

KANSAS GEOLOGICAL SURVEY

1930 Constant Ave., Campus West
The University of Kansas
Lawrence, Kansas 66047-3726
phone 785-864-3965
fax 785-864-5317

April 8, 2005

Mr. Christopher J. Snider, L.G. CHMM
Burns & McDonnell Engineering Co.
9400 Ward Parkway
Kansas City, Missouri 64114

**Re: Approval/Exemption Request
Proposed Construction and Demolition (C&D) Landfill Expansion
Butler County, Kansas C&D Landfill, Permit Number 799
Burns & McDonnell Project No. 37144**

Dear Mr. Snider,

I want to thank Burns and McDonnell Engineering Company, Inc. for taking the time to address my concerns about potential karst issues at the proposed expansion of the Construction and Demolition (C&D) landfill for Butler County. I have reviewed the geologic assessment provided with your letter dated March 15, 2005.

The Kansas Geological Survey (KGS) has no additional data about karst hazards at this site. I agree that the existence of karst features in Fort Riley Limestone at other locations in Butler County does not imply that karst problems exist in this geologic unit at the proposed C&D landfill expansion site. I also agree that the lack of geomorphic expression, primarily sinkholes, suggests a lack of recent karst activity. However, the descriptions of the soil and rock encountered in the borings suggest residual soils possibly derived from limestone. Boring PZ-6 encountered a layer of limestone with clay that was not encountered in the other borings that penetrated the same depth. Why is this limestone missing from the other borings? The other borings have one or more layers of clay with limestone, suggesting weathered limestone. The boring logs have not been correlated. The existence of residual soils, even residual soils on limestones, is not conclusive evidence of karst hazards; however, the presence of residual soils on limestones would suggest that some uncertainty about karst hazards remains.

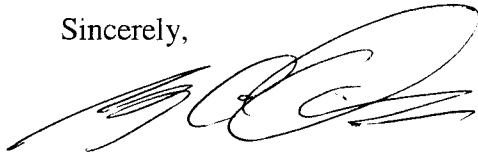
The KGS has requested that the Kansas Department of Health and Environment (KDHE) change in the wording of *Kansas Statutes Annotated ... Administrative Regulations Article 29-Solid Waste* with respect to "unstable areas." The change involves 28-29-302(h)(4) which currently states "... the applicant shall submit an approval or exemption for the siting of the new C&D unit with respect to stability from the Kansas geological survey (sic)." The KGS will continue reviewing geologic assessments provided by the applicant; however, the KGS has requested that we no longer approve or exempt the siting of new C & D landfills with respect to stability. Until the new regulations are

published, the KGS requests that you contact John W. Mitchell at KDHE for information on how to proceed with your application. His contact information is:

John W. Mitchell
Chief, Waste Compliance, Enforcement & Policy Section
Bureau of Waste Management
Kansas Department of Health & Environment
Phone: (785) 296-1608

If you have any questions about my comments, feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read 'G. Ohlmacher', with a stylized, flowing script.

Gregory C. Ohlmacher, P.G.
Engineering Geologist



March 15, 2005

Mr. Greg Ohlmacher, P.G.
Kansas Geological Survey
1930 Constant Avenue
University of Kansas, West Campus
Lawrence, KS 66047-3726

Approval/Exemption Request
Proposed Construction and Demolition (C&D) Landfill Expansion
Butler County, Kansas C&D Landfill, Permit Number 799
Burns & McDonnell Project No. 37144

Dear Mr. Ohlmacher:

Burns & McDonnell Engineering Company, Inc. is please to provide this stability assessment of the proposed new C&D landfill site located in the SW1/4 Section 21 T26S R5E of Butler County, Kansas. As you are aware, KAR 28-29-302(h) requires that an assessment of the stability of the area be performed considering factors including on-site or local conditions that could result in significant differential settling, on-site or local geologic or geomorphologic features, and on-site or local human-made features or events. Siting new C&D landfills is generally prohibited on areas susceptible to mass movements and within karst terrains.

Karst Terrain

As indicated in the Kansas Geological Survey (KGS) letter dated December 3, 2004, a concern does exist regarding the stability of the Fort Riley Limestone, which is the uppermost bedrock unit beneath the proposed C&D landfill footprint. The Fort Riley Limestone is known to host approximately 70 caves in Butler and Cowley Counties in Kansas (Young and Beard, 1993).

The Fort Riley is divided into three layers. On the Butler County Municipal Solid Waste (MSW) landfill site, drilling records (Burns & McDonnell, 1995) indicate the upper layer is about 5-10 feet thick consisting of sandy to silty limestone and highly weathered, when present. The upper layer forms sinkholes and is relatively porous (Young and Beard, 1993). The middle layer is a shaley limestone about 4.8-13.5 feet thick at the MSW site. The middle layer forms the roof of the cave passages (Young and Beard, 1993). The lower third layer, a sandy to shaley medium dark gray limestone with fossil algae and locally vuggy areas, is approximately 10 to 14.6 feet thick at the MSW site. The caves in Butler County are located in the lower third unit of the Fort Riley (Young and Beard, 1993).

A Kansas Geological Survey Open-file report (KGS, 1991) considered the occurrence of sinkholes in Butler County, Kansas. The report notes that "sinkholes are common" in the Ft. Riley and when present, "the sinkholes are quite numerous and conspicuous; a density of 10 or more sinkholes per quarter section is typical." A total of nine separate locations of sinkhole development were identified in the report and "Elsewhere sinkholes are generally lacking in the Ft. Riley outcrop region." A copy of the mapped sinkholes in Butler County is included as Figure 1. The nearest sinkhole is approximately four miles east-northeast of the proposed C&D landfill footprint in SE 1/4 of Sect. 13 T26S R5E and is indicated on Figure 2.



Mr. Greg Ohlmacher

March 15, 2005

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While sinkhole occurrence in the Fort Riley is a concern, data indicates sinkholes are not present beneath or near the proposed C&D landfill. The proposed C&D footprint is not located in karst terrain as defined by K.A.R. 28-29-302(h)(1)(B). K.A.R. 28-29-302(h) prohibits the siting of new C&D landfills in karst terrain, it does not however prohibit the siting of new C&D landfills on geologic formations which can exhibit karst features elsewhere.

Several subsurface investigations have been conducted over the years on the proposed C&D site and the adjacent MSW landfill site. Investigations include:

- Soil Borings for Existing Butler County Landfill No. 1 Project, prepared by Allied Laboratories and dated November 16, 1993;
- Hydrogeologic Site Investigation Butler County Landfill No. 1, Prepared by Allied Environmental Consultants, Inc. and dated December 15, 1993;
- Supplemental Soils Boring and Monitoring Wells for Butler County Landfill Project, prepared by Allied Laboratories and dated June 17, 1993;
- Soil Tests and Site Analysis for Proposed Butler County Landfill, prepared by Engineering Testing Company (ETC) and dated January 22, 1992.

In addition to the subsurface investigations listed above, in 1995, Burns & McDonnell conducted both a geologic/hydrogeologic investigation and a site location restriction demonstration for the MSW landfill located approximately 1,500 feet south of the proposed C&D expansion area. Investigation results indicated the site met MSW landfill siting criteria contained in KAR 28-29-102(f), which are similar to C&D siting criteria contained in KAR 28-29-302(h).

In August 2004, Burns & McDonnell advanced four borings and constructed four piezometers within the proposed C&D landfill footprint. Logs and a location map for the borings advanced in August 2004 are included in Attachment A.

Additional information from all of the above referenced reports will be provided to the KGS should the KGS desire to review them.

Potential Local Faulting

The occurrence of known Holocene-age faults in the vicinity of the proposed C&D landfill was evaluated because a fault could pose a risk to the structural integrity of the C&D landfill system. There is no occurrence of Holocene faulting documented in the immediate area surrounding the site. (Aber, 1991). The nearest fault is the Humbolt fault, which bounds the eastern edge and is part of the Nemaha Anticline. The Nemaha Anticline is a pre-Desmoinesian, post-Mississippian, structural feature that crosses Kansas from the north to the south.

Burns & McDonnell further investigated the suitability of the proposed site by determining if the site is located in a seismic impact zone. The term seismic impact zone is used for MSW landfill



Mr. Greg Ohlmacher

March 15, 2005

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siting, but is applicable when considering site stability under KAR 28-29-302(h). Butler County lies within an area identified as having a maximum horizontal ground acceleration greater than 0.10 g, with a 90 percent probability of not being exceeded in 250 years. In order to delineate the portion of the county falling within the seismic impact zone, the map prepared by Algermission, et.at. (Algermission, 1990) was scaled and transferred to the Kansas Department of Transportation map of Butler County. A copy of this scaled map illustrating horizontal ground accelerations was previously submitted to your office.

The proposed C&D site is not located within a seismic impact zone. The site is located outside the area identified as having a horizontal acceleration in lithified material of greater than 0.10 g, with a 90 percent probability of not being exceeded in 250 years.

Stability Assessment

Burns & McDonnell has reviewed the above mentioned reports and studies for references or data indicating any geologic features potentially causing a concern regarding the structural stability of the proposed site. No site-specific data on the boring logs or within the text of the reports was found indicating a concern with respect to the proposed site stability.

In summary, it is Burns & McDonnell's professional judgment that the proposed C&D expansion site is not located in an unstable area as defined by K.A.R. 28-29-302(h)(1)(A-E), which includes "areas susceptible to mass movement," "karst terrain," "poor foundation areas," and "unstable areas." Based on the reasoning and data provided herein, the site appears to be located in an area with no geologic or geomorphologic features that would threaten the integrity of the landfill.

As you are aware, KAR 28-29-302(h) states that permit modifications for expansions of C&D disposal facilities require a statement of approval or exemption from the Kansas Geological Survey with respect to stability. Should you agree with the professional opinions contained herein, a letter from the Kansas Geological Survey including a statement of approval would be appreciated.

We appreciate your assistance in this matter. Please contact the undersigned at (816) 822-3534 if you have any questions or comments. Thank you for your time and consideration.

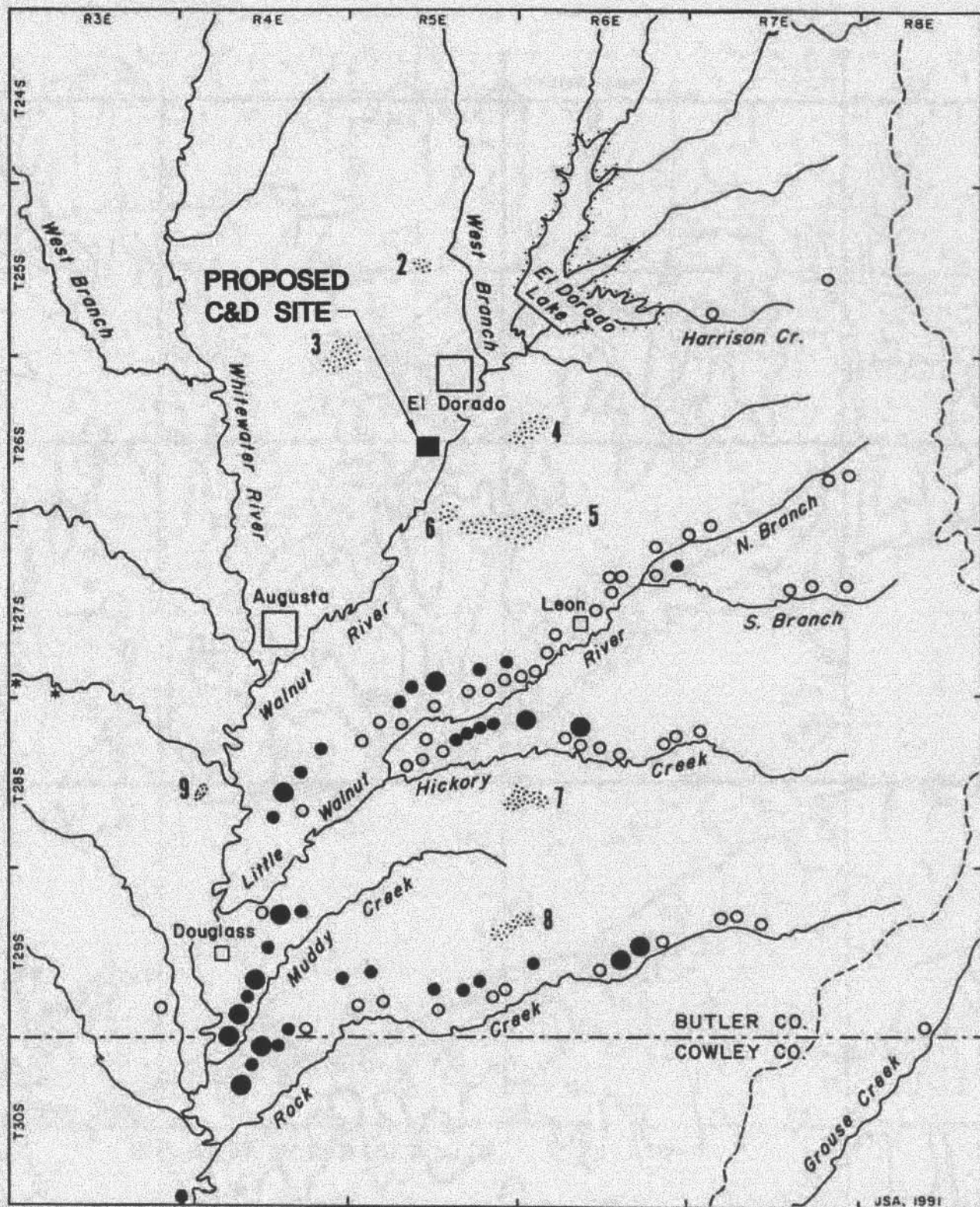
Sincerely,

Christopher J. Snider, LG, CHMM
Project Manager

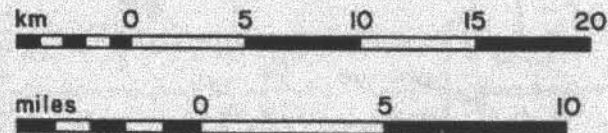
Attachments: As Noted

Cc: Mr. Darryl Lutz, P.E., Butler County Public Works Director (With Attachments)

FIGURES



- HILL-TOP GRAVEL (<160 acres >160)
- HIGH-TERRACE GRAVEL (<160 acres)
- NUMEROUS SINKHOLES
- - - DRAINAGE DIVIDE



JSA, 1991

FIGURE REFERENCE FROM:

Kansas Geological Survey Open File Report #91-48; Surficial Geology of Butler County, Kansas; Abner, James S.; 1991.

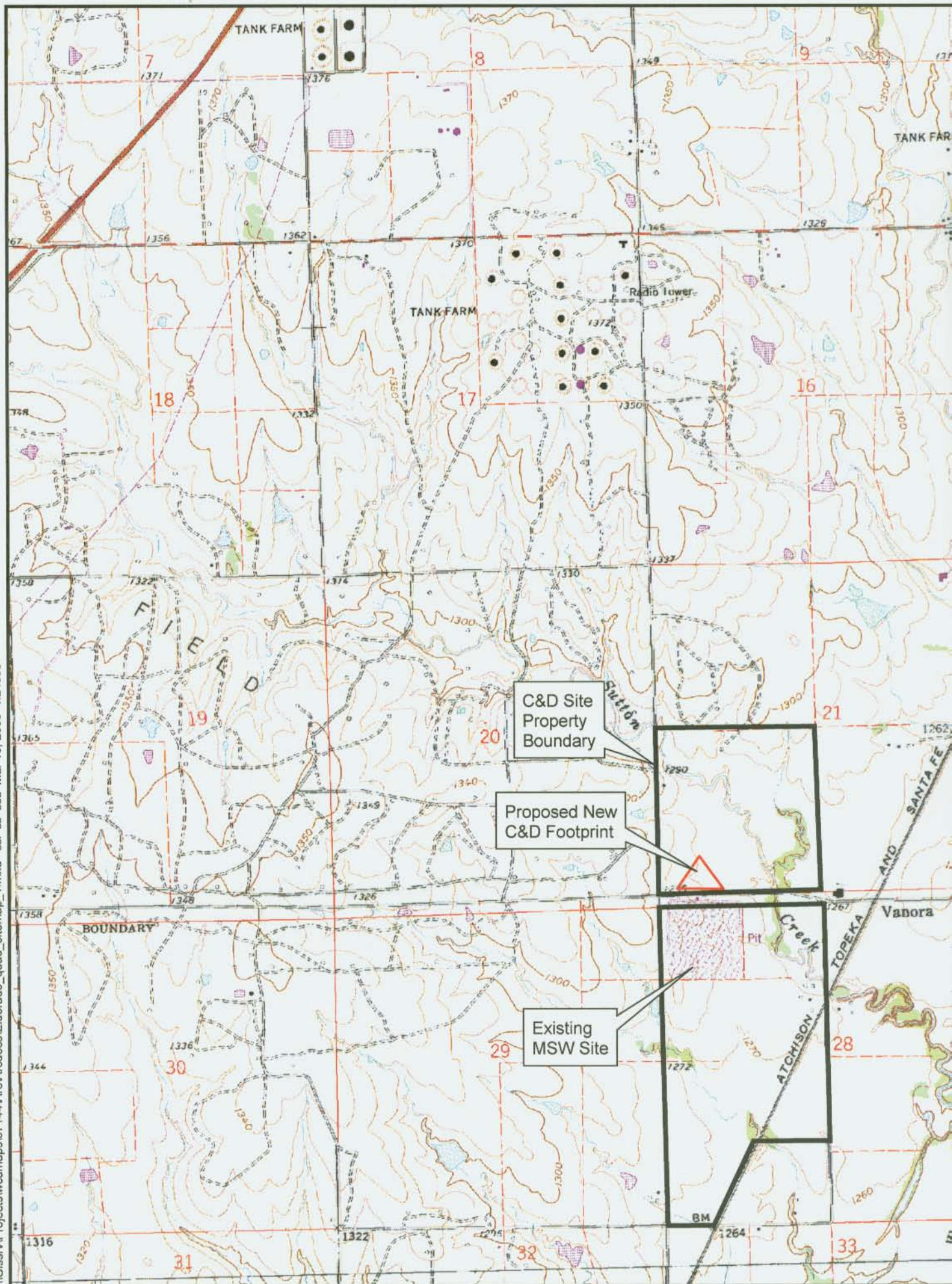
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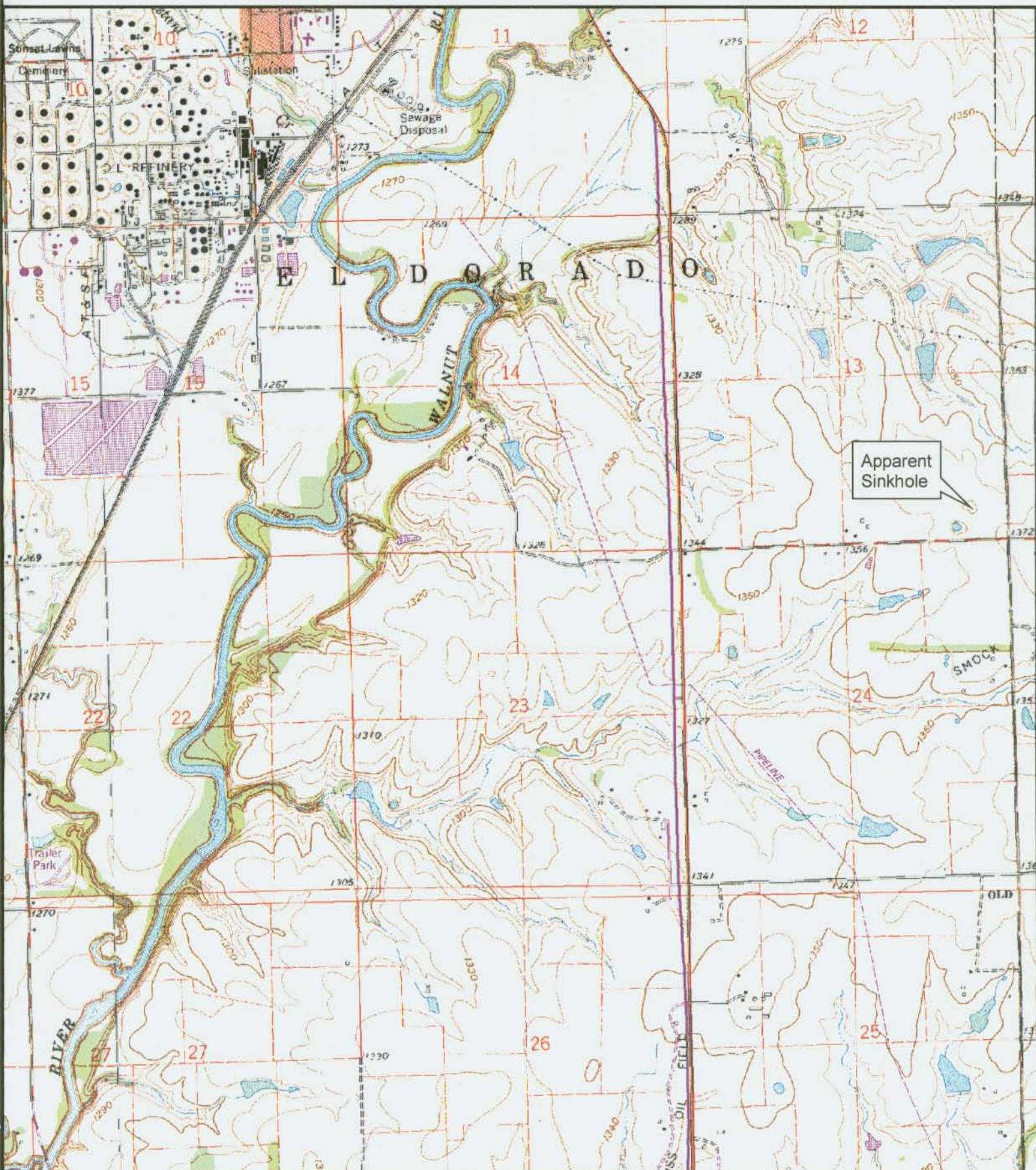
Map of Butler County (except T23S) and northern Cowley County showing upland chert gravel deposits, sinkhole zones, and principal streams. High-terrace gravels are <50 feet and hill-top gravels are >50 feet above modern valley flood plains.



Figure 1

**SINKHOLE LOCATIONS
BUTLER COUNTY, KANSAS**





Source: USGS 7.5' Series Topographic Maps
Eldorado SW, Kansas

2,000 0 2,000 Feet



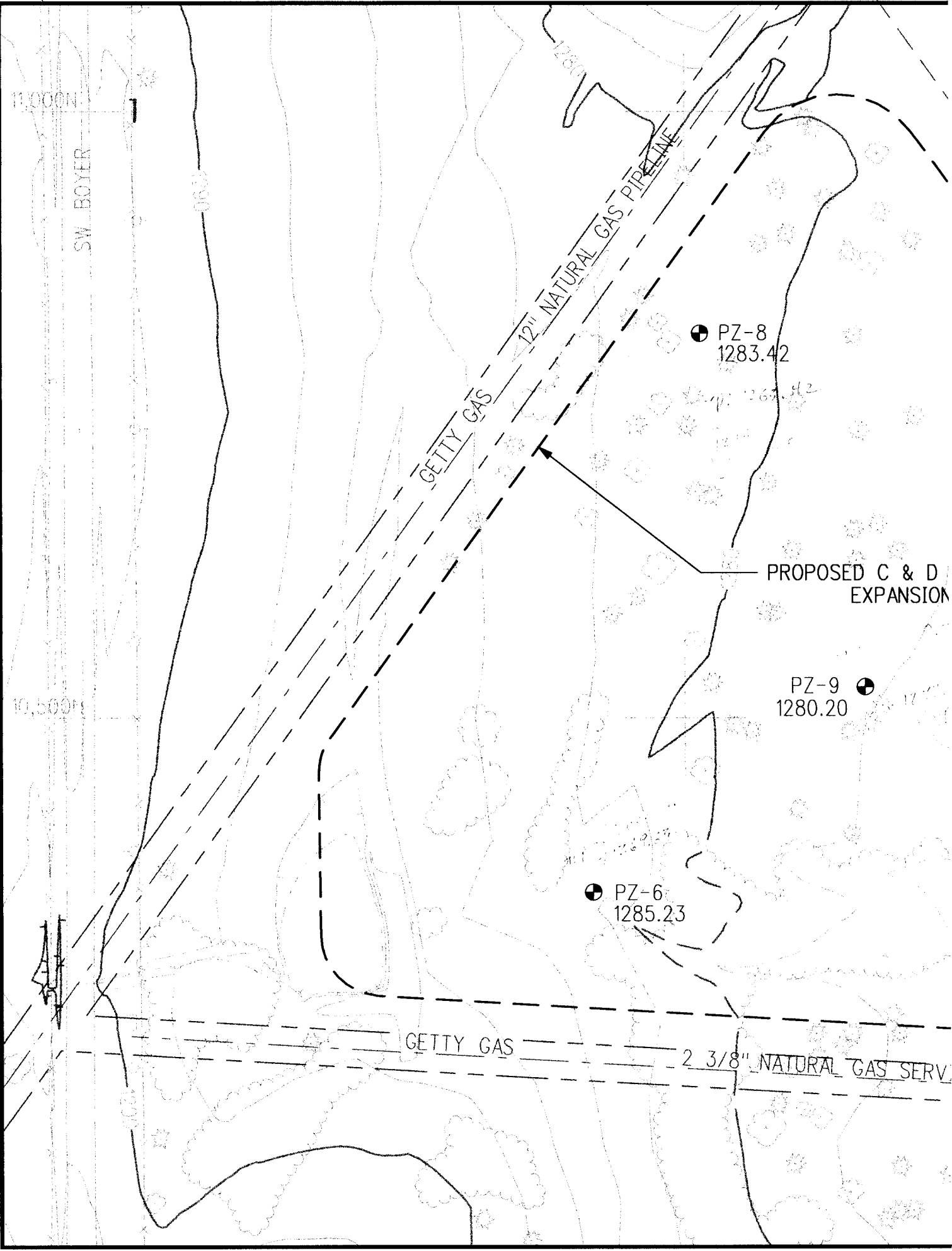
Burns & McDonnell
SINCE 1899

Figure 2
SITE LOCATION MAP

ATTACHMENT A

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10034CONT.DGN(12-14-02CONT) Off=none
10034PL.DGN() Off=none

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EXISTING
C & D WASTE DISPOSAL
AREA 2 (1999)

LANDFILL

● PZ-7
1273.57

1273.57

1273.57

ICE LINE



100' 0' 100' 200'



SCALE IN FEET



PIEZOMETER
LOCATION MAP

BUTLER COUNTY, KANSAS

Drilling Log

Project Name BUTLER C&D		Project No. 37143		Boring Number PZ-6			
Ground Elevation 1285.23 MSL		Location N10356.184 E10423.29		Page 1 of 2			
Air Monitoring Equipment				Total Footage 18			
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. Of Samples	No. Core Boxes	Depth to Water	Date Measured
Direct Push	8"	18	0	NA	NA		
Drilling Company Max's Enterprises, Inc.				Drillers (s) Doug Hunziker, Roy Feldhut			
Drilling Rig Mobile B-57				Type of Sampler Split Spoon Continuous Sampler			
Date 8-19-04		To 8-19-04		Field Observer (s) C. Knodel, O. Mills			

Depth	Description	Class	Blow Count	Recov.	Run/ Time	Sample Desig.	PID			Remarks/ Water Levels
							BZ	BH	S	
1	Organic Material	OH								
2	CLAY, stiff, trace plasticity, damp, dark brown (7.5YR3/2)	CL								
3										
4										
5	Getting redder	CL								
6	CLAY, damp, stiff, trace plasticity, reddish brown (5YR4/3)	CL								
7										
8				5/ 5						
9										
10	Getting wetter	CL								
11	CLAY, medium stiff, medium plasticity, moist	CL								
12										
13				5/ 5						
14										

ENVIRONMENTAL LOG BUTCD.GPJ BORLOGS GDT 3/11/05

Drilling Log, continued

Project Name BUTLER C&D							Boring Number PZ-6			
Project Number 37143							Page 2 of 2			
							Date 8-19-04			
Depth	Description	Class	Blow Count	Recov.	Run/ Time	Sample Desig.	PID			Remarks/ Water Levels
							BZ	BH	S	
15	CLAY, medium stiff, medium plasticity, moist	CL								
16	LIMESTONE, with clay, wet, very soft, highly plastic, very pale brown (10YR7/4)									
17										
18	Refusal at 18.0'. Stopped drilling.			5/ 5						
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										

ENVIRONMENTAL LOG BUTCD.GPJ BORLOGS.GDT 3/1/05

Drilling Log

Project Name BUTLER C&D		Project No. 37143				Boring Number PZ-7			
Ground Elevation 1273.57 MSL		Location N10374.272 E11016.791				Page 1 of 2			
Air Monitoring Equipment						Total Footage 16.2			
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. Of Samples	No. Core Boxes	Depth to Water		Date Measured	
Direct Push	8"	16.2	0	NA	NA				
Drilling Company Max's Enterprises, Inc.					Drillers (s) Doug Hunziker, Roy Feldhut				
Drilling Rig B-57					Type of Sampler Split Spoon Continuous Sampler				
Date 8-19-04		To 8-19-04			Field Observer (s) C. Knodel, O. Mills				

Depth	Description	Class	Blow Count	Recov.	Run/ Time	Sample Desig.	PID			Remarks/ Water Levels
							BZ	BH	S	
	Organic Material	OM								1520: BEGIN drilling.
1	CLAY, dry, stiff, trace plasticity, grey (2.5YR6/1)	CL								
2										
3										
4										
5										
6										
7	Getting more plastic, pale brown (10YR6/3)	CL		4/ 5						
8										
9										
10										
11										
12	CLAY with limestone, highly plastic, soft	CL		3.5/ 5						
13										
14										

ENVIRONMENTAL LOG BUTCD.GPJ BORLOGS.GDT 3/1/05

Drilling Log, continued

Project Name BUTLER C&D							Boring Number PZ-7			
Project Number 37143							Page 2 of 2			
							Date 8-19-04			
Depth	Description	Class	Blow Count	Recov.	Run/ Time	Sample Desig.	PID			Remarks/ Water Levels
							BZ	BH	S	
15	CLAY with limestone, highly plastic, soft	CL								
16	Refusal at 16.2. Stop drilling.									1620: END drilling.
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										

ENVIRONMENTAL LOG BUTCD.GPJ BORLOGS.GDT 3/1/05

Drilling Log

Project Name BUTLER C&D		Project No. 37143				Boring Number PZ-8			
Ground Elevation 1283.42 MSL		Location N10817.323 E10512.873				Page 1 of 2			
Air Monitoring Equipment						Total Footage 20			
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. Of Samples	No. Core Boxes	Depth to Water		Date Measured	
Direct Push	8"	20	0	NA	NA				
Drilling Company Max's Enterprises, Inc.					Drillers (s) Doug Hunziker, Roy Feldhut				
Drilling Rig B-57					Type of Sampler Split Spoon Continuous Sampler				
Date 8-19-04		To 8-19-04			Field Observer (s) C. Knodel, O. Mills				

Depth	Description	Class	Blow Count	Recov.	Run/ Time	Sample Desig.	PID			Remarks/ Water Levels
							BZ	BH	S	
1	SANDY CLAY, reddish brown (2.5YR5/3), stiff, dry, trace plasticity	SW-SC								1355: BEGIN drilling.
2										
3										
4										
5	Getting redder, more plastic	SW-SC								
6	CLAY, with sand, very stiff, trace plasticity, red (2.5YR5/6)	CL								
7										
8				4.5/ 5						
9										
10	CLAY, with limestone, plastic, soft, reddish brown (5YR5/4)	CL								
11										
12										
13	CLAY, wet, very soft, highly plastic, light reddish brown (5YR6/4)	CL								
14										

ENVIRONMENTAL LOG BUTCD.GPJ BORLOGS.GDT 3/11/05

Drilling Log, continued

Project Name BUTLER C&D							Boring Number PZ-8			
Project Number 37143							Page 2 of 2			
							Date 8-19-04			
Depth	Description	Class	Blow Count	Recov.	Run/ Time	Sample Desig.	PID			Remarks/ Water Levels
							BZ	BH	S	
15	CLAY, wet, very soft, highly plastic, light reddish brown (5YR6/4)	CL		4/ 5						
16										
17										
18										
19										
20	TD=20.0'									1420: END drilling.
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										

ENVIRONMENTAL LOG BUTCD.GPJ BORLOGS.GDT 3/11/05

Drilling Log

Project Name BUTLER C&D		Project No. 37143				Boring Number PZ-9			
Ground Elevation 1280.20 MSL		Location N10525.319 E10649.656				Page 1 of 2			
Air Monitoring Equipment						Total Footage 20			
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. Of Samples	No. Core Boxes	Depth to Water		Date Measured	
Direct Push	8"	20	0	NA	NA				
Drilling Company Max's Enterprises, Inc.					Drillers (s) Doug Hunziker, Roy Feldhut				
Drilling Rig B-57					Type of Sampler Split Spoon Continuous Sampler				
Date 8-19-04		To 8-19-04			Field Observer (s) C. Knodel, O. Mills				

Depth	Description	Class	Blow Count	Recov.	Run/ Time	Sample Desig.	PID			Remarks/ Water Levels
							BZ	BH	S	
1	ORGANIC material	OH								1110: BEGIN drilling.
2	CLAY, reddish brown (2.5YR4/4), stiff	CL								
3										
4										
5	CLAY, red (2.5YR4/6), some plasticity, damp	CL								
6										
7										
8	CLAY with limestone, soft, moist, plastic	CL		4.5/ 5						
9										
10										
11										
12										
13				3.5/ 5						
14										

ENVIRONMENTAL LOG BUTCD GPJ BORLOGS GDT 3/1/05

Drilling Log, continued

Project Name BUTLER C&D							Boring Number PZ-9			
Project Number 37143							Page 2 of 2			
							Date 8-19-04			
Depth	Description	Class	Blow Count	Recov.	Run/ Time	Sample Desig.	PID			Remarks/ Water Levels
							BZ	BH	S	
15	CLAY with limestone, soft, moist, plastic	CL								
16	GRAVELLY clay									
17										
18										
19										
20	TD=20.0'									1130: END drilling. Boring bottome very soupy with water/clay mixture. Boring baled dry before well was set at 1330.
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										

ENVIRONMENTAL LOG BUTCD.GPJ BORLOGS.GDT 3/11/05

REFERENCES

Aber, James S., Surficial Geology of Butler County, Kansas, Final Report, Kansas Geological Survey, Open-file Report #91-48, April 1991.

Algermission, S.T., D.M. Perking, P.C. Thenhase, S.L. Hanson, and B.L. Binder, Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico, United States Geological Survey, Map MS-2120, 1990.

Allied Laboratories, Inc., Soil Borings for Existing Butler County Landfill No. 1 Project, dated November 16, 1993.

Allied Environmental Consultants, Inc., Hydrogeologic Site Investigation Butler County Landfill No. 1, dated December 15, 1993.

Allied Laboratories, Inc., Supplemental Soils Borings and Monitoring Wells for Butler County Landfill Project, dated June 17, 1993.

Engineering Testing Company (ETC), Soil Tests and Site Analysis for Proposed Butler County Landfill, dated January 22, 1992.

Burns & McDonnell Engineering Company, Inc., Hydrogeologic Investigation for the Proposed Butler County Landfill, September 1995.

Young, James and Beard, Jonathan, Caves in Kansas, Kansas Geological Survey Educational Series 9, 1993.