

The following document is provided for informational purposes only and should be considered preliminary in nature. Any future development should include the performance of a site-specific geotechnical evaluation to address issues and subsurface conditions unique to the construction and soil conditions in a given area.

PRELIMINARY GEOTECHNICAL EVALUATION

**BLACKTHORN WEST BUSINESS PARK
ST. JOSEPH COUNTY, INDIANA**

Prepared for

**BW BUSINESS PARK LLC
777 CHIPPEWA AVENUE
SOUTH BEND, INDIANA 46614**

By

**SHILTS, GRAVES & ASSOCIATES
AN EARTH EXPLORATION, INC. COMPANY
1103 SOUTH BEND AVENUE
SOUTH BEND, INDIANA 46617**

July 24, 2000

Shilts, Graves & Associates
An Earth Exploration, Inc. Company



Shilts, Graves & Associates, Inc.

An Earth Exploration, Inc. Company

July 24, 2000

Mr. Matt Edmonds
BW Business Park LLC
777 Chippewa
South Bend, IN 46614

Re: Preliminary Geotechnical Evaluation:
Blackthorn West Business Park
St. Joseph County, Indiana
SGAEEI Project No. 2-2168

Dear Mr. Edmonds:

We have completed our preliminary geotechnical evaluation for the above-referenced project. For your information, we are enclosing three copies of our report for your review and distribution and can provide additional copies, if requested. This report presents the results of our field exploratory program and provides preliminary recommendations for development of the site from a geotechnical viewpoint, including such items as foundation and pavement design and construction. Unless you notify us otherwise, we will retain the soil samples from the field investigation for 60 days and then discard them.

The opinions submitted in this report are based, in part, on our interpretation of the subsurface information revealed by six test borings. Understandably, this report does not reflect variations in subsurface conditions between or beyond these borings. Variations in soil conditions can be expected between the boring locations, and fluctuation in the level of groundwater may occur with time. Other important limitations of this report are discussed in Appendix A.

DEVELOPMENT CONCEPTS

We understand that BW Business Park LLC (BWBP) is considering the development of an approximately 120 ac. parcel of property located in at the southwest corner of the intersection of the Indiana Toll Road (I-80/90) and Olive Road in St. Joseph County, Indiana. Refer to the vicinity map on a Test Boring Location Plan (Drawing No. 2-2168.B1) in Appendix C for the location of the planned business park. At this time, the development concepts are at an early stage. Although development plans are

July 24, 2000

Mr. Matt Edmonds
BW Business Park LLC

Page 2

preliminary, we anticipate that new construction of the northeast parcel is planned to consist of an approximately 440,000-sq ft single-story warehouse/office building with columns supported on spread foundations and a concrete slab-on-grade. In addition, 12 other parcels are planned to be developed. Although unknown at this time, structural loads are anticipated to be moderate (i.e., less than 300 kips). New construction may also include loading docks and parking areas with access drives adjacent to the buildings. Additionally, we anticipate that additions to the building or installation of internal machinery (including machine pits and foundations) could occur after the initial construction. At this time, no other information is known.

The purpose of our services was to assist in the evaluation of the development potential of the property. Specifically, we have made a preliminary evaluation of the subsurface conditions at the site and assessed the impacts of these conditions on foundation and pavement design and construction, as well as earthwork aspects of site development. Considering that the development concepts are at an early stage, our assessment should be considered preliminary in nature. Once information regarding the proposed construction of each parcel is available, SGAEEI should be retained to gather additional subsurface information and/or provide further recommendations related to how site specific issues may impact design and construction.

PRELIMINARY SUBSURFACE EXPLORATION PROGRAM

Subsurface conditions for the development were explored by performing six test borings to depths of 20 ft below the existing ground surface at the locations shown on the Test Boring Location Plan. It should be noted that eight borings were originally planned, however, the western approximately one-third of the site was planted with crops and the two borings in this area were not performed. The number, depths and location of the borings were selected by BWBP. The boring locations were staked in the field by SGAEEI personnel on June 6, 2000, via referencing (i.e., tape measurements) existing site features. It should also be noted that ground surface elevations at the boring locations were not provided and the boring locations are considered accurate only to the degree implied by the method used.

Field activities were performed by SGAEEI on June 14, 2000, using all-terrain mounted equipment. Hollow stem augers (3-1/4 in. I.D.) were used to advance the boreholes, and soil samples using Standard Penetration Test (SPT) procedures (ASTM D 1586) were obtained at 2-1/2 ft intervals to a depth of 15 ft and at 5 ft intervals thereafter. Further details of the drilling and sampling procedures are provided in Appendix B. Following the completion of field activities, final water level readings were then obtained, and each borehole was backfilled with auger cuttings and a bentonite chip plug placed near the surface.

Shilts, Graves & Associates

An Earth Exploration Inc. Company

July 24, 2000

Mr. Matt Edmonds
BW Business Park LLC

Page 3

After completing the subsurface exploratory program, the soil samples were visually classified by geotechnical engineer. Final boring logs were then prepared and are included in Appendix C. Soil classifications on the boring logs are according to the Unified Soil Classification System (ASTM D 2488). Laboratory testing was performed on representative soil samples to determine index properties. Testing consisted of natural moisture content (ASTM D 2166) and several hand penetrometer readings. Results of the laboratory tests are provided on the boring logs. The final boring logs represent our interpretation of the individual samples and field logs. Stratification lines on the boring logs represent the approximate boundary between soil types, and the transitions may actually be gradual.

DISCUSSION OF SITE CONDITIONS

Surface Conditions

From our field observations, the eastern three-quarters of the site has been used for agricultural purposes however, is currently unplanted. The western quarter is planted with corn. An exception to this is an area approximately 500 ft by 500 ft towards the western portion of the site which is forested. It should be noted that a significant amount of cobbles (i.e., particles with maximum dimension ranging from 3 in. to 12 in.) were observed at the ground surface across the entire site. Based on topographic information shown on the South Bend West Quadrangle (7.5 minute series), the ground surface within the property limits ranges from a high of about Elevation 825 to a low of about Elevation 800.

Subsurface Conditions

Based on the preliminary exploratory program, subsurface conditions at the boring locations were somewhat similar. In general, the subsurface profile consisted of (in descending order): 1) topsoil; 2) cohesive-type soils consisting of lean sandy clay and or clayey/silty sand; and 3) granular-type soils.

Cohesive Soils: The surficial topsoil was underlain by a strata of soils consisting of sandy lean clay or clayey/silty sand to depths ranging from about 5 to 8 ft. While the clayey/silty sand soils are not truly cohesive, they will behave similar to cohesive soils in their drainage and compaction characteristics. Therefore, we have combined these soils into one general soil strata for discussion purposes. Based on our observation of the quantity of cobbles at the surface, we would anticipate that cobbles also existing within the upper strata. The consistency of the cohesive type soils was stiff to very stiff with hand penetrometer readings ranging from 2 to 3 tons/sq ft (tsf). Natural moisture

July 24, 2000

Mr. Matt Edmonds
BW Business Park LLC

Page 4

contents ranged from 17 to 20 percent. The relative density of the granular soils (cohesive like) were loose to medium dense with SPT N-values ranging from 5 to 11 blows/ft (bpf).

Granular Soils: The cohesive soils were underlain by granular soils to the maximum depths explored. Generally, these soils consisted of sand with varying amounts of gravel. Additionally, the relative density was typically medium dense to dense with SPT N-values ranging from 5 to 26 bpf.

Groundwater Conditions: Groundwater level observations made during and shortly after completion of the borings are noted at the bottom of the boring logs. Groundwater was not observed within the depths explored. Based on well records published¹ for St. Joseph County, groundwater in the area of the site is anticipated to be at about Elevation 730. Given the presence of the granular soils, it is our opinion that these observations indicate that the phreatic groundwater level is below the maximum depth explored.

PRELIMINARY CONSIDERATIONS

In our opinion, the site is generally suitable for development. Based upon the subsurface conditions at the boring locations, the proposed construction is also conducive for the use of conventional shallow foundations. However, due to the limited number of test borings and availability of details of the proposed construction, the following recommendations are regarded as preliminary in nature. Once information regarding the proposed construction is available, SG&EEI should be retained to gather additional subsurface information to provide further recommendations related to how site specific issues may impact design and construction.

Based on the site topography, we anticipate that a significant amount of grading will be required to establish building and pavement grades. Given the quantity of cobbles observed at the ground surface, we anticipate that the soil within the upper stratum (i.e., approximately 5 to 8 ft) may have to be screened (i.e., particles larger than 4 in. in maximum dimension) for use as engineered fill beneath buildings or pavements.

From our observations, the cohesive soils or granular soils containing a high percentage of fine particles encountered at the site are of low to moderate plasticity and are often moderately to highly over-consolidated as a result of desiccation. Due to their over-consolidated nature, these soils often have acceptable strength/deformation characteristics for support of shallow spread foundations. Additionally, during

¹Ground-Water Resources of Northwestern Indiana, Bulletin No. 15, 1962.

July 24, 2000

Mr. Matt Edmonds
BW Business Park LLC

Page 5

foundation installation activities, stabilization of these soils will likely be required to expedite construction activities and/or to improve the long-term performance of the structure/pavement. Subgrade stabilization may consist of re-working (discing, aeration and recompaction) the soils with conventional equipment or undercutting and replacement with compacted granular fill. Often decisions regarding the appropriate type(s) of required stabilization can be provided prior to construction if sufficient information regarding the subsurface conditions is available; however, in some cases, this may not be enough.

Foundation Design Considerations

Depending on the actual column loads and foundation grades, we anticipate that foundations established on the improved granular soils or engineered granular fill could be proportioned for a net allowable bearing pressure in the range of 3,000 to 5,000 lb/sq ft (psf). It should be noted that loose soils were encountered at some locations. If soft or loose soil is encountered in foundation excavations, the unsuitable soil should be removed and replaced with compacted granular fill, or the foundations could be lowered to a soil of adequate bearing. In some cases, if the thickness of the soft layer is not significant, it may be more cost effective to use a large-sized aggregate, such as No. 2 stone, to stabilize foundation excavations. To minimize the potential for localized shear failure, we also recommend a minimum footing width of 30 in. and 18 in. for isolated column and continuous wall footings, respectively. We also recommend that foundations be established at least 4 ft below the finished grade for frost heave considerations.

Below-Grade Walls

For design of the loading dock walls, we recommend that the walls be designed to resist at-rest lateral earth pressures. Considering that the walls will be fixed at the top, we anticipate that a rigid condition will exist. For this condition, we recommend using an equivalent fluid pressure of 60 lbs/sq ft/ft of depth below the top of the wall. This condition assumes that free-draining (i.e., $P_{200} \leq 12$ percent) granular soils are used as wall backfill; the backfill extends horizontally from the wall a distance equal to at least 1/2 of the depth of the wall below grade; a moist unit weight of 125 lbs/cu ft; and an angle of internal friction of 30 degrees. In addition to the lateral earth pressures, surcharges from temporary loads during construction (if any) or adjacent foundations should be taken into account in the wall design. We also recommend that the backfill behind the walls be compacted to 90 percent of the maximum dry density (modified Proctor, ASTM D 1557). Compaction of backfill within 3 ft of the walls should be performed with a hand-guided compactor to avoid over-stressing the walls.

July 24, 2000

Mr. Matt Edmonds
BW Business Park LLC

Page 6

Pavement Design Considerations

In our opinion, the cohesive soils either natural or fill (used to raise the site grades) will control pavement design. The cohesive soils are considered to be relatively poor subgrade materials due to their frost susceptibility and tendency to soften when wet. Consequently, a poor subgrade condition has been assumed [i.e., a design CBR (California Bearing Ratio) of 5]. For these conditions, we recommend that pavement designs be based on estimated traffic loading conditions and a 20-year design life using the AASHTO design method and layer coefficients. The pavement thicknesses for this method are based on the presence of a stable, non-yielding pavement subgrade prepared as described previously. Additionally, particular attention to subgrade preparation, control of subsurface drainage and periodic preventative maintenance are critical to the design life of any pavement section. The final pavement design should also incorporate adequate surface and subsurface drainage. Once information regarding the anticipated traffic loading/frequency is known, EEI should be retained to provide a design for the pavement section(s).

Construction Considerations

Based on our experience with other projects having similar soil conditions, we anticipate that earthwork operations performed during wet weather conditions will require subgrade stabilization. Experience shows that when the upper sandy clay/clayey sand soils are wet, their strength and ability to "hold up" under construction traffic are poor. Because these soils tend to soften when exposed to water, surface run-off should be diverted from excavations and the site, and ponding of water from rainfall should be minimized. In addition, due to the clayey nature of the soils anticipated at the site, travel on the foundation/pavement subgrades with construction equipment, apart from proof-rolling, should be minimized. If areas of the subgrade become disturbed, they should be undercut and replaced with crushed aggregate.

Engineered fill compacted to 95 percent of the modified Proctor density is recommended in areas to raise site grades. In our opinion, the on-site cohesive and granular soils, with the exception of topsoil, are suitable for reuse as engineered fill. However, cohesive soils are moisture sensitive and may require conditioning prior to obtaining adequate compaction. This will likely require aeration by discing, in order to expose the soil particles to ambient conditions including wind, favorable temperatures and sunlight, to reduce the moisture content. Under some climatic conditions, such as cold and/or rainy weather, adequate moisture conditioning may be extremely difficult to impossible to achieve. If site preparation activities occur during wet weather periods, imported granular fill compacted in accordance with General Specification No. 1 in Appendix D may be required. We also recommend that SGA/EEI be present during any

Shilts, Graves & Associates

An Earth Exploration Inc. Company

July 24, 2000

Mr. Matt Edmonds
BW Business Park LLC

Page 7

fill placement to perform periodic field density tests to determine the adequacy of compactive effort.

Based on the soil conditions encountered at the boring locations, it is our opinion that shallow (i.e., less than 4 ft), temporary construction excavations can be cut with sideslopes at nearly vertical in cohesive soils. However, excavations should conform with Occupational Safety and Health Administration (OSHA) requirements.

Based on the boring and published information, we do not anticipate that dewatering will be required. However, water entering excavations from runoff can likely be removed by using a pump and filtered sump, possibly in combination with collection trenches.

CONCLUDING REMARKS

In closing, SGAEEI's professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally and currently accepted soil and foundation engineering practices. This warranty is in lieu of all other warranties either expressed or implied.

We have enjoyed working with you on this project and trust that this report is sufficient for your present needs. Please contact our office if you have any questions or when the development concepts are finalized so that we are able to address site specific issues and how they may impact design and construction.

Sincerely,

SHILTS, GRAVES & ASSOCIATES/EARTH EXPLORATION, INC.

Kenneth P. Miller, P.E.
Senior Project Engineer