REPORT OF SUBSURFACE EXPLORATION
FOR KINNICKINNIC RIVER STABILITY ANALYSIS AND
DREDGING STUDY

MILWAUKEE COUNTY, WISCONSIN

PREPARED FOR:

BARR ENGINEERING COMPANY

JUNE 9, 2006

CEC PROJECT #GD-06032

Prepared By:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

TABLE OF CONTENTS

APPENDIX

I. INTRODUCTION

The Wisconsin Department of Natural Resources (WDNR) has proposed sediment removal from a stretch of the Kinnickinnic River, from Becher Street to Kinnickinnic Avenue located in the City of Milwaukee, Wisconsin. As part of this initiative, the U.S. Army Corps of Engineers has determined that certain engineering aspects of the project warrant a subsurface geotechnical investigation to evaluate the stability of the seawalls and unprotected riverbanks along this section of the river prior to sediment removal. This determination will be provided by Barr Engineering Company (Barr) of Minneapolis, Minnesota.

Coleman Engineering Company (CEC) was retained by Barr to perform surveying, field drilling, geotechnical laboratory testing, sheet-pile wall surveying and parallel seismic surveying. These services included field drilling and sampling at boring locations provided by Barr, laboratory testing consisting of visual soil classifications and physical laboratory testing as deemed necessary to correctly classify the soils, surveying the dimensions and elevations of existing structures and boring locations along the river banks, seismic testing to identify the bottom of the existing sheet piles and preparing a summary report describing the activities associated with this project.

CEC is responsible for the above-noted services. Interpretation of the data and all other aspects are the responsibilities of others.

II. FIELD PROCEDURES

Field Drilling and Sampling

The drilling services required for this project consisted of six (6) soil borings located within the site area. At the direction of Barr, all six borings were to be drilled to a depth of fifty (50) feet. Actual completed depths for the six borings range from 42.2 feet to 53.8 feet deep. In addition, three (3) of the borings would be completed with 2 ½" PVC casing to facilitate the placement of a geophone below the surface for parallel seismic testing.

Drilling was completed by a CEC drill crew present on-site from April 18 to April 27, 2006, using 4¼ inch hollow-stem augers (HSA) powered by a Diedrich D-50 drill. Hollow-stem augers act as continuously-advanced steel casing to prevent soils from collapsing into the open borehole. The hollow augers were advanced to the sampling depth, and sampling tools were then lowered down through the augers to sample undisturbed soils below the tip of the augers. Drilling and field sampling were performed in accordance with ASTM D-1586, "Penetration Test and Split Barrel Sampling of Soils" with a 2-inch O.D. split spoon, and with ASTM D-1587, "Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes". One hundred (100) split-spoon samples and eight (8) thin-walled tube samples were obtained.

Soil cuttings generated from the test drilling were contained in 55-gallon drums and staged on site until they could be picked up for disposal. CEC retained the services of OSI of Milwaukee, Wisconsin, a licensed waste disposal contractor, to effectuate appropriate disposal.

A field log was prepared for each boring during exploration which contained the work method, standard penetration test (SPT) data, samples recovered and the indication of the presence of various soil types/conditions. Pocket penetrometer and torvane tests were conducted and recorded in the field only for soil samples identified as lean clays (CL), the silts and organic silts (ML and OL) being observed to occur generally in a soft to very soft condition. The field logs were submitted to CEC's Iron Mountain laboratory along with the soil samples for evaluation of the subsurface information and preparation of the final boring logs. Rough field and final typed boring logs are presented in Appendix E.

Three (3) of the test borings (S-1, S-3 and S-5) were completed with 2 ½" PVC casing extending to the bottom of the borehole. This casing was grouted in place with neat cement grout to securely anchor the casing and provide a continuous connection to the borehole walls. The casing was filled with water to prevent it from floating out of the borehole before the grout set. The casing was abandoned upon completion of the seismic survey by filling with bentonite chips and cutting the casing off below grade before reclaiming the site.

Access to the test boring locations required that all property owners be notified in advance. Verbal notification was provided at least five days in advance of CEC being on site. Additionally, boring S-1 was located along a steep embankment just west of the Gillen Company parking area. This location required temporary removal of heavy ornamental chain and an elaborate system of cribbing with a drilling platform to safely access the site and complete the drilling. Photographs of this site are presented in the project photographic log in Appendix J.

Tie-back Survey

The tie-backs associated with anchoring the sheet pile wall were surveyed to document the existing condition of the sheet pile wall. Tie-backs were identified on the face of the wall and measurements were taken to locate the horizontal location as well as the vertical placement on the face of the wall. CEC Drawing No. H documenting the existing locations of tie-backs is presented in Appendix H.

Parallel Seismic Survey

After completion of the drilling, three test borings (S-1, S-3 and S-5) were selected for parallel seismic testing to establish the bottom of the sheet-pile wall. Within these borings, a geophone was lowered down each boring and the sheet-pile wall was struck smartly with a sledge hammer. The energy was received by the geophone, recorded, and plotted in order to determine the elevation of the base of the sheet-pile wall. A more detailed description of this activity as well as results of this investigation are included in Appendix I.

The boring locations were selected and established in the field by Barr with direction from the U.S.

Army Corps of Engineers. Figure 1 in Appendix A shows the project location, Figure 2 in Appendix B shows the individual boring locations.

III. LABORATORY PROCEDURES

All field samples collected were visually classified in accordance with ASTM D-2488, "Description and Identification of Soils (Visual-Manual Procedure)". Laboratory testing of collected soil samples was assigned by Barr under the direction of the U.S. Army Corps of Engineers and included tests for moisture content, Atterberg limits for cohesive soils, combined mechanical/hydrometer grain-size analyses, specific gravity, unit dry density, unconfined compression, and CIU triaxial compression with pore pressure. CEC retained the services of Soils Engineering Testing, Inc. (SET) of Bloomington, Minnesota to perform the requested CIU triaxial compression testing of particular undisturbed samples. SET also performed moisture content, dry density, Atterberg limits, and hydrometer grain-size analyses on these same samples. Individual test reports for all laboratory tests are included in Appendix G.

The final boring logs contain both factual and interpretive information. It should be emphasized that any recommendations are based only on the final boring logs. On the final boring logs, horizontal lines designating the interface between differing materials encountered represent approximate boundaries. The transition between soil layers is typically gradual.

IV. SITE CONDITIONS

The predominant soil types disclosed throughout the area of investigation are cohesive soils including silt (ML), organic silt (OL), and clay (CL and CH). Some peat (Pt) was observed in the upper areas of Borings S-4 and S-6, and throughout the site are scattered thin seams of sand (SP-SM) and silty sand (SM). Borings S-1 and S-5 encountered probable bedrock between 42.2 and 46.5 feet deep. We recommend that you review the subsurface soil information presented on the respective boring logs for each section of the site for more in-depth site-specific data.

Groundwater was found between 4.2 feet and 10.1 feet deep. Long-term monitoring of groundwater was not part of the scope of this project; therefore, the water level information indicated on the final logs is accurate at the time of drilling only. Groundwater levels vary greatly depending on meltwater, runoff, time of year, amount of precipitation, and other factors, and are likely directly related to water elevations in the Kinnickinnic River. It should, therefore, be expected that different groundwater levels may be encountered at other times throughout the year.

* * * * * * * *