided by Mark Taylor, Sheridan LQD. Proper management of the overburden in the Croell Redi-Mix Roger's Pit permit area is essential for the success of reclamation in the mine area and the achievement of the post-mining land use.

D5.2 RESULTS

All available geology and overburden information for the proposed Roger's Pit permit area was obtained and reviewed. This included both general information for the geological formations and site-specific information primarily concerning the limestone area. Various detailed base maps of the permit area that were available for use and review included (1) the USGS 7.5' Sundance, Wyoming, topographic quadrangle map, (2) a "CIR" color infra-red image taken in September 2001, obtained from USGS sources, Wyoming GIS Coordination Structure website, scale 1"=400', and (3) the USDA Natural Resources Conservation Service (NRCS) Order 3 air-photo base soil survey maps (Map Sheets 115 and 116) of the "Soil Survey of Crook County, Wyoming" (Elwonger, 1983).

D5.2.1Geology

The permit area is divided into two areas dominated by different types of bedrock (Love and Christiansen, 1985; DeWitt et. al., 1989; Robinson et. al., 1964; and GTR Mapping, 2006). The eastern portion of the permit area in underlain by the Permian age "Minnekahta" limestone and "Opeche" shale (geologic map symbol Pmo), whereas the western portion is underlain by the Triassic age "Spearfish" Formation (geologic symbol TrPs). This statement is supported by review of the four geological maps cited above. The base maps of the project area and the four geological maps are of sufficient detail and

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scale to be able to separate the permit area into two separate portions, the eastern portion underlain by the Minnekahta limestone and the western portion underlain by the Spearfish Formation. The surface land features also support the existence of these two different formations. Stratigraphically, the Minnekahta limestone immediately underlies the Spearfish Formation so it is assumed that limestone is present at depth below the surficial Spearfish Formation in the western part of the permit area, but this has not been investigated in the field. Site-specific drilling to assess the limestone reserve has only been completed for the eastern part of the permit area (the LMO area currently being mined and its extension across the limestone outcrop to its south).

There is a somewhat narrow, generally north-to-south band that separates the distinctive Minnekahta limestone area to the east from the distinctive Spearfish Formation area to the west. On the soils map of the permit area, this in-between area is an elongate, north-to-south delineation of Map Unit A (Tilford-Nevee complex, 2 to 10% slopes). This delineation has deep soils (>40 inches to bedrock) and it is difficult to determine to which formation the underlying bedrock belongs.

Map D5-1 contains two figures, Figure 1 is a geologic cross section showing the spatial distribution of formations, including the Minnekahta limestone and Spearfish Formation, shown in Figure 2. Figure 1 is modified from DeWitt et. al. (1989). Figure 2 illustrates a generalized stratigraphic column showing the distribution of limestone and gypsum/anhydrite in the northern Black Hills.

D5.2.1.1 Minnekahta Limestone

The Permian Age (286 to 254 million years old) "Minnekahta" limestone is the target limestone bed being mined by Croell Redi-Mix at Roger's Pit Quarry. As a general description of the formation, it is about 40 feet in thickness and consists of light-gray limestone with purplish laminae with individual limestone beds ranging in thickness from less than 1 inch to 3 feet (Robinson et. al., 1964). The lower part is silty and grades downward into red sandy and silty shale of the underlying "Opeche" Formation. Fossils are rare in the Minnekahta limestone.

In the permit area, the Minnekahta limestone is located in an elongate band that extends from north-to-south across the middle of Section 25, T.52N., R.62W. The limestone outcrops, or thinly subcrops, across much of this area. The current LMO mining is in the northern part of this area. On the soils map of the permit area, the Minnekahta limestone area is mapped as Map Units C (Laporte loam, 2 to 35% slopes) or D (Limestone Rock Outcrop, Laporte inclusion, 2 to 50% slopes), with one delineation of Map Unit A (Tilford-Nevee complex, 2 to 10% slopes) located in a portion of the SW1/4 of the SE1/4 of Section 25, T.52N., R.62W.

A site-specific study of the exposed limestone area was conducted for Croell Redi-Mix by Mr. E.B. Olson and/or Mr. James McLellan in May and June of 2007 (McLellan, 2007). The proposed quarry site was called the "Harper Quarry" at that time. Although it is said he did

not produce a written report of his field study, he did produce: (1) a "Figure 1" map showing the location of 27 test holes, 3 surface samples, and 2 cross sections of the limestone area (Figures 2 and 3), (2) some laboratory results of the 3 limestone surface samples, and 1 combined crushed limestone core, and (3) the description logs of the 27 drill holes. A copy of these study deliverables is attached to this report as Addendum 1. An electronic version was not available.

Included in the report is the west-to-east A-A' geologic cross section mentioned above as Figure 2 (McLellan, 2007). Figure 3 of the addendum is the north-to-south B-B'geologic cross section mentioned above. Figures 4 and 5 show the distribution of the Minnekahta limestone across the current LMO mining area as well as the immediate area to its south. The limestone is described as "very dense, pink to grey, Limestone, dry" and is approximately 10 to 15 feet thick, although at least one small drainage has cut across the area and eroded the limestone in one narrow band. The cross sections also show the overlying intermittent, thin topsoil as well as the underlying geology which is composed of a 5 to 10 foot zone of "interbedded silt, shale, and limestone" and a lower zone of "very hard, tan to maroon silt Shale, dry" (McLellan, 2007), which is considered the Permian "Opeche Shale".

The 27 individual drill holes ranged in depth from 10.5 to 40 feet, with an average depth of 24.3 feet. The drill hole logs included depth measurements of the (1) topsoil, (2) overburden including, where present, "weathered limestone and silt", "weathered limestone and clay", and "fractured limestone and silt", and (3) the underling "dense limestone" (the target limestone to be mined). The logs also referenced the various "shale and limestone", "soft limestone", and "silt shale" strata underlying the dense limestone. The "Materials Deposit Layout Sheet" concluded that 20,000 cubic yards of "overburden" and 185,000 cubic yards of "limestone" were present in the study area (McLellan, 2007). It appears topsoil was included with overburden for the overburden measurement.

D5.2.1.2 Spearfish Formation

The Permian-Triassic Age (286 to 225 million years old) Spearfish Formation is composed of dark red, friable, fine-grained sandstone, maroon siltstone, and interbedded shale with several beds of gypsum in the lower part of the formation. Oxidation of iron minerals causes the redness of the rocks. These highly oxidized sands and shale beds have the appearance of deposits found in modern arid intertidal flat environments. Dissolution of the gypsum and anhydrite has resulted in the development of several small, scattered sinkholes and other karstic features. Fossils have not been reported in the Spearfish Formation (Robinson et. al., 1964).

The Spearfish Formation "rests with sharp contact but with no apparent unconformity on the underlying Minnekahta limestone" (Robinson et. al., 1964). The Spearfish Formation rocks were laid down in a shallow sea during the late Permian-early Triassic time. Outcrops of the Spearfish Formation encircle the Black Hills forming a topographic depression known as the "racetrack" because it is exposed as an irregular oval around the

entire Black Hills. Where the Spearfish Formation outcrops in the western part of the permit area, it is capped by scattered, small areas of gypsum, an evaporitic mineral.

As stated at the beginning of this report, no drilling for limestone has been conducted in the western part of the permit area, the area underlain by the Spearfish Formation. As a result, the thickness of the Spearfish Formation in the permit area and whether or not the underlying Minnekahta limestone is at a reasonable depth for mining, is not known at this time.

D5.2.2 Overburden

Overburden is generally considered the earth material between the bottom of the soil and the top of the target item being mined – whether sand-and-gravel, limestone, bentonite, or coal for instance (WDEQ, 1996). Some consider the soil to be part of the overburden. For the Roger's Pit permit area, overburden will be described considering both the soil and underlying material. A detailed soil resources assessment has been completed as Appendix D-7 of the permit application package. Some of the soil conclusions will be restated below. Table D7-1 of the soils report includes a summary of map unit depths and recommended topsoil salvage. Although individual soil types were fully described and sampled for laboratory characterization from one to several times each, permit area overburden was not sampled for laboratory analysis. In addition, overburden was only investigated for the Minnekahta limestone area and not for the Spearfish Formation area.

D5.2.2.1 Minnekahta Limestone

For the main Minnekahta limestone area, excluding the narrow band to its west where the grass hayland fields exist and limestone may or may not be present below the deep soil, both soil and overburden were investigated. The detailed soil survey indicates three map units are delineated in this area – Map Units C, D, and one delineation of Map Unit A. Map Units C and D exist over most of the area. Map Unit C is composed of the very shallow (4 to 10 inches to limestone) to shallow (10 to 20 inches to limestone) Laporte soil which is entirely suitable for topsoil salvage and is recommended for 8 inches salvage, the average depth of the soil in Map Unit C. Map Unit D is composed mainly of barren Limestone Rock Outcrop with only small scattered areas of Laporte loam, considered a soil inclusion occurring on only about 10 to 15 percent of the map unit. Where present in Map Unit D, Laporte loam could only be salvaged to 4 inches, its average depth in Map Unit D. Both Tilford and Nevee loams are present in the one delineation of Map unit A in the limestone area. Both are deep, suitable soils and the map unit can be salvaged to a depth of 24 inches.

As stated above, the previous geological study of the limestone area (McLellan, 2007) included measurements of the overburden above the "dense limestone". The 27 drill hole logs included depth measurements of "weathered limestone and silt", "weathered limestone and clay", and "fractured limestone and silt". The thickness of these overburden materials ranged from less than 1 foot to a few feet at their maximum. The "Materials

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Deposit Layout Sheet" concluded that 20,000 cubic yards of overburden, probably including the topsoil, are present in the limestone study area (McLellan, 2007).

D5.2.2.2 Spearfish Formation

As stated before, there has been no study of either the limestone resource or the overburden in the Spearfish Formation portion of the permit area. Only the soil portion of the overburden has been investigated. The detailed soil survey (Appendix D7) indicates three map units are present in this area – Map Units E, F, and a couple delineations of Map Unit A. Map Unit E is composed of the very shallow to shallow, loamy Rekop soil and the moderately deep (20 to 40 inches to reddish siltstone or gypsum bedrock), fine-silty Gystrum soil. Both soils are suitable for salvage but only 6 inches in recommended for salvage, the average depth of Rekop in Map Unit E. Map Unit F is composed of Gypsum Rock Outcrop with small scattered inclusions of Rekop clay, and no soil is recommended for salvage due to the inability to separately salvage the small spots of the very shallow Rekop soil inclusion. A couple of small, and one larger, delineations of Map Unit A exist in the Spearfish Formation area. Both the Tilford and Nevee loam soils are deep and suitable, and can be salvaged to 24 inches in depth.

D5.3 REFERENCES:

DeWitt, Ed, Redden, J.A., Busher, David, and Wilson, A.B. 1989. Geologic Map of the Black Hills Area, South Dakota and Wyoming. U.S. Geological Survey Miscellaneous Investigations Series Map I-1910, scale: 1:250,000.

Elwonger, W.G. 1983. Soil Survey of Crook County, Wyoming. U.S.D.A. – Natural Resources Conservation Service (NRCS, formerly Soil Conservation Service), in cooperation with the Forest Service and the Wyoming Agricultural Experiment Station.

GTR Mapping. 2006. Wyoming Geologic Highway Map. Published by GTR Mapping with the cooperation of the Wyoming Geological Survey. GTR Mapping, P.O. Box 1984, Canon City, CO 81215.

McLellan, James. 2007. Limestone Study – Harper Quarry, Sundance, Wyoming. Project I-90-4 (14). Portions of Section 25, T.52N., R.62W. File Material. May-June 2007.

Love, J.D. and Christiansen, Ann Coe. 1985. Geologic Map of Wyoming. U.S. Geological Survey (USGS), scale 1:500,000.

Robinson, Charles S., William J. Mapel, and Maximillian H. Bergendahl. 1964. Stratigraphy and Structure of the Northern and Western Flanks of the Black Hills Uplift, Wyoming, Montana, and South Dakota. USGS Geological Survey Professional Paper 404. US Government Printing Office, Washington D.C. 1964.

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Wyoming Department of Environmental Quality-Land Quality Division (WDEQ). 1996. Guideline No.1, Topsoil and Overburden. Rules Update, August 1994. Selenium Update, November 1996.

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ADDENDUM D5-1

SITE GEOLOGY

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Croell Redi-Mix, #___ Permit To Mine

August 2009

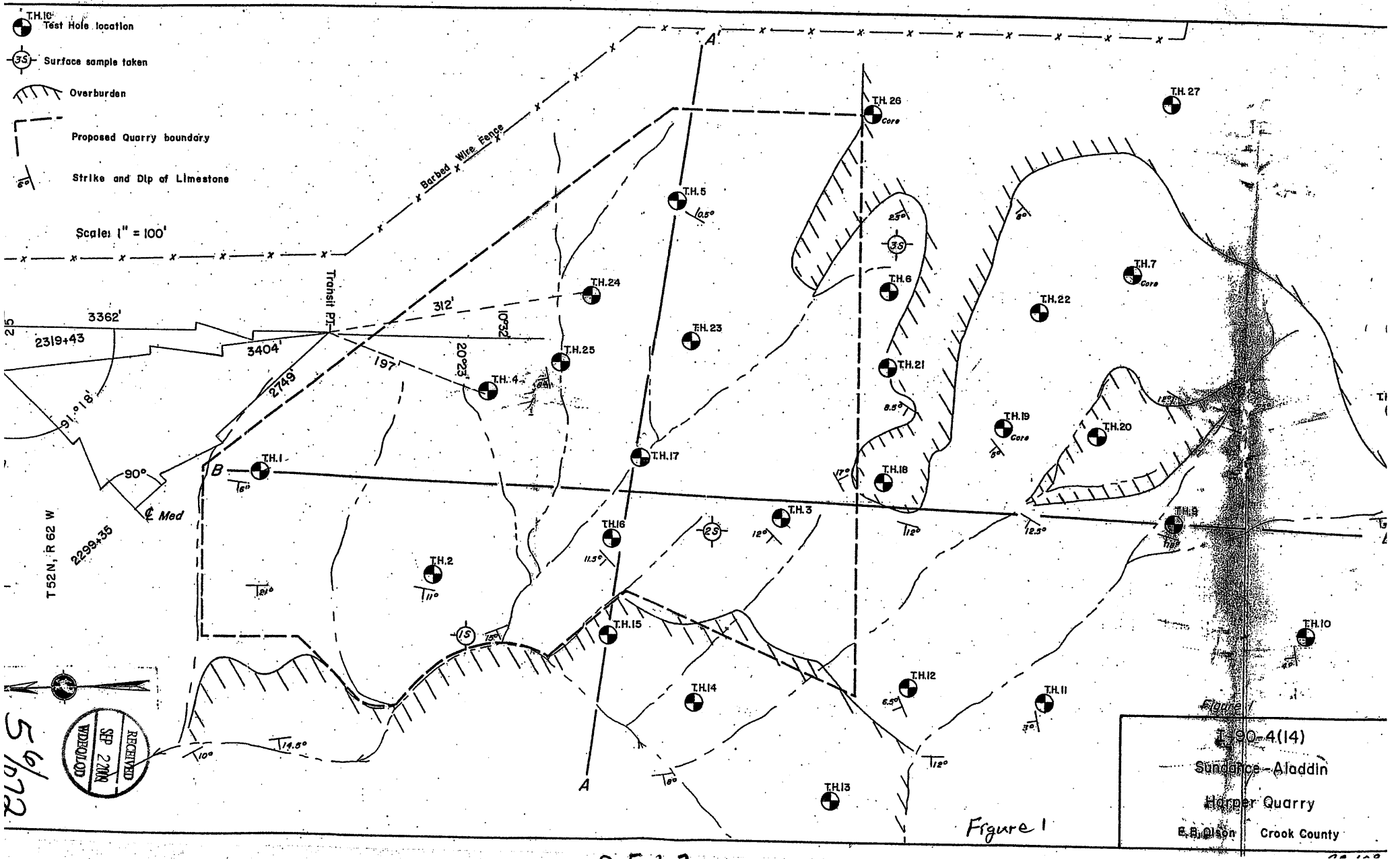


Figure 1

D.5-1-7

B "Croell Redi-Mix," ____ Permit to Mine August, 2__1

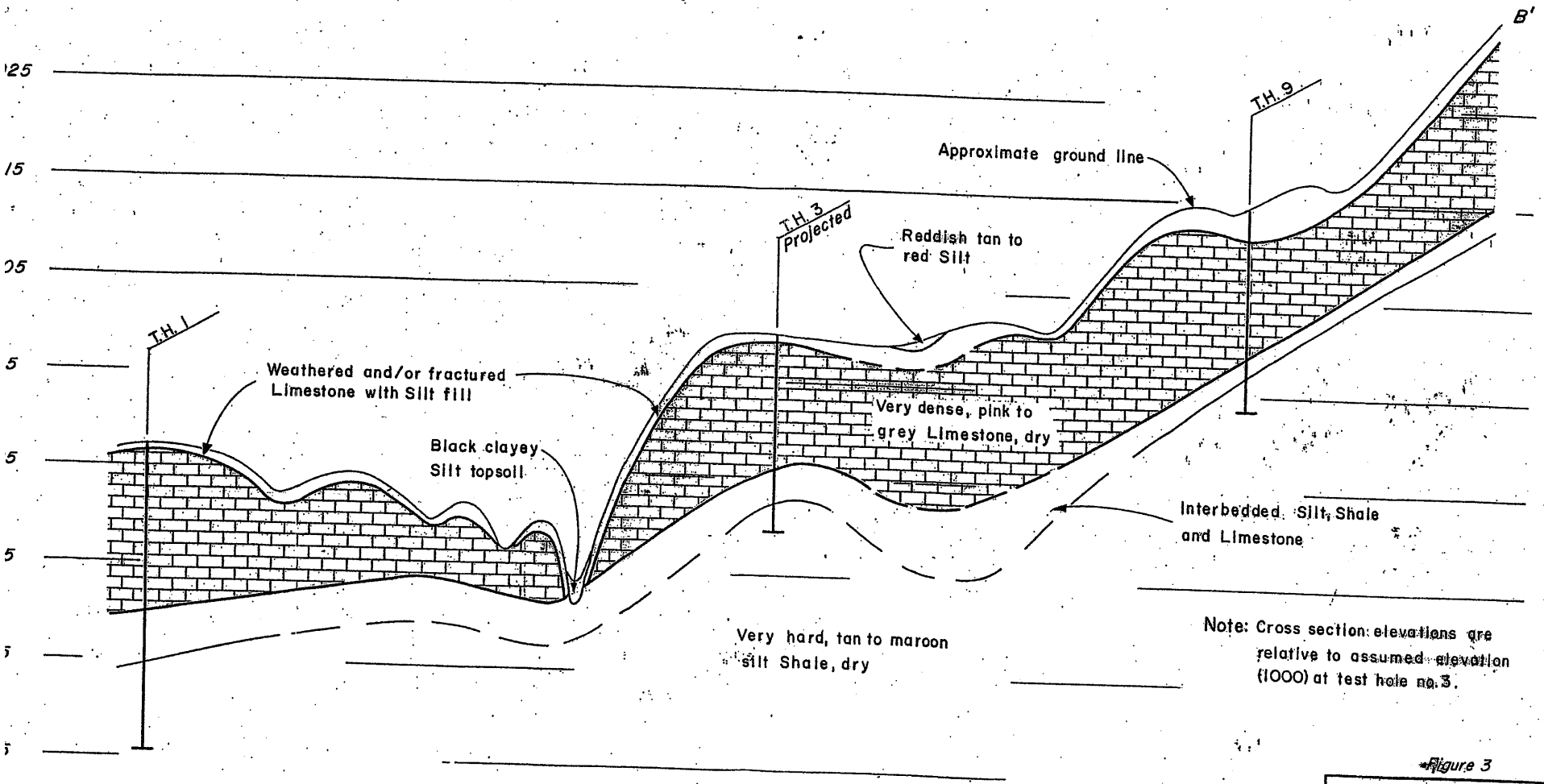


Figure 3

I-90-4(14)

Sundance - Aladdin

Harper Quarry

E.B. Olson Crook County

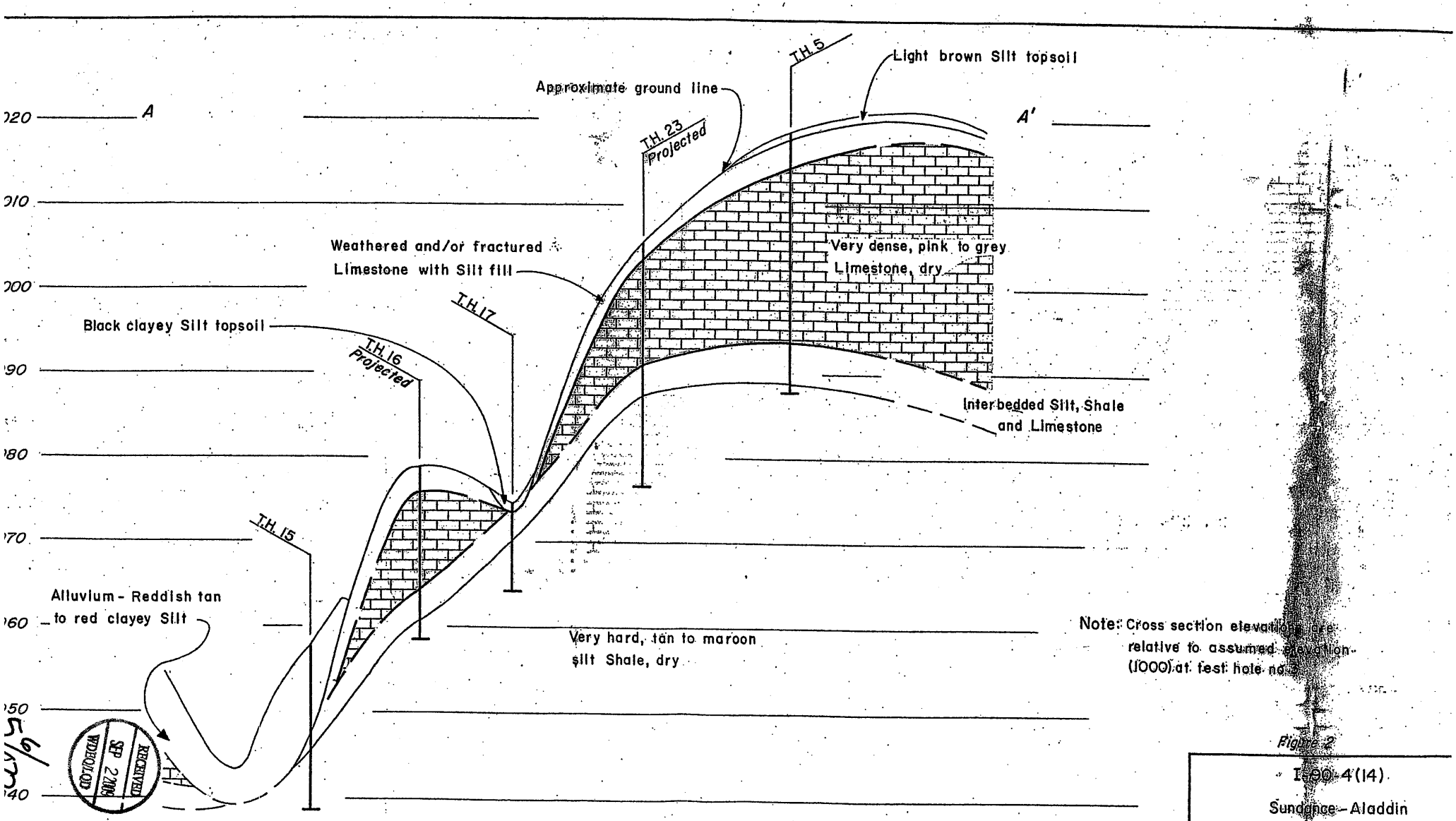
C.R.-10.R

Scale: Horiz. - 1" = 100'
Vert. - 1" = 10'

CL/5

Croell Redi-Mix, # ____ Permit To Mine

August, 2009



Note: Cross section elevations are relative to assumed elevation (1000) at test hole no. 2

Figure 2

I-90-4(14)

Sundance - Aladdin

Hopper Quarry

E.B. Olson Crook County

D.5-1-4

Crowell Redi-Mix, # ___ Permit To Mine

August, - 9

MATERIALS DEPOSIT LAYOUT SHEET

PROJECT _____ SHEET NO. _____ TOTAL SHEETS _____

A.F.E. NO. _____

NAME Harper Quarry DEADHAUL _____ MILES TO STA. _____

GINEER _____ OR DEADHAUL IS _____ MILES TO

TE _____ CO. NO. _____ STA. _____ ON PROJECT _____

ND DESCRIPTION _____ QUANTITIES:

_____ OVERBURDEN _____ TONS

_____ GRAVEL _____ TONS

/NERSHIP _____ CAN PIT BE EXTENDED? _____

HOLE NO.	FIELD NO.	LAB NO.	OVERBURDEN VERT. LIMITS	GRAVEL VERT. LIMITS	MAXIMUM SIZE	PERCENT PASSING 3"	2"	1"	3/4"	1/2"	NO. 4	NO. 10	NO. 40	NO. 200	LIQUID LIMIT	PLASTIC INDEX	C.V.	"R" VALUE	SAND EQUIV.	REMARKS
1,384	72-1920							100	97	48	37	18	11.1	17	NP					Limestone Cores (Combined) Crushed
								Wear	Grading			"C"	26.4 %							
1 S	72-1906							100	98	52	33	17	8.4	21	NP	19		69		Limestone (Crushed Surface Sample
								Wear	Grading			"C"	39 %							
2 S	72-1907							100	98	50	32	11	6.1	21	NP	99		85		Limestone (Crushed Surface Sample
								Wear	Grading			"C"	30 %							
3 S	72-1908							100	98	49	34	12	6.4	21	NP	79		71		Limestone (Crushed Surface Sample
								Wear	Grading			"C"	29 %							

L. A. WEAR GRADING " " % SPECIFIC GRAVITY STRIP TEST

FILE NO. CR-108

CL 1/05

RECEIVED SEP 27 1999 WDEQ/LQD

SCALE _____

D.5-1-5

Croell Redi-Mix, Inc. Permit to Mine

August, 2009

MATERIALS DEPOSIT LAYOUT SHEET

PROJECT I-90-4(14) SHEET NO. TOTAL SHEET

A.F.E. NO.

T NAME: HARPER QUARRY
NGINEER James McLellan
TE CO. NO.
ND DESCRIPTION
W 1/4 & W 1/2 SE 1/4 SEC.
5 T52 N R62W
VNERSHIP Leota Osgard under contract to Lorin Harper

DEADHAUL 52V MILES TO STA 2299+35
OR DEADHAUL IS MILES TO
STA. ON PROJECT I-90-4(14)
QUANTITIES:
OVERBURDEN 20,000 C.Y. TONS
LIMESTONE 185,000 C.Y. TONS
GRAVEL
CAN PIT BE EXTENDED? Yes

HOLE NO.	FIELD NO.	LAB NO.	OVERBURDEN	VERT. LIMITS	GRAVEL	VERT. LIMITS	MAXIMUM SIZE	PERCENT PASSING 3"	2"	1"	3/4"	1/2"	NO. 4	NO. 10	NO. 40	NO. 200	LIQUID LIMIT	PLASTIC INDEX	C.V.	"R" VALUE	SAND EQUIV.	REMARKS
1			0-.5																			
				.5-17																		Weathered Ls & Silt
			17-20																			Limestone (dense)
					20-22.5																	Shale & Limestone
			22.5-31.5																			Limestone (soft)
																						Silt Shale
2			0-1																			
				1-15.5																		Weathered Ls & Silt
			15.5-17																			Limestone (dense)
					17-19																	Silt Shale
			19-20.5																			Limestone (soft)
																						Silt Shale
3			0-.5																			
				.5-14																		Weathered Ls & Silt
					14-15																	Limestone (dense)
			15-16																			Limestone (soft)
					16-17.5																	Silt Shale
			17.5-20.5																			Limestone (soft)
																						Silt Shale
4			0-.5																			
				.5-14																		Weathered Ls & Silt
					14-15																	Limestone (dense)
			15-19																			Limestone (soft)
			19-20.5																			Shale & Limestone
																						Silt Shale
5			0-.5																			
			.5-4																			Silt
					4-24.5																	Weathered Ls & Silt
			24.5-29.5																			Limestone (dense)
			29.5-30.5																			Shale & Limestone
																						Silt Shale
6			0-.5																			
			.5-1.5																			Topsoil
					1.5-17																	Weathered Ls & Clk
			17-21.5																			Limestone (dense)
			21.5-29.5																			Shale & Limestone
																						Shale

L. A. WEAR GRADING " " % SPECIFIC GRAVITY STRIP TEST

SCALE

FILE NO. CR-108

CL/S

RECEIVED SEP 2 2009 WIDEOLOD

D.5-1-6

Croell Redi-Mix, Inc — Permit To Mine

August, 2009

MATERIALS DEPOSIT LAYOUT SHEET

PROJECT _____ SHEET NO. _____ TOTAL SHEETS _____

A.F.E. NO. _____

NAME Harper Quarry DEADHAUL _____ MILES TO STA. _____

ENGINEER _____ OR DEADHAUL IS _____ MILES TO

TE _____ CO. NO. _____ STA. _____ ON PROJECT _____

ND DESCRIPTION _____ QUANTITIES:

_____ OVERBURDEN _____ TONS

_____ GRAVEL _____ TONS

NERSHIP _____ CAN PIT BE EXTENDED? _____

HOLE NO.	FIELD NO.	LAB NO.	OVERBURDEN	VERT. LIMITS GRAVEL	VERT. LIMITS MAXIMUM SIZE	PERCENT PASSING 3"	2"	1"	3/4"	1/2"	NO. 4	NO. 8	NO. 40	NO. 200	LIQUID LIMIT	PLASTIC INDEX	C.V.	"R" VALUE	SAND EQUIV.	REMARKS
7			0-5																	Topsoil
			5-15																	Weathered Ls & Clay
				15-45																Limestone (dense)
	1	72-1920		45-95			(See Last Sheet)													Limestone Core
				95-14																Limestone (dense)
			14-16.5																	Shale & Limestone
	2	72-1909	16.5-25					100	99	82	81	77	71.6	21	3			4		Silt Shale
8			0-2.5																	
				2.5-20																Topsoil
			20-23																	Limestone (dense)
			23-25																	Shale & Limestone
																				Silt Shale
9			0-3																	
				3-15																Fractured Ls & Silt
			15-17																	Limestone (dense)
			17-19																	Shale & Limestone
			19-21																	Siltstone
																				Silt Shale
10			0-.5																	
			.5-1.5																	Topsoil
			1.5-3																	Silt
				3-17																Fractured Ls & Silt
			17-19																	Limestone (dense)
			19-20.5																	Shale & Limestone
																				Siltstone
11			0-.5																	
				.5-19																Topsoil
			19-21																	Limestone (dense)
			21-25																	Shale & Limestone
																				Silt Shale
12			0-.5																	
			.5-2																	Topsoil
				2-10.5																Weathered Ls & Silt
			10.5-20.5																	Limestone (dense)
																				Silt Shale
13			0-10.5																	
			10.5-19																	Silt & Sand
			19-22																	Fractured Ls & Clay
			22-25																	Shale & Limestone
																				Silt Shale

L. A. WEAR GRADING " " % SPECIFIC GRAVITY STRIP TEST

FILE NO. CR-108

SCALE _____

RECEIVED SEP 2 2009 WRDO/LQD

D. 5-1-7

Croell Redi-Mix, ___ Permit To Mine

August, 2009

46

MATERIALS DEPOSIT LAYOUT SHEET

PROJECT _____ SHEET NO. _____ TOTAL SHEET

A.F.E. NO. _____

PIT NAME Harper Quarry DEADHAUL ____ MILES TO STA. ____

ENGINEER _____ OR DEADHAUL IS ____ MILES TO

DATE ____ CO. NO. ____ STA. ____ ON PROJECT ____

LAND DESCRIPTION _____ QUANTITIES:

OVERBURDEN ____ TONS

GRAVEL ____ TONS

OWNERSHIP _____ CAN PIT BE EXTENDED? ____

HOLE NO.	FIELD NO.	LAB NO.	OVERBURDEN	VERT. LIMITS	GRAVEL	VERT. LIMITS	MAXIMUM SIZE	PERCENT PASSING 3"	2"	1"	3/4"	1/2"	NO. 4	NO. 8	NO. 10	NO. 200	LIQUID LIMIT	PLASTIC INDEX	C.V.	R-VALUE	SAND EQUIV.	REMARKS
14			0-4.5																			Silt
			4.5-14																			Fractured Ls & Cl
			14-17																			Shale & Limestone
			17-20.5																			Silt Shale
15			0-10																			Clayey Silt
			10-12																			Fractured Ls & Cl
			12-19																			Silt Shale
16			0-3																			Fractured Ls & Sil
					3-14.5																	Limestone (dense)
			14.5-18																			Shale & Limestone
			18-20.5																			Silt Shale
17			0-1																			Topsoil
			1-4																			Fractured Ls & Clay
			4-10.5																			Silt Shale
18			0-11																			Silt
			11-14.5																			Weathered Ls
					14.5-15.5																	Limestone (dense)
			15.5-16.5																			Silt Shale
					16.5-32.5																	Limestone (dense)
			32.5-35																			Shale & Limeston
19			0-.5																			Topsoil
			.5-1.5																			Fractured Ls & Sil
					5-10																	Limestone (dense
	3	72-1920			10-15			(See Last Sheet)														Limestone Core
					15-17.5																	Limestone (dense
			17.5-19.5																			Silt Shale
20			0-1																			Topsoil
			1-7																			Silty Clay
			7-10.5																			Weathered Ls & Si
					10.5-29.5																	Limestone (dense
			29.5-31.5																			Shale & Limestor
			31.5-35.5																			Silt Shale

L. A. WEAR GRADING " " % SPECIFIC GRAVITY STRIP TEST

SCALE _____

FILE NO. CR-108

RECEIVED SEP 2 2009 WELCO LOG

D.5-1-8

CL/S

Croell Redi-Mix, # ___ Permit To Mine

August, 2009

MATERIALS DEPOSIT LAYOUT SHEET

NAME Harper Quarry DEADHAUL ___ MILES TO STA. ___

GINEER ___ OR DEADHAUL IS ___ MILES TO

E ___ CO. NO. ___ STA. ___ ON PROJECT ___

ID DESCRIPTION ___ QUANTITIES:

___ OVERBURDEN ___ TONS

___ GRAVEL ___ TONS

NERSHIP ___ CAN PIT BE EXTENDED? ___

PROJECT ___ SHEET NO. ___ TOTAL SHEET

A.F.E. NO. ___

HOLE NO.	FIELD NO.	LAB NO.	OVERBURDEN VERT. LIMITS	GRAVEL VERT. LIMITS	MAXIMUM SIZE	PERCENT PASSING 3"	2"	1"	3/4"	1/2"	NO. 4	NO. 10	NO. 40	NO. 200	LIQUID LIMIT	PLASTIC INDEX	C.V.	"R" VALUE	SAND EQUIV.	REMARKS
21			0-1																	Topsoil
			1-2																	Silty Clay
				2-22.5																Limestone (dense)
			22.5-25.5																	Shale & Limeston
			25.5-30.5																	Silt Shale
22			0-2																	
				2-15.5																Fractured Ls & Silt
			5.5-17.5																	Limestone (dense)
			7.5-19																	Shale & Limestone
			19-21.5																	Siltstone
																				Silt Shale
23			0-2																	
				2-14.5																Fractured Ls & Silt
			4.5-18																	Limestone (dense)
			18-19																	Shale & Limestone
																				Silt Shale
24			0-.5																	
			.5-2																	Weathered Ls & Silt
				2-16.5																Weathered Limesto
			16.5-19.5																	Limestone (dense)
			19.5-20.5																	Shale & Limestone
																				Silt Shale
25				0-7																
			7-11.5																	Limestone (dense)
			11.5-20																	Shale & Limestone
																				Silt Shale
26			0-.5																	
			.5-3																	Topsoil
				3-4																Silt
	4	72-1920		4-9																Limestone (dense)
				9-30.5																Limestone Core
			30.5-35.5																	Limestone (dense)
			35.5-40																	Shale & Limestone
																				Silt Shale
27			0-1																	
			1-3																	Topsoil
			3-4.5																	Silt
			4.5-6.5																	Weathered Ls & Silt
				6.5-23.5																Fractured Ls & Silt
			23.5-25.5																	Limestone (dense)
			25.5-30																	Shale & Limestone
																				Silt Shale

(See Last Sheet)

L. A. WEAR GRADING " " % SPECIFIC GRAVITY STRIP TEST

D: 5-1-9

SCALE ___

RECEIVED SEP 2 2009 MINERALS

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