KANSAS GEOLOGICAL SURVEY

1930 Constant Ave., Campus West
The University of Kansas
Lawrence, Kansas 66047-3726
phone 785-864-3965
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March 9, 2005

Catherine J. Rocky, P.E., I.E.
Terracon Consults, Inc.
2111 West Harry Street
Wichita, Kansas 67213-3299

Re: Construction and Demolition Landfill Permit Compliance
Grant County C&D Landfill, Ulysses, Kansas

Dear Ms. Rocky,

I received your request for comment by the Kansas Geological Survey (KGS) on the proposed Construction & Demolition (C&D) Landfill for Grant County. The proposed disposal area is located in the W½ SE¼ of Section 25, Tier 28S, Range 37W.

Your letter of notification included a portion of the Ulysses 7.5' topographic quadrangle, a site plan, a geologic stability assessment, and two earthquake hazard maps. The geologic stability assessment is primarily a review of existing geologic literature. The report refers to some well logs for monitor wells installed at the site and provides a two sentence summary of the well log data. No material property data was provided.

Landslides: The land surface has a gentle slope gradient; however the local relief across the site, as determined from the topographic quadrangle, is greater that the 20 feet stated in your geological assessment states. The slope gradient for the site is not reported, but a range of values could be easily calculated. No information about the landslide susceptibility of the subsurface materials at the site. KGS Bulletin 168 reports that this material is Pleistocene alluvium, loess, and paleosols. In general alluvium and loess are relatively stable and paleosols have variable stability. Since the C & D waste will be placed in trenches and no surcharge will be placed on the soils, the probability of landslides at this site is low. Stability of trench walls is always a concern, and proper precautions should be taken.

Karst: The report covers karst issues in the Miocene/Pliocene Ogallala Formation and bedrock units, primarily the Cretaceous Dakota Formation. No mention was made of the roughly 200 feet of Pleistocene deposits above the Ogallala. No karst susceptible units (limestone, gypsum, and salt) have been reported in drill holes in the Pleistocene deposits. The probability of karst is low for this site.

Poor Foundation conditions: I agree that the probability of liquefaction is low. I have one concern that needs to be addressed. The Ulysses 7.5' topographic quadrangle has several depressions. Two of these depressions are within a mile of the landfill site.

Several possible reasons exist for these depressions: deflation basins, playas, consolidation of loess and alluvial deposits, and grading of the ground surface. Groundwater flow through alluvium and loess deposits can remove the salts and weaken the bonds between soil grains leading to slow consolidation of the deposits. A rapid influx of water could speed up the process. I don't know to what degree this process will affect this landfill.

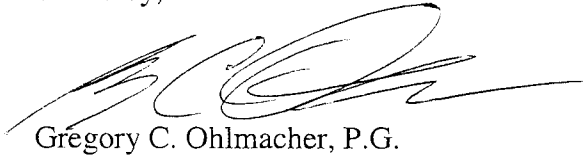
Summary: The KGS recommends that the geologic stability assessment be revised to address the above comments prior to being submitted with the final application. The KGS has only reviewed this assessment with respect to "unstable areas" defined as landslides, karst, and poor foundation conditions. Unanticipated stability problems that will need to be addressed may be encountered during detailed site characterization or landfill operation.

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 to 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,



Gregory C. Ohlmacher, P.G.
Engineering Geologist

February 14, 2005

Terracon
Consulting Engineers & Scientists

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Mr. Gregory Ohlmacher, P.G.
Kansas Geological Survey
1930 Constant Ave.
University of Kansas
Lawrence, Kansas 66047-3726

Re: Construction & Demolition Landfill Permit Compliance
Grant County C&D Landfill
Ulysses, Kansas
Terracon Project No. 01047028

Dear Mr. Ohlmacher:

Our client, Grant County Landfill, is seeking a permit modification to increase the volume of the Grant County Construction and Demolition (GCC&D) Landfill at the Grant County Solid Waste Facility (Facility). The Facility includes a closed MSW landfill, transfer station, and active C&D landfill.

The Kansas Department of Health and Environment (KDHE) requires the permittee to notify your agency to satisfy location restrictions. Grant County is seeking to increase the permitted volume to utilize Trench No. 3, previously permitted on August 7, 1997. In compliance with K.A.R. 28-29-302, approval for siting the C&D expansion area is required from your agency with respect to geologic stability.

The site is located east of Ulysses, Kansas, approximately 2.5 miles east of the intersection of State Highway 25 and U.S. Highway 160 in the W ½, SE¼ of Section 25, Township 28 South, Range 37 West, in Grant County, Kansas. The location of the subject site is depicted on the enclosed United States Geological Survey (USGS) 7.5-Minute Quadrangle Map (see Figure 1). The proposed expansion area (Trench No. 3) is located south of active C&D Trench No. 2 (see Figure 2).

1.0 GRANT COUNTY C&D LANDFILL GEOLOGIC STABILITY ASSESSMENT

Readily available published information pertaining to the geologic stability of the GCC&D Landfill area was reviewed, as well as available site-specific lithologic information. A list of references is included at the end of this document.

The stability of the site was evaluated relative to areas susceptible to mass movement, karst terrain, and poor foundation areas.

1.1 Areas Susceptible to Mass Movement

Figure 1 is a Location Map indicating the GCC&D Landfill on a portion of the Ulysses 7.5-Minute USGS Quadrangle map. As indicated on Figure 1, the topography at, and adjacent to, the GCC&D Landfill has relatively low relief, with less than 20-feet of vertical relief across the site and adjacent properties. The topography is generally flat to "gently sloping," and abrupt changes in slope are not indicated at the GCC&D Landfill. Based upon the low topographic relief, gentle slopes, and seismic risk (see Section 1.3), the potential for landslides or other mass movement is considered low.

In addition, waste is placed and compacted in below-grade cells (trenches) using generally accepted industry methods, therefore shifting of waste is not anticipated. The waste does not extend significantly above grade, and the compacted waste density is estimated to range from about 1250 to 2000 lbs/cy. Therefore, it is anticipated there will be a net reduction in bearing pressure on the native soils at the base of the cells. Also, soil stockpiles are placed at least 15 feet from the edge of open cells, therefore slope stability due to surcharging by soil stockpiles is not anticipated.

1.2 Karst Topography

Based upon KGS Bulletin 168, Geohydrology of Grant and Stanton Counties, Kansas, bedrock in the area of the GCC&D Landfill consists of the Pliocene Ogallala Formation, which consists of individual and mixed layers of stream-deposited silt, clay, sand, and gravel. Caliche-cemented sand and gravel zones can occur in the Ogallala Formation. According to the KGS publication, "Caves in Kansas," Education Series 9, 1993, a few small shelter caves are found in the Ogallala Formation where it crops out as "mortar beds." However, the KGS Surface Geologic Map of Grant and Stanton Counties, KGS Bulletin 168, indicates the Ogallala Formation does not outcrop in Grant County.

Included in KGS Bulletin 168 are geologic cross-sections located north and south of the GCC&D Landfill. These geologic cross-sections indicate the Ogallala is underlain by the Cretaceous Cheyenne Sandstone (south) and the Dakota (sandstone) Formation (north). The Dakota/Cheyenne sandstones typically consist of fine to medium-grained quartz fragments, trace minerals, and can be carbonaceous and shaley. Karst terrain is not anticipated in these sandstone formations.

The KGS publication "User's Guide to the Dakota Aquifer in Kansas," Technical Series 2, was reviewed with regard to the Dakota geology. A map showing the extent of the Dakota aquifer in Kansas indicates in general, Grant County is underlain by the Dakota aquifer. The geologic cross-sections included with KGS Bulletin 168 indicate the Dakota aquifer is approximately 400 feet below ground surface in the vicinity of the site. Karst features associated with the Dakota are not mentioned in this publication.

Additional information obtained from the KGS Web Site includes the following:

"According to the Kansas Speleological Society, the Kansas landscape is dotted with several hundred caves. Few layers of rock in the state are thick enough to support extensive cave systems, but caves are found in the limestones of the Ozark Plateau area in southeastern Kansas, the limestones of the Flint Hills, and in the gypsum layers of the Red Hills." The landfill site is not located in these areas.

Available on-site geologic information consists of well logs for monitor wells installed at the Facility. The well logs indicated sand, clay, silt, and "rock" to depths of about 100 feet, with groundwater encountered at depths that ranged from approximately 30 to 80 feet. Indications of karst features are not mentioned on the well logs from Facility wells.

1.3 Poor Foundation Areas

Foundation conditions were evaluated based on soil characteristics, potential for liquefaction, and settlement.

Based upon KGS Bulletin 168, Geohydrology of Grant and Stanton Counties, Kansas, surface geology at the GCC&D Landfill consists of Pleistocene loess. According to the Soil Survey of Grant County, Kansas (USDA SCS, 1969), most of the soils of Grant County developed in deposits of loess or sand. The Manter fine sandy loam, 1-3% slopes in the eastern half of the Facility, and the Otero fine sandy loam, 4-12% slopes in the western half of the Facility, are present at the GCC&D. Based upon Table 6, Estimated Engineering Properties of Soils, the Manter fine sandy loam and Otero fine sandy loam both have a low shrink-swell potential. In addition, based upon Table 5, Engineering Test Data, the Manter fine sandy loam has a low Plasticity Index. As indicated on the design plans dated March 1996 for the C&D landfill, the side slopes of previous, current, and proposed disposal trenches are not vertical, although loess can maintain a near vertical face without caving or slumping. Also, based upon information provided by the facility operator, slope failure has not occurred at the Facility.

Historically, liquefaction primarily occurs in uniformly-graded cohesionless soil, where the soil loses its strength during an earthquake and acquires a degree of mobility sufficient to permit large deformations. Other conditions that influence the liquefaction potential of a soil are the relative density, groundwater, and the magnitude of the stresses or strains introduced by earthquake. Based upon the seismic risk map published by Jackson, 1979 (copy attached), the GCC&D landfill is located within seismic risk Zone 1 – minor damage. A USGS Seismic Hazard Map (copy attached) indicates the GCC&D area lies within a zone designated *1-2% g, Peak Horizontal Acceleration with 10% Probability of Exceedance in 50 Years*. Therefore, the area of the GCC&D would not be considered unstable with respect to

seismic risk. The Soil Survey of Grant County indicates that uniformly-graded cohesionless soils are not expected in the site area. The general groundwater level at the site is expected about 30 to 80 feet below ground surface. Based on the groundwater depth, the absence of uniformly-graded cohesionless soils, and the low seismic risk (Section 1.3 of this letter) the site soils are not considered susceptible to liquefaction.

When completed, the elevation of the top of the landfill will be at or near the existing grade. We estimate that the excavated soil has a density significantly greater than that of the refuse that will be placed in the landfill. The stress at the base of the landfill at completion of landfilling operations will be considerably less than the existing stress, and therefore bearing capacity is not of concern. Because the stress is less than presently exists, we estimate the long-term settlement at the base of the landfill will be minor, less than 1 inch.

2.0 SUMMARY

Terracon reviewed readily available published and on-site information regarding general stability issues for the GCC&D area. Terracon reviewed information with regard to areas susceptible to mass movement, karst topography, and poor foundation areas. Based upon our review, information was not developed to indicate the GCC&D Landfill is located in a geologically unstable area.

3.0 GENERAL COMMENTS

The geological assessment conducted by Terracon was limited and should not be considered a comprehensive assessment of the site. Readily available published information was reviewed to evaluate the general geology of the study area. The limitations of the assessment methods should be recognized. Please note that Terracon does not warrant the work of regulatory agencies or other parties supplying information used in the compilation of reports.

REFERENCES

United States Geological Survey (USGS) Ulysses, Kansas 7.5-Minute Quadrangle Map, 1959, Photorevised 1978.

Kansas Geological Survey (KGS) Website, Geologic Map of Grant County

KGS Bulletin 168, Geohydrology of Grant and Stanton Counties, Kansas, Fader, Stuart W., et al, 1964.

KGS "Caves in Kansas", Education Series 9, 1993.

Soil Survey of Grant County, Kansas, US Department of Agriculture, Soil Conservation Service, Swanson, D.W., 1986.

KGS "User's Guide to the Dakota Aquifer in Kansas", Technical Series 2, 1998.

USGS Website, Seismic Hazard Map (http://eqmaps.cr.usgs.gov/servlet)

Please contact us if you need any further information for your review. We respectfully request an expedited review and response. Please call (316-262-0171) or fax (316-262-6997) us with results.

Sincerely,
TERRACON

Prepared By:

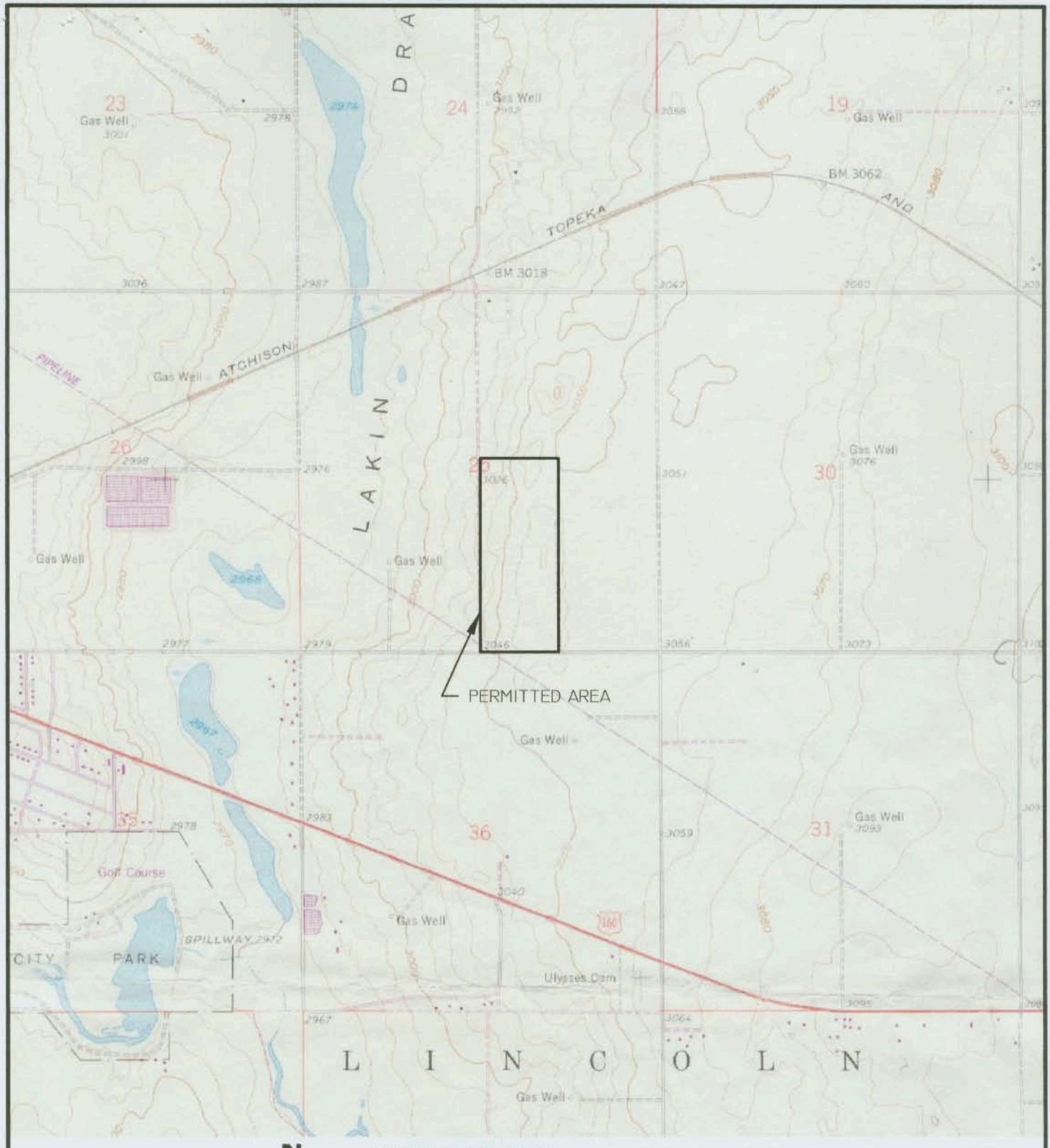
Catherine J. Rocky, P.G., I.E.
Senior Project Manager

Reviewed By:

Douglas A. Aldrich, P.E.
Principal, Office Manager

Attachment

N:\ENV Projects\2004\01047028\Letters\Location Restriction Demonstrations\KGS.doc



APPROXIMATE W/2 SE/4
OF SECTION 25,
TOWNSHIP 28 SOUTH,
RANGE 37 WEST.

N

ULYSSES QUADRANGLE
KANSAS - GRANT COUNTY
7.5 MINUTE SERIES (TOPOGRAPHIC)
1959 - PHOTO REVISED IN 1978

0 1,000' 2,000' 4,000'

MAP IS INTENDED FOR GENERAL USE ONLY, NOT FOR CONSTRUCTION PURPOSES. LOCATIONS ARE APPROXIMATE.

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GRANT COUNTY SOLID WASTE FACILITY

3 MILES WEST OF ULYSSES
GRANT COUNTY, KANSAS

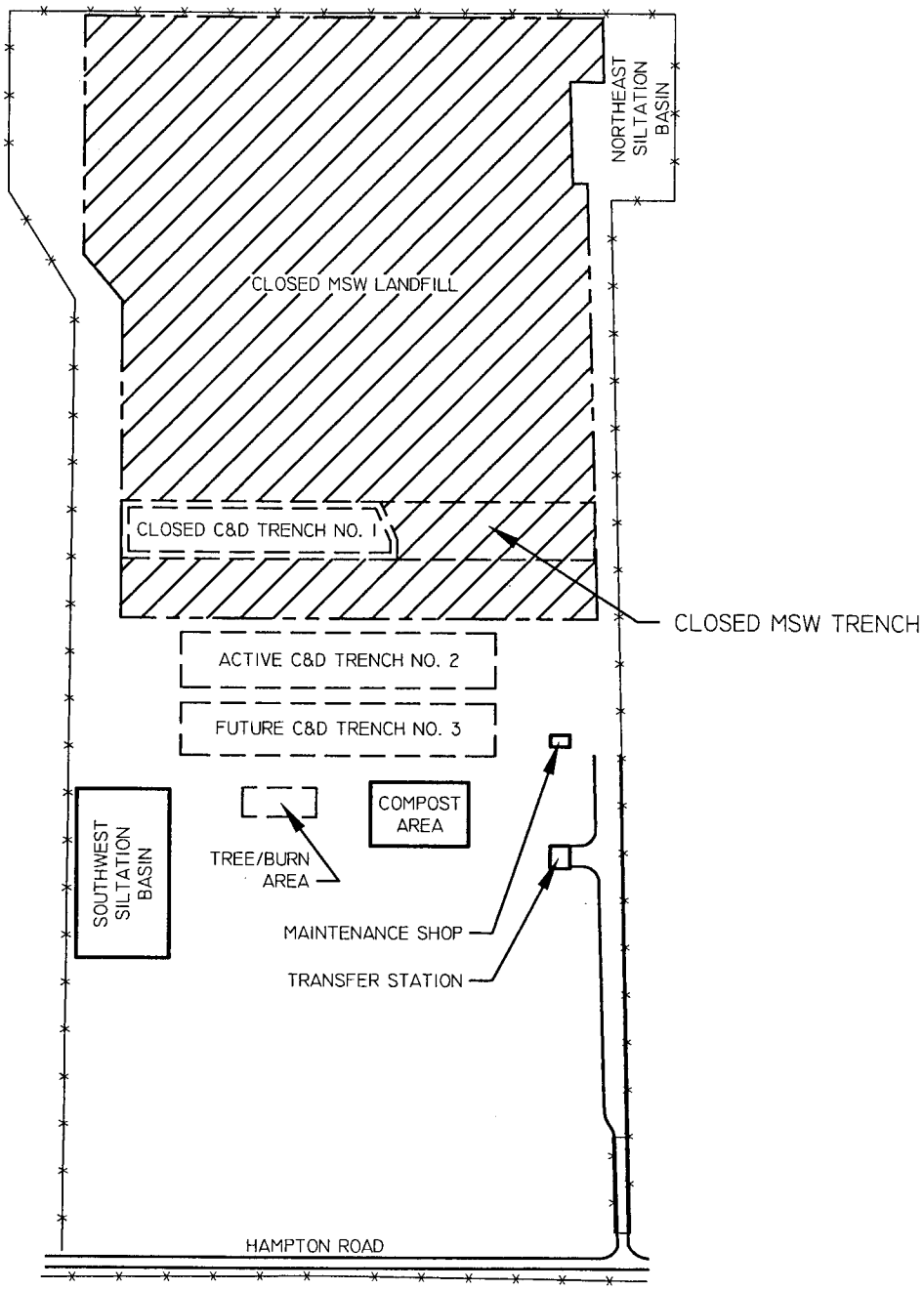
MARK	DATE	DESCRIPTION

PROJECT NO:	01047028
CAD DWG FILE:	7028FL.DWG
DRAWN BY:	BCB
CHK'D BY:	CJR
DATE:	01/04/05

SHEET TITLE

LOCATION MAP

FIGURE 1



NOTE:
LOCATION OF TRENCH NO. 2 AND NO.3 BASED ON SCS DRAWINGS APPROVED AUGUST 11, 1997.

N

0 200' 400' 800'

MAP IS INTENDED FOR GENERAL USE ONLY, NOT FOR CONSTRUCTION PURPOSES. LOCATIONS ARE APPROXIMATE

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GRANT COUNTY SOLID WASTE FACILITY

3 MILES EAST OF ULYSSES
GRANT COUNTY, KANSAS

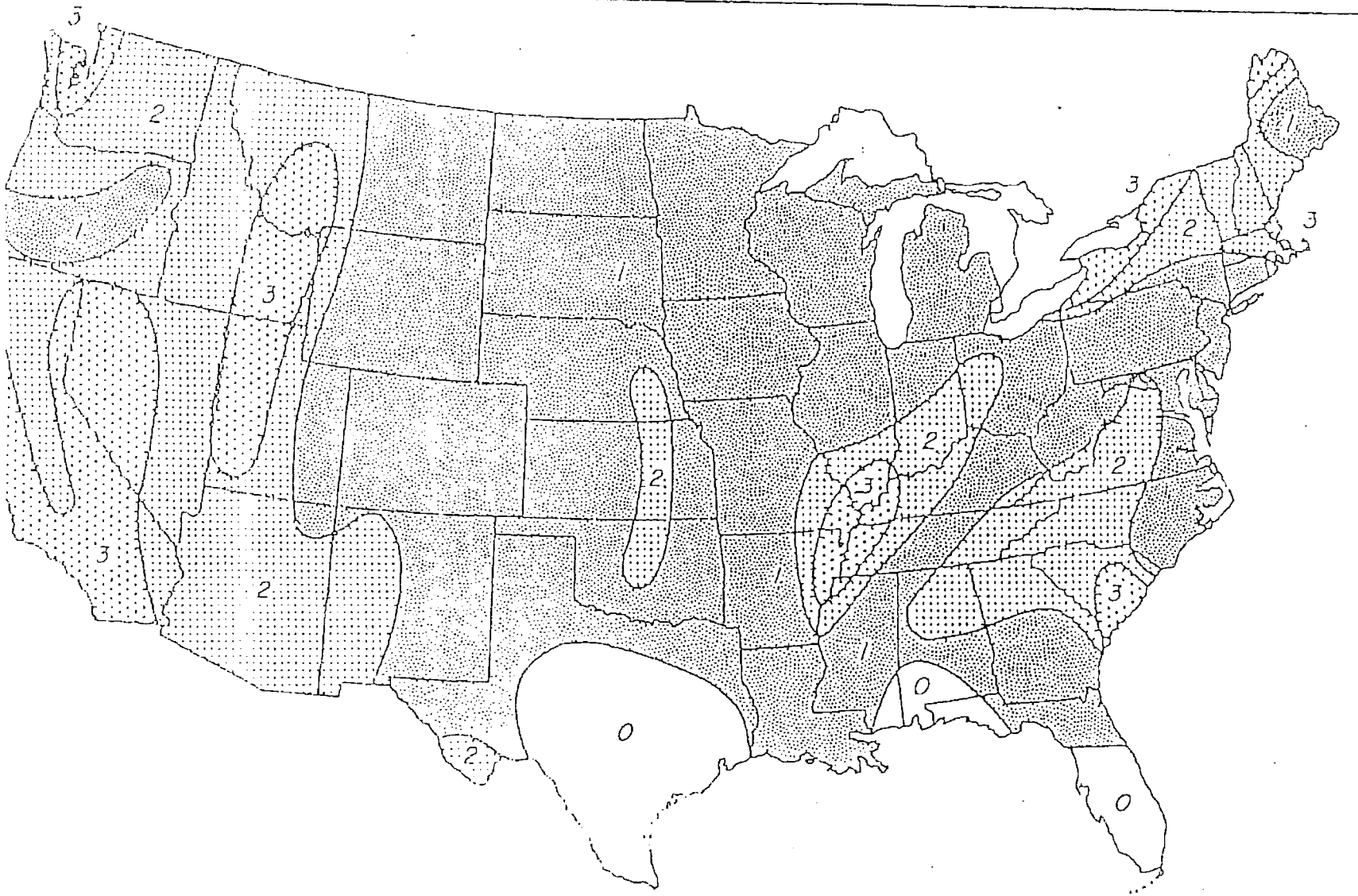
MARK	DATE	DESCRIPTION

PROJECT NO:	01047028
CAD DWG FILE:	7028F2.DWG
DRAWN BY:	BCB
CHK'D BY:	CJR
DATE:	01/04/05

SHEET TITLE

SITE DIAGRAM

FIGURE 2



Seismic risk map for conterminous United States. Zone 0 – no damage. Zone 1 – minor damage; corresponds to intensities V and VI of the M. M.* scale. Zone 2 – moderate damage; corresponds to intensity VII of the M. M.* scale. Zone 3 – major damage; corresponds to intensity VIII and higher on the M. M.* scale. (* – M. M. refers to the Modified Mercalli Intensity Scale.)

(From Jackson, 1979)