SECTION 00200

INSTRUCTIONS TO BIDDERS

TABLE OF CONTENTS

ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office* – The office from which the Bidding Documents are to be issued.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit with its Bid (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:

A. Evidence of Bidder's authority to do business in the state where the Project is located.

B. Bidder's state or other contractor license number, if applicable.

C. Subcontractor and Supplier qualification information; coordinate with provisions of Article 12 of these Instructions, "Subcontractors, Suppliers, and Others."

D. **As supporting data to the Bidder Qualification Statement, provide information regarding Claims and Lawsuits (If the answer to any of the questions below is yes, please attach details.)**

1. **Has your organization ever failed to complete any work?**

2. **Within the last five years has your organization or any of its officers prosecuted any Claims, had any Claims prosecuted against it or them, or been involved in or is currently involved in any mediation or arbitration proceedings or lawsuits suits related to any construction project, or has any judgments or awards outstanding against it or them? If the answer is yes, please attach the details for each Claim, including the names and telephone numbers of the persons who are parties, the amount of the Claim, the type of Claim and basis for the Claim, and the outcome**

3. **Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? If the answer is yes, please attach details for each instance, including the names and telephone numbers of the persons who are parties to the contract, and the reason(s) the contract was not completed.**

E. **As a part of the Bidder Qualification Statement, or on a separate sheet, list construction projects your organization has in progress with an original Contract Sum of more than $100,000.00, giving the name of project, owner and its telephone number, design professional and its telephone number, contract amount, percent complete and scheduled completion date. State total amount of work in progress and under contract.**

F. **As a part of the Bidder Qualification Statement, or provide the following information for each contract your organization has had during the last five (5) years, including current contracts, where the Contract Sum is fifty percent (50%) or more of the bid amount for this Project, including add alternates. If there are more than ten (10) of these contracts only provide information on the most recent ten (10) contracts, including current contracts.**

1. **Project name**
2. **Your scope of work**
3. **Owner contact and telephone number**
4. **Engineer or architect and telephone number**

G. **As supporting data to the Bidder Qualification Statement, state average annual amount of construction work your organization has performed during the last five years.**

H. **As supporting data to the Bidder Qualification Statement, if any of the following members of your organization's management--president, chairman of the board, or any director--operates or has operated another construction company during the last five (5) years, identify the member of management and the name of the construction company.**

I. **As supporting data to the Bidder Qualification Statement, if your organization is operating under a trade name registration with the Secretary of State for the State of Ohio, identify the entity for which the trade name is registered. If none, state "none."**

J. **As supporting data to the Bidder Qualification Statement, list the education, training and construction experience for each person who will fill a management role on the Project, including without limitation the Project Executive, Project Engineer, Project Manager, and Project Superintendent. For each person listed, include with the other information the last three projects on which the person worked and the name and telephone number of the Design Professional and the Owner.**

K. **As a part of the Bidder Qualification Statement, provide the following References**

1. **Trade References**
2. **Bank References**

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 *Existing Site Conditions*

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:

a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.

b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

c. reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or adjacent to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.03 *Site Visit and Testing by Bidders*

A. Bidder shall conduct the required Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.

B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions **but may choose to do so**.

C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.

D. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

E. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

4.04 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.05 *Other Work at the Site*

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 5 – BIDDER'S REPRESENTATIONS

5.01 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work, **including but not limited to American Iron and Steel requirements as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes**

mandating domestic preference which apply to the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;

E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;

F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and

J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 – **PRE-BID CONFERENCE**

6.01 A pre-Bid conference will be held at the time and location stated in the invitation or advertisement to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective. **Attendance at the pre-Bid conference is strongly encouraged.**

ARTICLE 7 – **INTERPRETATIONS AND ADDENDA**

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

ARTICLE 8 – **BID SECURITY**

8.01 A Bid must be accompanied by Bid security **in the form of a certified check or bank money order** made payable to Owner in an amount of **10** percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) ~~and in the form of a certified check, bank money order~~, or **in the form of** a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions **in an amount of 10 percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates).**

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 – **CONTRACT TIMES**

9.01 The number of days within which, or the dates by which, Milestones are to be achieved and the Work is to be substantially completed, and completed and ready for final payment, are set forth in the Agreement.

ARTICLE 10 – **LIQUIDATED DAMAGES**

10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract for the Work, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or- equal" or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 days prior to the date for receipt of Bids in the case of a proposed substitute and 5 days prior in the case of a proposed "or-equal." Each such request shall comply with the requirements of Paragraphs 7.04 and 7.05 of the General Conditions. **Each such request shall include Manufacturer's Certification letter for compliance with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents.** The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner. Substitutes and "or-equal" materials and equipment may be proposed by Contractor in accordance with Paragraphs 7.04 and 7.05 of the General Conditions after the Effective Date of the Contract.

11.02 **All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or- equal" or substitution requests are made at Bidder's sole risk.**

11.03 **If an award is made, Contractor shall be allowed to submit proposed substitutes and "or-equals" in accordance with the General Conditions. The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.**

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 ~~A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents (most commonly in the Specifications) to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.~~

12.02 ~~Subsequent to the submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.~~

12.03 **If required by the bid documents,** the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work: _____

If requested by Owner, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

12.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

12.05 **Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.**

12.06 **The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 7.06.**

ARTICLE 13 – **PREPARATION OF BID**

13.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

13.02 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown.

13.03 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The partnership's address for receiving notices shall be shown.

13.04 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the firm's address for receiving notices shall be shown.

13.05 A Bid by an individual shall show the Bidder's name and address for receiving notices.

13.06 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture's address for receiving notices shall be shown.

13.07 All names shall be printed in ink below the signatures.

13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.09 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

13.10 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 – **BASIS OF BID**

14.01 *Lump Sum*

A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form.

14.02 *Unit Price*

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity" (which Owner or its representative has set forth in the Bid Form) for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

14.03 *Allowances*

A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 15 – **SUBMITTAL OF BID**

15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.

15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package with the

Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to **Village of Dresden, 904 Chestnut Street, P.O. Box 539, Dresden, OH 43821**.

15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.

16.03 ~~If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.~~ **All bids shall remain valid and open for acceptance for a period of at least 60 days after the bid opening; provided, however, that a Bidder may withdraw its bid from consideration after the bid deadline when all of the following apply.**

1. **the price bid was substantially lower than the other bids;**
2. **the reason for the bid being substantially lower was a clerical mistake, rather than a mistake in judgment, and was due to an unintentional and substantial error in arithmetic or an unintentional omission of a substantial quantity of work, labor, or material;**
3. **the bid was submitted in good faith; and**
4. **the Bidder provides written notice to the Owner within two (2) business days after the bid opening for which the right to withdraw is claimed.**

16.04 **No bid may be withdrawn if the result would be the awarding of the contract on another bid for the work for which the Bidder is withdrawing its bid to the same Bidder.**

16.05 **If a bid is withdrawn under this provision, the Owner may award the Contract to another Bidder determined by the Owner to have submitted the lowest and best bid or the Owner may reject all bids and advertise for other bids. In the event the Owner advertises for other bids, the withdrawing Bidder shall pay the costs incurred in connection with the rebidding by the Owner, including the cost of printing new Contract Documents, required advertising, and printing and mailing notices to prospective bidders, if the Owner finds that such costs would not have been incurred but for such withdrawal.**

ARTICLE 17 – OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in **these Instructions to Bidders and** the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 If Owner awards the contract for the Work, such award shall be to the ~~responsible Bidder submitting the lowest responsive Bid~~ **Bidder submitting the lowest and best Bid as set forth in Ohio law.**

19.03 ~~Evaluation of Bids~~ **Determination of the Lowest and Best Bid**

A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

B. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

19.04 In evaluating whether a Bidder is ~~responsible~~ **lowest and best**, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 20 – BONDS AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

20.02 **Performance Bond: The successful Bidder shall furnish a Performance Bond in the form of the Performance Bond included in the Bid Documents in an amount equal to 100% of the Contract Price.**

20.03 **Payment Bond: The successful Bidder shall furnish a Payment Bond in the form of the Payment Bond included in the Bid Documents in an amount equal to 100% of the Contract Price.**

20.04 **All bonds must be issued by a surety company authorized by the Ohio Department of Insurance to transact business in the State of Ohio and acceptable to the Owner. The bond must be issued by a surety capable of demonstrating a record of competent underwriting, efficient management, adequate reserves, and sound investments. These criteria will be deemed to be met if the surety currently has an A.M. Best Company Policyholders Rating of "A-" or better and has or exceeds the Best Financial Size Category of Class VI. Other sureties may be acceptable to the Owner, in its sole discretion.**

20.05 **All bonds shall be signed by an authorized agent of an acceptable surety and by the Bidder.**

20.06 **All bonds shall be supported by credentials showing the Power of Attorney of the agent, a certificate showing the legal right of the Surety Company to do business in the State of Ohio, and a financial statement of the Surety.**

ARTICLE 21 – **SIGNING OF AGREEMENT**

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 22 – **SALES AND USE TAXES**

22.01 Owner is exempt from **Ohio** state sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes shall not be included in the Bid. Refer to Paragraph SC-7.09 of the Supplementary Conditions for additional information.

ARTICLE 23 – ~~**CONTRACTS TO BE ASSIGNED**~~ **NOT USED**

ARTICLE 24 – **FEDERAL REQUIREMENTS**

24.01 **Federal requirements at Article 19 of the Supplementary Conditions apply to this Contract.**

24.02 **Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel,**

reinforced precast concrete, and construction materials. The deminimis and minor components waiver {add project specific waivers as applicable} apply to this contract.

SECTION 00300

INFORMATION AVAILABLE TO BIDDERS

1.01 SUBSURFACE INVESTIGATION REPORT

A. The following geotechnical reports with respect to the project site have been prepared as a service to the Owner:

1. Title: Geotechnical Engineering Report, Waste Water Treatment Plant Improvements, 30 East Lock Street, Dresden, Ohio

a. Date: November 15, 2011

b. Prepared by: Terracon, Inc., Columbus, Ohio

2. Title: Geotechnical Engineering Report, Wastewater Treatment Plant Improvements, 30 East Lock Street, Dresden, Ohio

a. Date: April 8, 2016

b. Prepared by: Terracon, Inc., Columbus, Ohio

3. Title: Geotechnical Engineering Report Addendum, Wastewater Treatment Plant Improvements, 30 East Lock Street, Dresden, Ohio

a. Date: April 29, 2016

b. Prepared by: Terracon, Inc., Columbus, Ohio

B. Copies of the complete reports have been included.

C. These reports identify properties of below grade conditions primarily for the use of the Architect/Engineer.

D. The recommendations described shall not be construed as a requirement of this Contract unless specifically referenced in the Contract Documents.

E. These reports, by their nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from these reports, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to Owner.

2.01 INTERPRETATION

A. No representation or warranty is made by GGC Engineers (CT Consultants, Inc.) or the Owner of the adequacy or content of this Information Available to Bidders.

B. Information Available to Bidders is not a part of the Contract Documents.

END OF SECTION

Geotechnical Engineering Report

Waste Water Treatment Plant Improvements

30 East Lock Street

Dresden, Ohio

November 15, 2011

Terracon Project No. N4115067

Prepared for:
Village of Dresden
Dresden, Ohio

Prepared by:
Terracon Consultants, Inc.
Columbus, Ohio

November 15, 2011

Terracon

Village of Dresden
904 Chestnut Street
Dresden, Ohio 43821

Attn: Mr. Robert Lane
Mayor
P: [740] 754 3151
F: [740] 754 4005

Re: Geotechnical Engineering Report
Village of Dresden – Waste Water Treatment Plant Improvements
30 Lock Street
Dresden – Muskingum County, Ohio
Terracon Project No. N4115067

Dear Mr. Lane:

Terracon Consultants, Inc. (Terracon) has completed the subsurface exploration and laboratory testing services for the above referenced project. These services were performed in general accordance with our proposal number PN4110202 dated May 26, 2011 and written authorization dated June 8, 2011 provided by the Village of Dresden. The field exploration phase of the project was completed on June 21, 2011.

At the time this report was prepared information concerning the preliminary layout, tank and basin bottom elevations, finished floor elevations, and structural loading information required to develop our geotechnical engineering recommendations is not available. We will provide our geotechnical engineering recommendations once the above requested information along with information related to ground surface elevations at test boring locations becomes available.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please do not hesitate to contact us.

Sincerely,
Terracon Consultants, Inc.

Prasad S. Rege, P.E.
Office Manager/Principal

Kevin M. Ernst, P.E.
Geotechnical Department Manager

Copies to: Addressee (3 hard copies); Mr. William Newton – GGC Engineers (e-mail only)

TABLE OF CONTENTS

EXECUTIVE SUMMARY

A geotechnical exploration has been performed for the Village of Dresden – Waste Water Treatment Plant Improvements project located at 30 Lock Street in Dresden – Muskingum County, Ohio. Our geotechnical scope of work included the advancement of thirteen (13) soil test borings to a depth range of approximately 20 to 30 feet below existing surface grades.

At the time this report was prepared information concerning the preliminary layout, tank and basin bottom elevations, finished floor elevations, and structural loading information required to develop our geotechnical engineering recommendations is not available. We will provide our geotechnical engineering recommendations once the above requested information along with information related to ground surface elevations at test boring locations becomes available.

GEOTECHNICAL ENGINEERING REPORT
WASTE WATER TREATMENT PLANT IMPROVEMENTS
30 LOCK STREET
DRESDEN – MUSKINGUM COUNTY, OHIO

Terracon Project No. N4115067
November 15, 2011

1.0 INTRODUCTION

A geotechnical exploration has been performed for the Village of Dresden – Waste Water Treatment Plant Improvements project located at 30 Lock Street in Dresden – Muskingum County, Ohio. Our geotechnical scope of work included the advancement of thirteen (13) soil test borings to a depth range of approximately 20 to 30 feet below existing surface grades. Logs of the borings along with a Boring Location Plan (Exhibit A-1) are included in the Appendix. A description of the field exploration is also included in the Appendix.

The purpose of these services is to provide information relative to:

- subsurface soil conditions
- groundwater conditions

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Site layout	See Appendix A, Exhibit A-2, Boring Location Plan
Wastewater treatment plant improvements	The planned improvements will include tanks, an aeration basin, a 30 feet diameter clarifier and a building for various process equipments.

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	The project is located at the existing Village of Dresden Waste Water Treatment Plant located at 30 Lock Street in Dresden, Ohio.
Existing site features	Waste water treatment plant (WWTP) with associated drives and infrastructure.
Current ground cover	Grass and pavements

3.0 SUBSURFACE CONDITIONS

3.1 Typical Subsurface Profile

Specific conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs included in the Appendix. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows.

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Surface	1 to 4 inches	Topsoil; 4 inches of granular aggregate base at boring B-3	N/A
Stratum 1 (only at boring B-12)	8 feet	Existing fill material consisting of silty sand and clayey sand with various proportions of gravel size constituents, cinder and slag fragments	Loose to medium dense relative density
Stratum 2 (at test borings B-1, B-2, B-4, B-5, B-6, B-7, B-11 and B-13)	3 to 13 feet	Native cohesive and fine textured granular soils consisting of sandy lean clay, lean clay and silty clay with various proportions of sand size constituents, and clayey sand	Cohesive: medium stiff to stiff consistency Fine textured granular: loose to medium dense relative density

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Stratum 3 (all borings)	13 to 22 feet	Native granular soils consisting of silty sand and poorly graded sand with various proportions of silt and gravel size constituents and rock fragments; silty gravel with sand	Loose to medium dense relative density
Stratum 4 (at borings B-1, B-2, B-4, B-5, B-6, B-7, B-12, and B-13)	Below a depth range of 20 to 40 feet (test boring termination depth)	Native cohesive soils consisting of fat clay, lean clay, and sandy lean clay	Soft to very stiff consistency
Stratum 5 (at borings B-3, B-8, B-9, B-10, and B-11)	Below a depth range of 13.1 to 25 feet (test boring termination depth)	Shale and sandstone bedrock	Shale: very soft to soft bedrock hardness rating Sandstone: medium to moderately hard bedrock hardness rating

3.2 Groundwater

The boreholes were observed while drilling and after completion for the presence and level of groundwater. In addition, delayed water levels were also obtained in some of the borings where temporary groundwater observation wells had been installed. The water levels observed in the boreholes are noted on the attached boring logs, and are summarized below:

Boring Number	Depth to groundwater while drilling, ft.	Depth to groundwater after drilling, ft.
B-1	12.0	Not encountered
B-2	12.0	Not encountered
B-3	13.0	Not encountered
B-4	12.0	Not encountered
B-5	12.0	Not encountered
B-6	12.0	Not encountered
B-7	12.0	Not encountered
B-8	8.0	Not encountered
B-9	13.0	Not encountered
B-10	13.0	Not encountered
B-11	9.0	Not encountered

Boring Number	Depth to groundwater while drilling, ft.	Depth to groundwater after drilling, ft.
B-12	13.0	11.7
B-13	12.0	Not encountered

The water levels summarized above do not necessarily represent stable groundwater levels. Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

At the time this report was prepared information concerning the preliminary layout, tank and basin bottom elevations, finished floor elevations, and structural loading information required to develop our geotechnical engineering recommendations is not available.

We will provide our geotechnical engineering recommendations once the above requested information along with information related to ground surface elevations at test boring locations becomes available.

APPENDIX A
FIELD EXPLORATION

Field Exploration Description

The subsurface exploration consisted of drilling and sampling thirteen (13) borings at the site to a depth range of approximately 13 to 40 feet below existing grades. The boring locations were laid out by GGC Engineers personnel. Ground surface elevations at the test boring locations are to be provided by GGC Engineers.

The borings were drilled with an ATV-mounted rotary drill rig using hollow stem augers to advance the boreholes. Representative soil samples were obtained by the split-barrel sampling procedure. In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). These values are indicted on the boring logs at the depths of occurrence. This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. The sampling depths and penetration distance, plus the standard penetration resistance values, are shown on the boring logs. The samples were sealed and taken to the laboratory for testing and classification.

An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed at this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT values and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the standard penetration resistance blow count (N) value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method.

Rock coring was performed at one test boring location. Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

The samples were classified in the laboratory based on visual observation, texture and plasticity. The descriptions of the soils indicated on the boring logs are in general accordance with the enclosed General Notes and the Unified Soil Classification System. Estimated group symbols according to the Unified Soil Classification System are given on the boring logs. A brief description of this classification system is attached to this report.

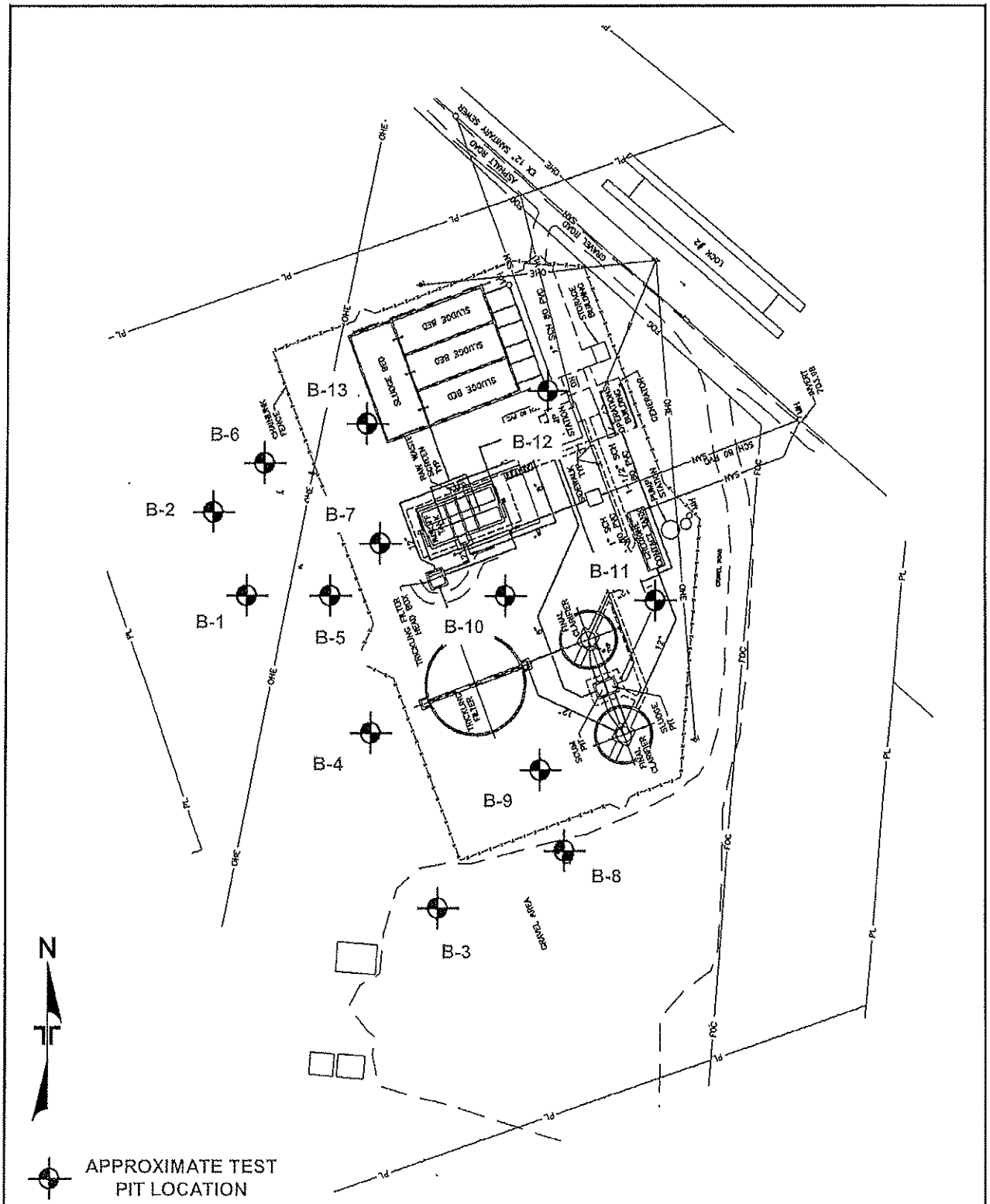


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: KME	Project No. N4115067	Terracon Consulting Engineers & Scientists	BORING LOCATION PLAN
Drawn by: DJT	Scale: N.T.S.	760 Morrison Road Columbus, Ohio 43230	WASTE WATER TREATMENT PLANT IMPROVEMENTS
Checked by: KME	File Name: N4115067BLP	PH. (614) 865-3113 FAX (614) 865-8475	VILLAGE OF DRESDEN
Approved by: PSR	Date: June 2011		DRESDEN, OHIO

Exhibit A-2

LOG OF BORING NO. B-1

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.3 **TOPSOIL** (4")									
	LEAN CLAY WITH SAND, trace organics,noted silt layers		CL	1	SS	18	5	20		5000*
	3 Brown and gray, stiff									
	SANDY LEAN CLAY, noted silt layer Dark reddish brown and gray, medium stiff		CL	2	SS	18	5	22		1500*
	5.5	5								
	CLAYEY SAND Brown, loose		SC	3	SS	18	9	21		1500*
	8									
	SILTY SAND WITH GRAVEL and rock fragments Brown, medium dense ▽		SM	4	SS	18	10			
		10								
			SM	5	SS	16	7			
		15								
	17									
	FAT CLAY Brownish gray, soft		CH	6	SS	18	4	40		500*
	20	20								
	Boring terminated at 20 feet									
	Note: Boring offset approximately 20 feet S due to overhead utilities.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Callbrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▽ N/E	ACR
WL	▽		▽	
WL	DCI - 10'			

Terracon

TEST BORING STARTED	6-21-11		
TEST BORING COMPLETED	6-21-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-2

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf	
	0.3 TOPSOIL (3")										
	LEAN CLAY WITH SAND, trace rock fragments		CL	1	SS	18	2	26		500*	
	3 Brown, gray and yellowish brown, soft										
	LEAN CLAY WITH SAND, trace gravel, noted silt layers		CL	2	SS	18	6	19		4000*	LL = 32 PI = 16
	5.5 Mottled brown and gray, stiff	5									
	LEAN CLAY WITH SAND, trace rock fragments		CL	3	SS	18	7	23		3000*	
	8 Gray and reddish brown, medium stiff										
	POORLY GRADED SAND WITH SILT, trace gravel		SP	4	SS	18	7				
	Brown, loose ▽	10									
	13										
	SILTY SAND, trace gravel		SM	5	SS	18	4				
	Brown, loose	15									
	17										
	FAT CLAY		CH	6	SS	18	2	40		500*	
	Brownish gray, soft	20									
	23										
	FAT CLAY, trace sand		CH	7	SS	18	22			7000*	
	Brownish gray, very stiff										
	25	25									
	Boring terminated at 25 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: In-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL ▽ 12	WD ▽ N/E	ACR	
WL ▽	▽		
WL	DCI - 12'		

Terracon

TEST BORING STARTED	6-21-11
TEST BORING COMPLETED	6-21-11
RIG 93	FOREMAN KH
	JOB # N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-3

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.3 AGGREGATE BASE (4")									
	POORLY GRADED SAND WITH SILT Reddish brown, loose		SP	1	SS	18	8			
	3 POORLY GRADED SAND WITH SILT, trace gravel Light reddish brown, loose		SP	2	SS	16	7			
		5	SP	3	SS	8	6			
	8 POORLY GRADED SAND WITH GRAVEL Light brown, loose		SP	4	SS	12	5			
		10								
			SP	5	SS	8	9			
		15								
	16.5 16.7 SHALE, arenaceous, gray, very severely weathered, very soft Auger and sampler refusal on shale bedrock Boring terminated at 16.7 feet		SP	6	SS	2	50/2"			

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 13	WD ▽ N/E	ACR
WL	▽	▽	
WL	DCI - 7'		

Terracon

TEST BORING STARTED	6-21-11		
TEST BORING COMPLETED	6-21-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-4

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.3 **TOPSOIL** (3")									
	SILTY SAND WITH GRAVEL Reddish brown, medium dense		SM	1	SS	18	23			
	3 **CLAYEY SAND**, trace gravel and rock fragments Reddish brown, loose		SC	2	SS	18	4	16		2000*
	5.5 **POORLY GRADED SAND WITH SILT**, trace gravel Brown, medium dense	5	SP	3	SS	18	10			
	8 **SILTY SAND WITH GRAVEL** and rock fragments Brown, loose ▽		SM	4	SS	16	7			
		10								
			SM	5	SS	10	5			
		15								
	19 **FAT CLAY** Gray, soft		CH	6	SS	18	3	39		500*
	22 **SANDY LEAN CLAY**, with sandstone fragments (completely weathered sandstone)	20								
	25 Gray, trace yellowish brown, stiff to very stiff		CL	7	SS	16	46	17		
	Boring terminated at 25 feet	25								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▽ N/E	ACR
WL	▽		▽	
WL	DCI - 15'			

Terracon

TEST BORING STARTED	6-21-11		
TEST BORING COMPLETED	6-21-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-5

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.2 TOPSOIL (2")									
	SILTY CLAY WITH SAND, trace rock fragments		CL ML	1	SS	18	5	19		3000*
	3 Brown and light gray, medium stiff to stiff									
	SANDY LEAN CLAY, trace rock fragments		CL	2	SS	18	5	19		2000*
	5.5 Brown and light gray, medium stiff	5								
	CLAYEY SAND		SC	3	SS	18	8	34		
	7 Brown, loose									
	POORLY GRADED SAND WITH SILT		SP	4	SS	18	8			
	Brown, loose	10								
	▽									
	13									
	SILTY SAND WITH GRAVEL		SM	5	SS	4	13			
	Brown, medium dense	15								
	19.5		CH	6	SS	18	8	34		1000*
	20 FAT CLAY	20								
	Brownish gray, medium stiff									
	Boring terminated at 20 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL ▽ 12	WD ▽ N/E	ACR	
WL ▽	▽		
WL	DCI - 12'		

Terracon

TEST BORING STARTED	6-21-11
TEST BORING COMPLETED	6-21-11
RIG 93	FOREMAN KH
	JOB # N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-6

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf	
	0.2 TOPSOIL (2")										
	SILTY CLAY Light brownish gray and reddish brown, stiff		CL ML	1	SS	18	5	19		5000*	
3											
	LEAN CLAY WITH SAND, trace rock fragments Dark reddish brown, stiff		CL	2	SS	18	10	20		3000*	
5.5		5									
	SANDY LEAN CLAY, trace rock fragments Reddish brown, stiff		CL	3	SS	18	11	23		3500*	LL = 30 PI = 13
8											
	POORLY GRADED SAND WTIH SILT, trace gravel Brown, medium dense		SP	4	SS	18	10				
13		10									
	POORLY GRADED SAND Brown, loose		SP	5	SS	18	7				
18		15									
	FAT CLAY Brownish gray, soft		CH	6	SS	18	3	42		500*	LL = 59 PI = 36
22		20									
	LEAN CLAY, trace sand Gray, medium stiff to stiff		CL	7	SS	18	7	22		3000*	
28		25									
	CLAYEY SILT Gray, medium dense		ML	8	SS	18	14	27		3500*	
30		30									
	Boring terminated at 30 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 12	WD ▽ N/E	ACR
WL	▽	▽	
WL	DCI - 11'		

Terracon

TEST BORING STARTED	6-21-11		
TEST BORING COMPLETED	6-21-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-7

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf	
	0.3 TOPSOIL (3")										
	SILTY CLAY WITH SAND, trace gravel Brown and light brown, medium stiff to stiff		CL ML	1	SS	16	6	20		4000*	
	3 SANDY LEAN CLAY Brown, trace gray, medium stiff		CL	2	SS	18	7	19		2000*	
	5.5 CLAYEY SAND 7 Brown, medium dense	5	SC	3	SS	18	14	15			
	SANDY LEAN CLAY Brown, medium stiff		CL	4	SS	18	4	22		2000*	
	13	10									
	SILTY SAND WITH GRAVEL Brown, loose		SM	5	SS	12	7				
		15									
			SM	6	SS	18	9				
	22	20									
	FAT CLAY Gray, medium stiff to soft		CH	7	SS	18	7	40		1000*	
		25									
			CH	8	SS	18	4	44		500*	LL = 62 PI = 38
		30									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 12	WD ▼ N/E	ACR
WL	▽	▼	
WL	DCI - 13'		

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-21-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-7

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	FAT CLAY Gray, medium stiff to soft		CH	9	SS	18	5	42		500*
		35								
	38									
	LEAN CLAY, trace sand, trace gravel Gray, very stiff		CL	10	SS	18	25	18		8000*
	40	40								
	Boring terminated at 40 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▽ N/E	ACR
WL	▽		▽	
WL	DCI - 13'			

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-21-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-8

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.3 **TOPSOIL**, with gravel (3")									
	POORLY GRADED SAND, trace gravel Light reddish brown, loose		SP	1	SS	16	7			
	- noted clay seam below 3.5 feet		SP	2	SS	16	5			
	5.5 **SILTY SAND WITH GRAVEL** Brown, loose ▽	5	SM	3	SS	8	5			
			SM	4	SS	10	8			
	13.5	10								
	13.7 **SHALE**, arenaceous, gray, very severely weathered, soft			5	SS	2	50/2"			
	Auger and sampler refusal on shale bedrock Boring terminated at 13.7 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: In-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 8	WD	▼ N/E ACR
WL	▽		▼
WL	DCI - 7'		

Terracon

TEST BORING STARTED	6-21-11		
TEST BORING COMPLETED	6-21-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-9

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.2 TOPSOIL (2")									
	SILTY SAND WITH GRAVEL and rock fragments, Brown, medium dense		SM	1	SS	16	20			9000*
			SM	2	SS	18	13			
	5.5 SILTY SAND WITH GRAVEL and rock fragments, Brown, loose	5	SM	3	SS	10	4			
			SM	4	SS	9	6			
	13	10								
	SILTY GRAVEL WITH SAND, Brown, very dense		SM	5	SS	12	50/5"			
	15 SHALE, arenaceous, gray, moderately severely weathered, soft	15		6	NQ2	6	RQD			
				7	NQ2	57	0% RQD 61%			
	17.8									
	19.1 SANDSTONE, brownish gray, moderately severely weathered, soft									
	20.7 SANDSTONE, gray and brown, moderately severely weathered, medium	20		8	NQ2	58	RQD 34%			
	22 SHALE, arenaceous, gray, severely weathered, soft									
	23.4 SANDSTONE, gray, moderately severely weathered, moderately hard									
	25 SHALE, arenaceous, gray, very severely weathered, very soft	25								
	Boring terminated at 25 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 13	WD	▼ 8.5	ACR
WL	▽		▼	
WL	WCI - 9'			

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-20-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-10

CLIENT: **Village of Dresden**

SITE: **30 Lock Street, Dresden, Ohio**

PROJECT: **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.3 TOPSOIL (3)									
	SILTY SAND, trace gravel, noted cobbles Brown, loose		SM	1	SS	14	6			
			SM	2	SS	0	3			
		5	SM	3	SS	2	5			
			SM	4	SS	2	4			
	13 ▽	10								
	POORLY GRADED SAND WITH SILT, trace gravel Brown, loose		SP	5	SS	8	9			
	17	15								
	17.1 SHALE, arenaceous, gray, very severely weathered, soft Auger and sampler refusal on shale bedrock Boring terminated at 17.1 feet			6	SS	2	50/2"			

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 13	WD	▽ N/E ACR
WL	▽		▽
WL	DCI - 11'		

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-20-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-11

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.1 TOPSOIL (1")									
	SANDY LEAN CLAY WITH GRAVEL Brown, medium stiff to stiff		CL	1	SS	14	5	13		2500*
	3									
	SILTY SAND WITH GRAVEL and rock fragments Brown, medium dense		SM	2	SS	18	23			
	5.5	5								
	SILTY SAND WTH GRAVEL and rock fragments Brown, loose		SM	3	SS	3	5			
	8									
	SILTY GRAVEL WITH SAND Light brown, loose		GM	4	SS	16	7			
		10								
	13									
	13.1 SHALE, arenaceous, brownish gray, very severely weathered, soft			5	SS	1	50/1"			
	Auger and sampler refusal on shale bedrock									
	Boring terminated at 13.1 feet									
	Note: Boring offset approximately 20 feet NW due to underground utilities under direction of WTP supervisor.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 9	WD	▽ 8.5	ACR
WL	▽		▽	
WL	WCI - 9'			

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-20-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-12

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.2 TOPSOIL (2")									
	FILL: Silty sand with gravel, Brown, medium dense to loose - noted clay seam			1	SS	14	10			
				2	SS	18	8			
	5.5 FILL: Clayey sand, trace gravel, trace slag and cinders, Brown, loose	5		3	SS	16	6	16		
	8 SILTY SAND WITH GRAVEL, Brown, loose		SM	4	SS	10	3			
	13 POORLY GRADED SAND WITH SILT, trace gravel, Brown, loose	10	SP	5	SS	10	5			
	17 FAT CLAY, Gray, stiff	15								
	20 Boring terminated at 20 feet	20	CH	6	SS	18	16			2500*

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 13	WD	▼ 11.7	ACR
WL	▽		▼	
WL	WCI - 12'			

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-20-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

LOG OF BORING NO. B-13

CLIENT: Village of Dresden

SITE: 30 Lock Street, Dresden, Ohio

PROJECT: Waste Water Treatment Plant Improvements

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf	
	0.3 TOPSOIL (3")										
	LEAN CLAY, trace sand, trace organics, noted iron oxide staining		CL	1	SS	18	3	28		1500*	
	3 Mottled reddish brown and gray, medium stiff		CL	2	SS	18	9	22		4000*	
	LEAN CLAY, trace sand, trace organics	5									
	5.5 Mottled dark brown and gray, stiff		CL	3	SS	18	10	22		1500*	LL = 30 PI = 15
	SANDY LEAN CLAY										
	8 Dark brown and gray, medium stiff		SM	4	SS	18	8				
	SILTY SAND, trace gravel	10									
	Brown, loose										
	13										
	SILTY SAND WITH GRAVEL		SM	5	SS	18	7				
	Brown, loose	15									
	17										
	FAT CLAY		CH	6	SS	18	4	37		500*	
	Brownish gray, soft	20									
	20 Boring terminated at 20 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: In-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▼ N/E	ACR
WL	▽		▼	
WL	DCI - 11'			

Terracon

TEST BORING STARTED	6-21-11		
TEST BORING COMPLETED	6-21-11		
RIG	93	FOREMAN	KH
		JOB #	N4115067

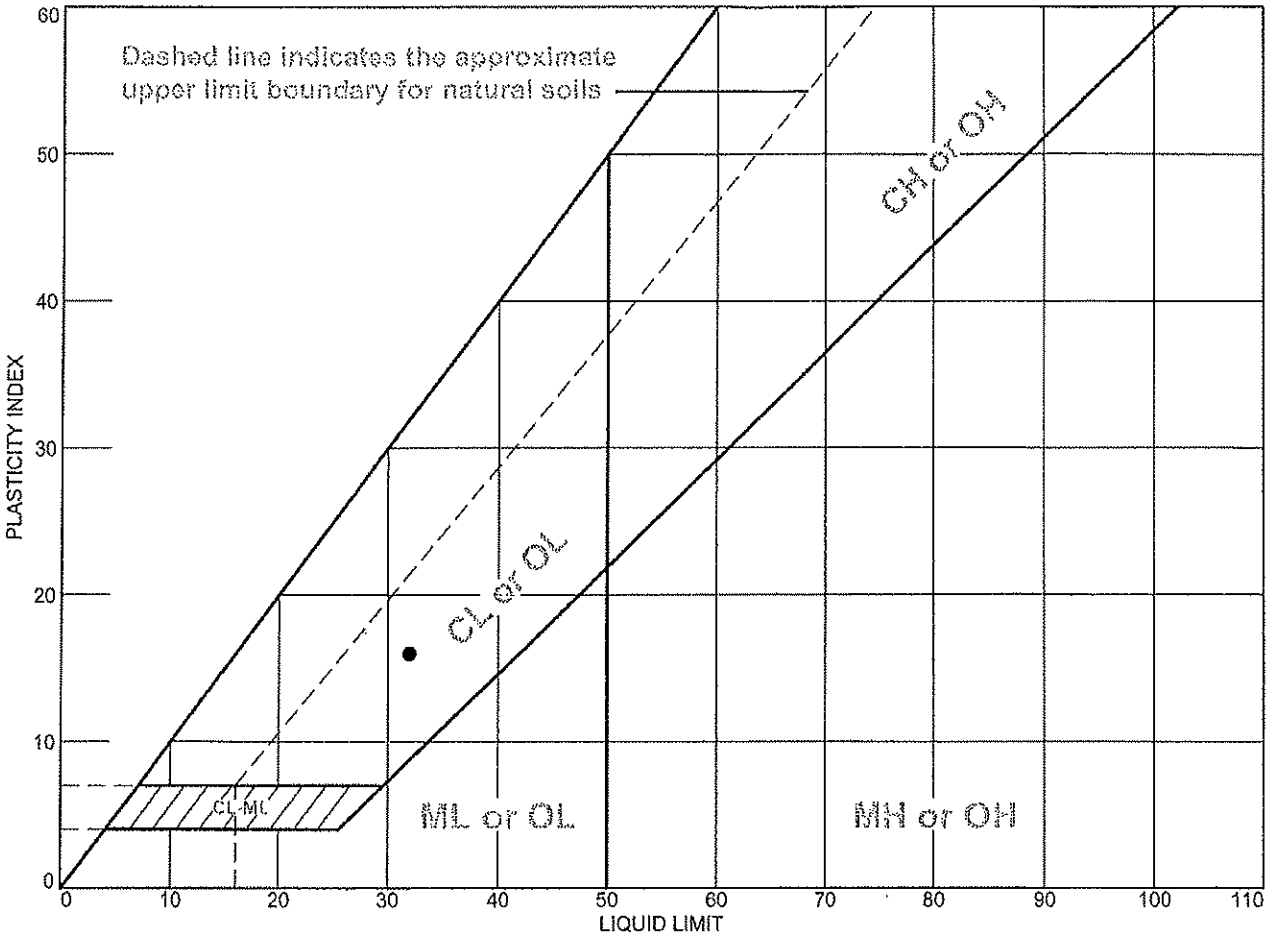
REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 7/12/11

APPENDIX B
LABORATORY INFORMATION

Laboratory Testing

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification System Symbols. A brief description of this classification system is attached to this report. Classification was performed by visual and manual procedures. Atterberg Limits (plasticity) tests and grain size distribution tests were performed on selected samples. The data sheets for this laboratory testing are included in Appendix B.

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Mottled brown and gray LEAN CLAY with sand, trace gravel	32	16	16			CL

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-2 **Depth:** 3.5'-5.0' **Sample Number:** S-2

Remarks:

● Lab No. 473
Date: 7-5-11

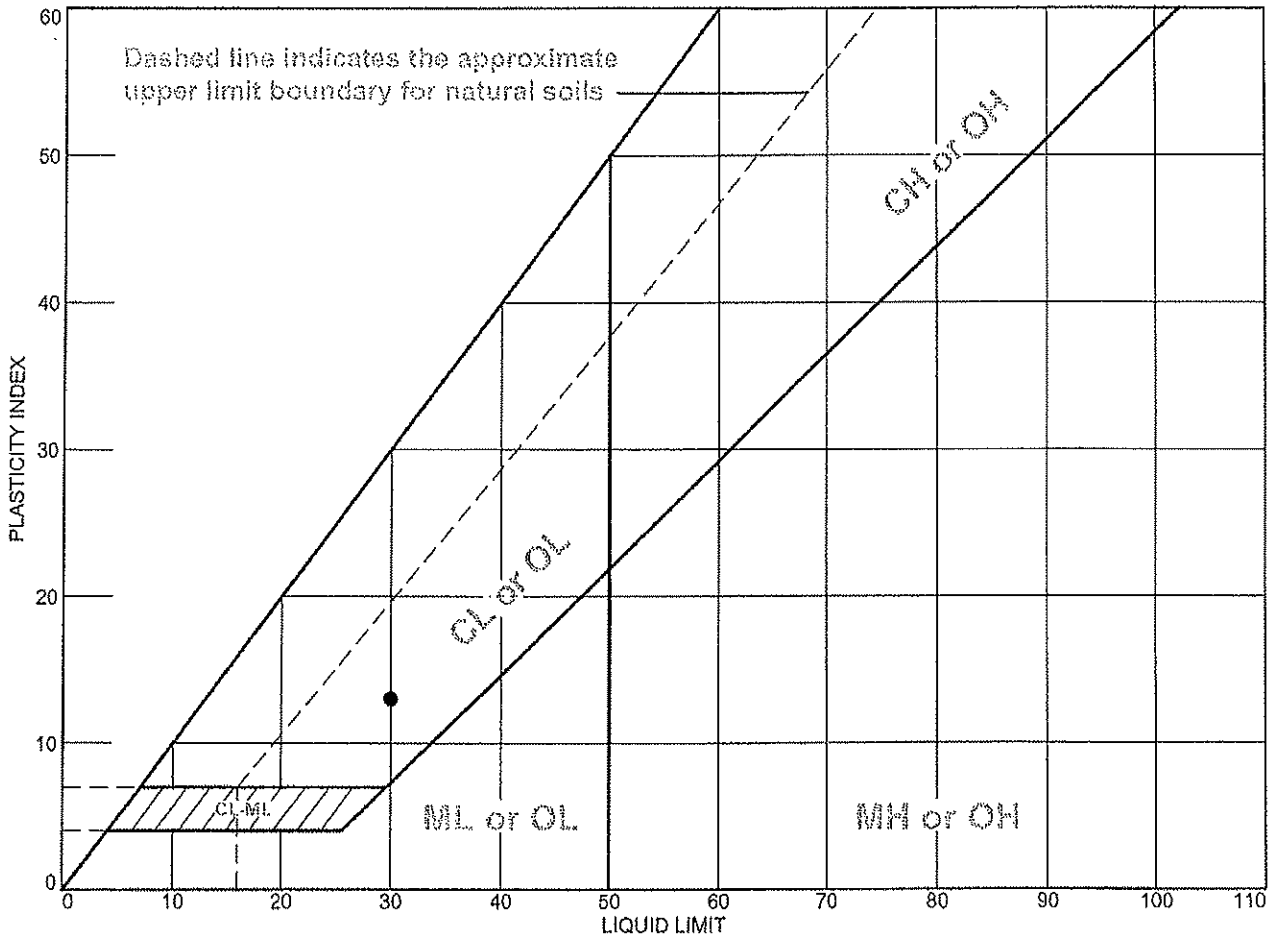
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-2

Tested By: DS **Checked By:** AM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Reddish brown SANDY LEAN CLAY, trace rock fragments	30	17	13			CL

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-6 **Depth:** 6.0'-7.5' **Sample Number:** S-3

Remarks:

● Lab No. 474
Date: 7-5-11

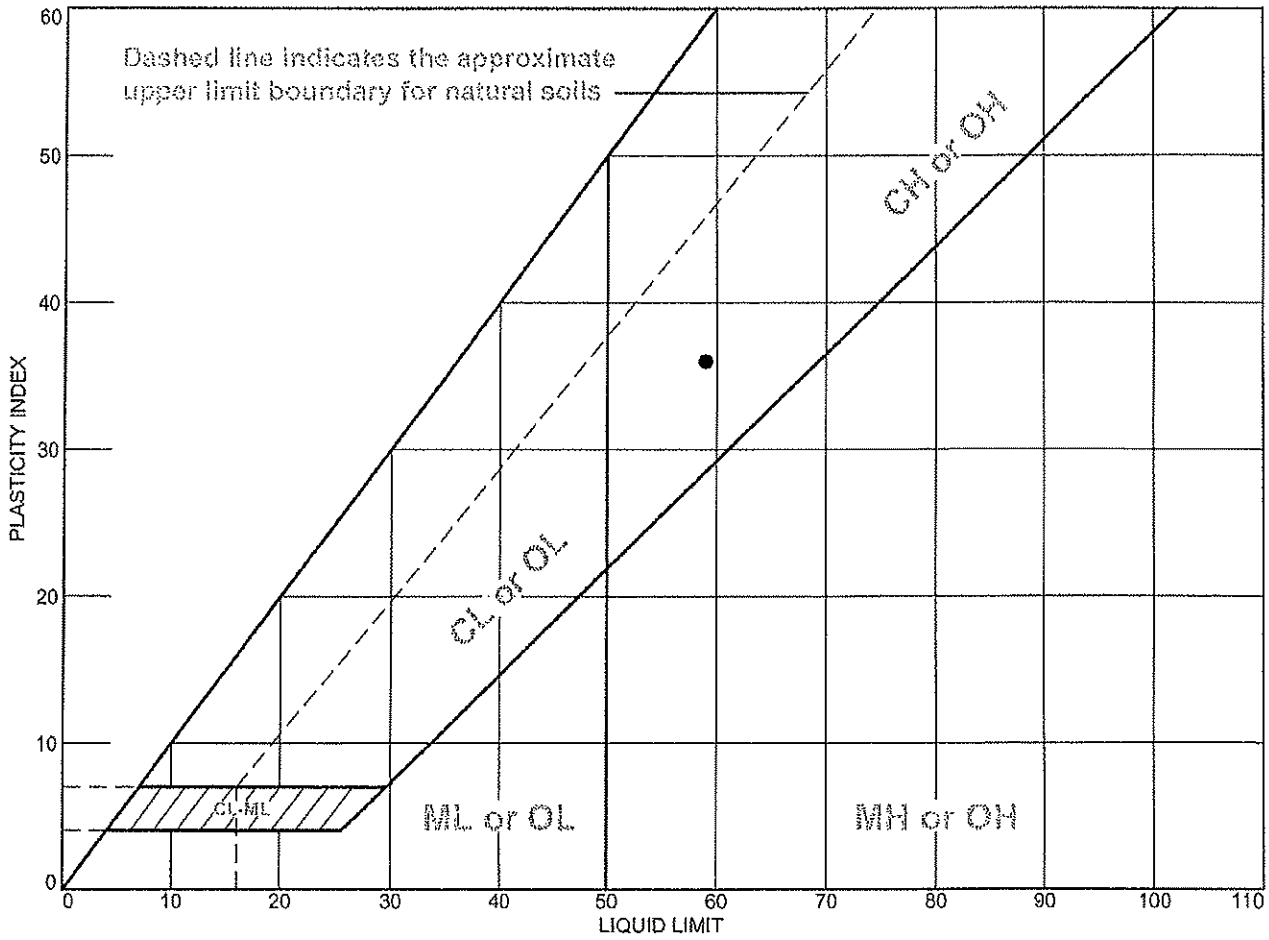
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-3

Tested By: DS Checked By: AM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brownish gray FAT CLAY	59	23	36			CH

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-6 **Depth:** 18.5'-20.0' **Sample Number:** S-6

Remarks:

● Lab No. 475
Date: 7-5-11

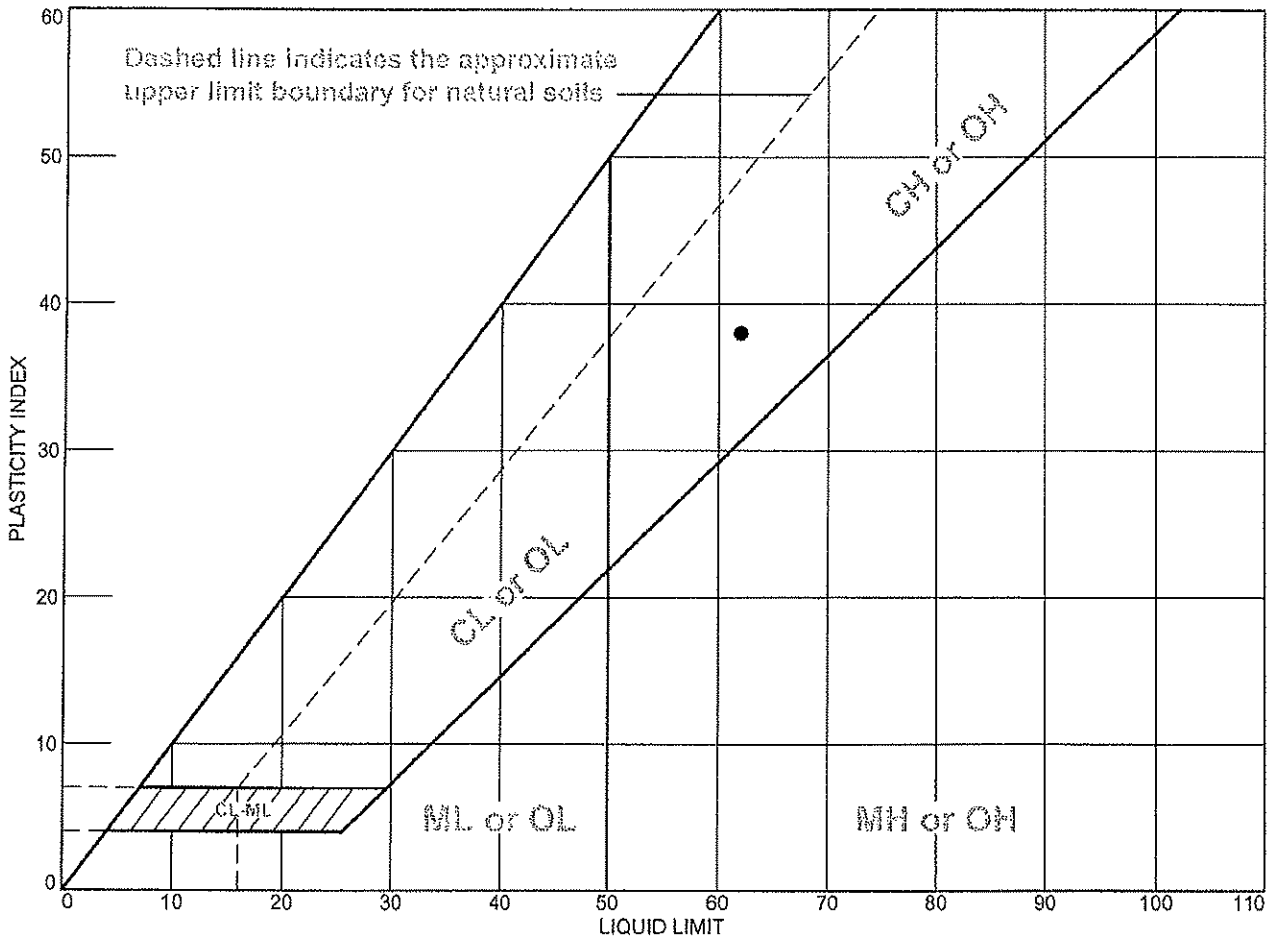
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-4

Tested By: DS **Checked By:** AM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray FAT CLAY	62	24	38			CH

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-7 **Depth:** 28.5'-30.0' **Sample Number:** S-8

Remarks:
● Lab No. 476
Date: 7-5-11

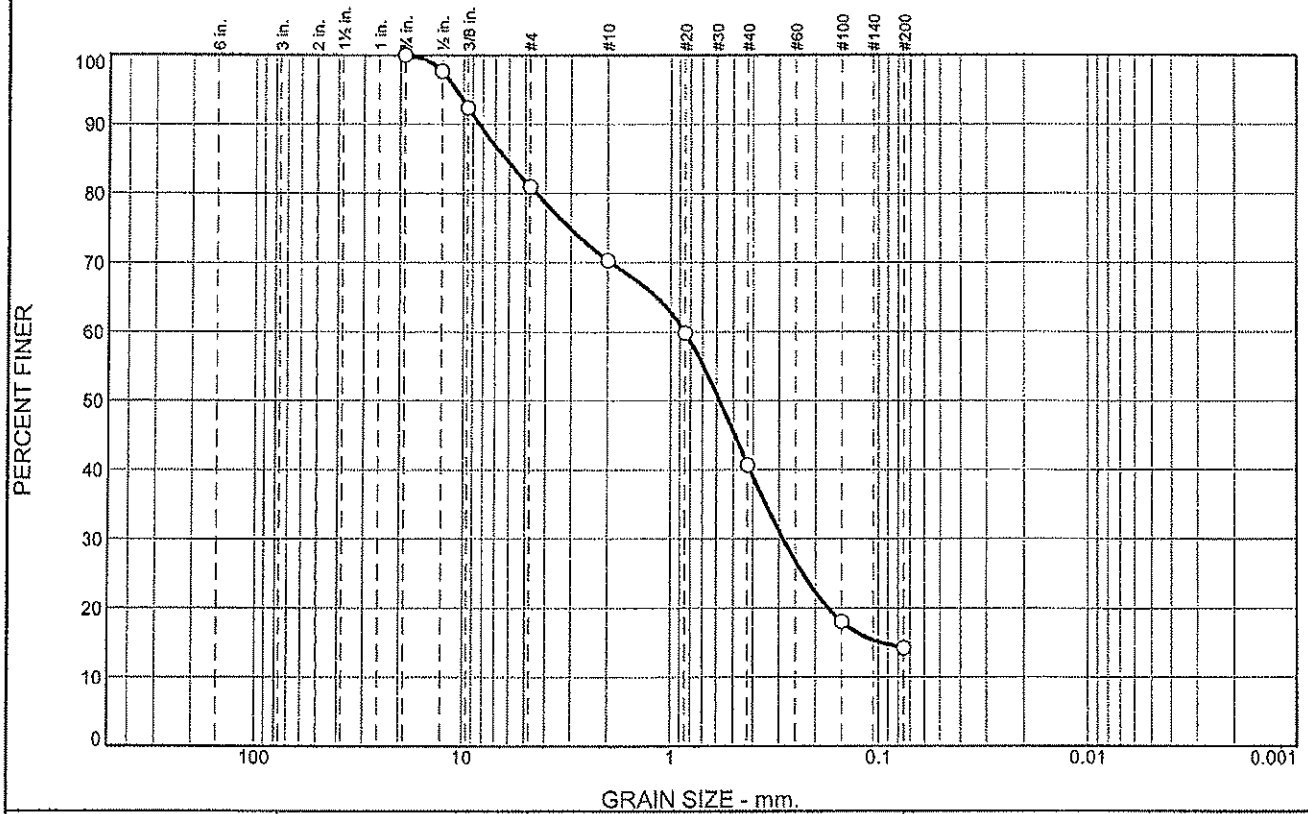
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-5

Tested By: DS Checked By: AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	19.0	10.7	29.6	26.4	14.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	97.7		
3/8	92.4		
#4	81.0		
#10	70.3		
#20	59.8		
#40	40.7		
#100	18.1		
#200	14.3		

* (no specification provided)

Material Description

Brown SILTY SAND with fine gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 8.3942 D_{85}= 6.2289 D_{60}= 0.8564
D_{50}= 0.5800 D_{30}= 0.2861 D_{15}= 0.0965
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Lab No. 477
F.M.=2.89

Source of Sample: B-8 **Depth:** 6.0'-7.5'
Sample Number: S-3

Date: 7-5-11

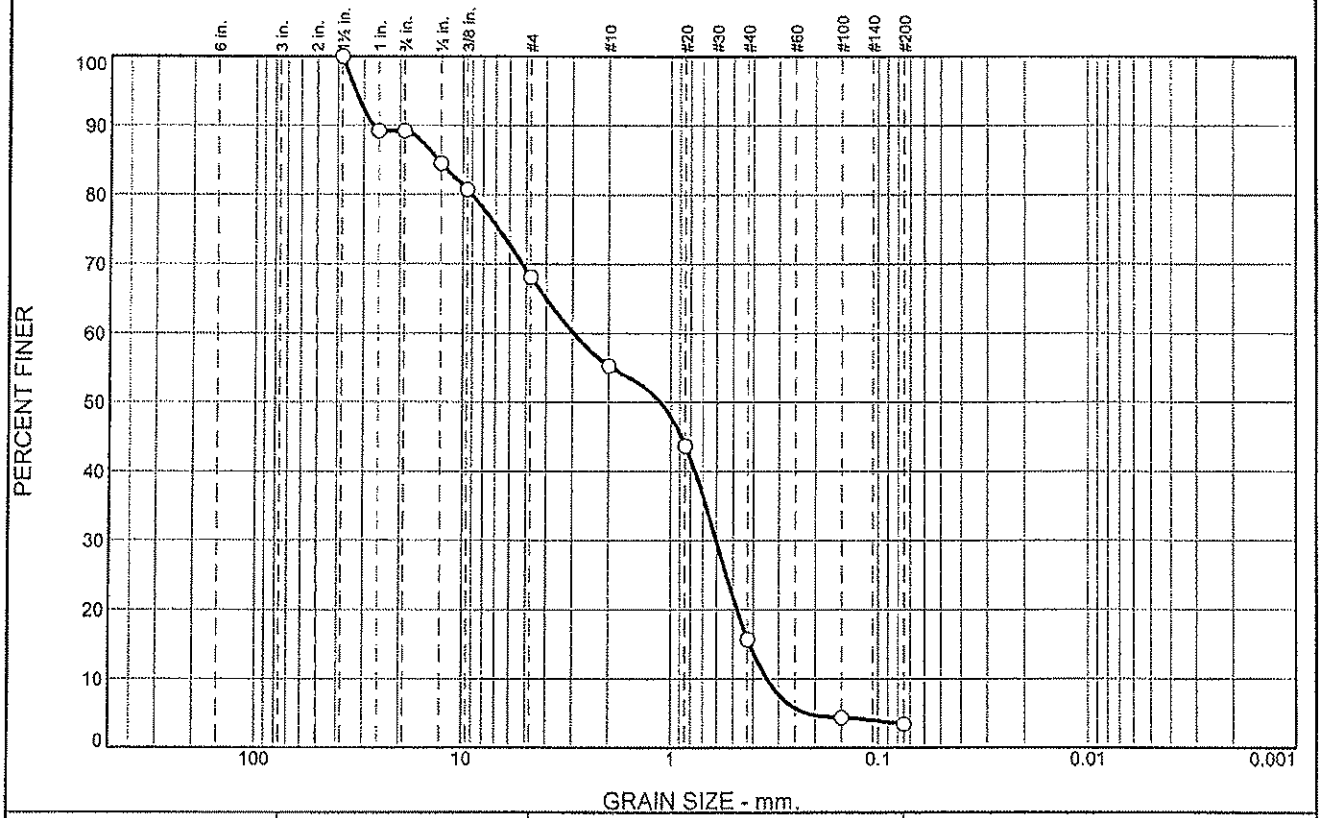
TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: Village of Dresden
Project: WWTP Improvements

Project No: N4115067 **Exhibit** B-6

Tested By: DS Checked By: AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.8	21.1	12.8	39.6	12.3	3.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1.0	89.2		
3/4	89.2		
1/2	84.5		
3/8	80.7		
#4	68.1		
#10	55.3		
#20	43.7		
#40	15.7		
#100	4.4		
#200	3.4		

* (no specification provided)

Material Description

Brown poorly graded SAND with fine to coarse gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 27.0209 D_{85}= 13.1161 D_{60}= 2.9677
D_{50}= 1.1222 D_{30}= 0.6028 D_{15}= 0.4156
D_{10}= 0.3430 C_u= 8.65 C_c= 0.36

Classification

USCS= SP AASHTO=

Remarks

Lab No. 478
F.M.=4.12

Source of Sample: B-10 **Depth:** 13.5'-15.0'
Sample Number: S-5

Date: 7-5-11

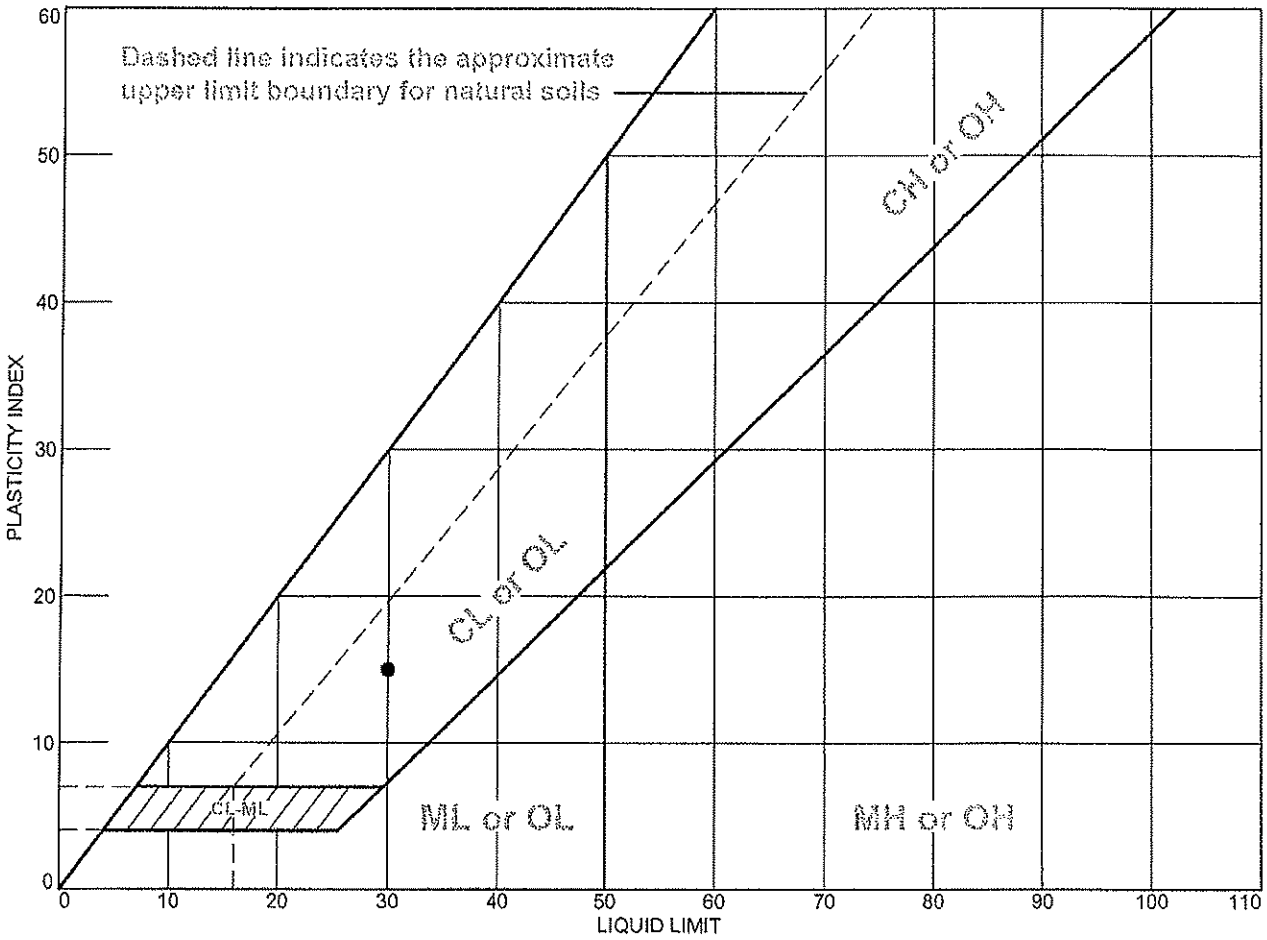
TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: Village of Dresden
Project: WWTP Improvements

Project No: N4115067 **Exhibit** B-7

Tested By: DS Checked By: AM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown and gray SANDY LEAN CLAY	30	15	15			CL

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-13 **Depth:** 6.0'-7.5' **Sample Number:** S-3

Remarks:

● Lab No. 479
Date: 7-5-11

TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-8

Tested By: DS **Checked By:** AM

APPENDIX C
SUPPORTING INFORMATION

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1-$^3/_8$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling		
DCI:	Dry Cave in	BCR:	Before Casing Removal		
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0-1	Very Soft
500 – 1,000	2-4	Soft
1,000 – 2,000	4-8	Medium Stiff
2,000 – 4,000	8-15	Stiff
4,000 – 8,000	15-30	Very Stiff
8,000+	>30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
>50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	>30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

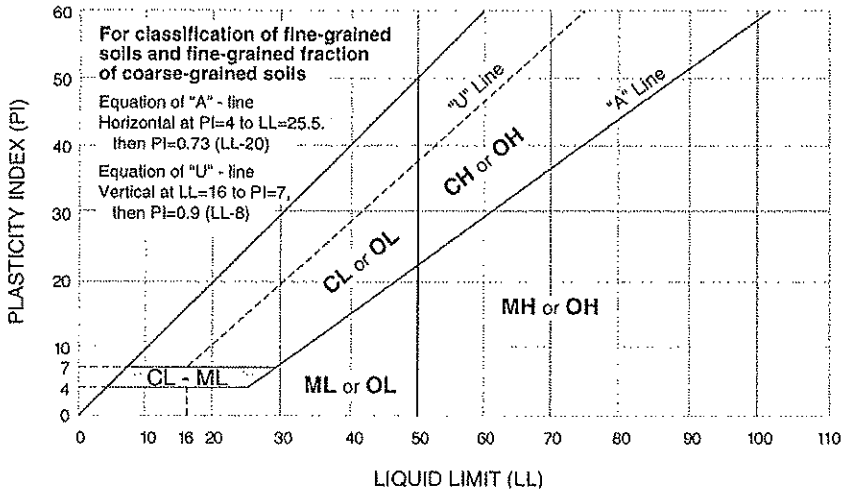


Exhibit C-2

GENERAL NOTES

Description of Rock Properties

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding and Foliation Spacing in Rock[a]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

Rock Quality Designator (RQD)[b]		Joint Openness Descriptors	
RQD, as a percentage	Diagnostic description	Openness	Descriptor
Exceeding 90	Excellent	No Visible Separation	Tight
90 – 75	Good	Less than 1/32 in.	Slightly Open
75 – 50	Fair	1/32 to 1/8 in.	Moderately Open
50 – 25	Poor	1/8 to 3/8 in.	Open
Less than 25	Very poor	3/8 in. to 0.1 ft.	Moderately Wide
		Greater than 0.1 ft.	Wide

a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.
b. RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976.
U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

Terracon

Geotechnical Engineering Report

Wastewater Treatment Plant Improvements

30 East Lock Street

Dresden, Ohio

April 8, 2016

Terracon Project No. N4115067

Prepared for:
Village of Dresden
Dresden, Ohio

Prepared by:
Terracon Consultants, Inc.
Columbus, Ohio

April 8, 2016

Terracon

Village of Dresden
904 Chestnut Street
Dresden, Ohio 43821

Attn: Mr. David Mathew
Mayor
P: [740] 754 3151
F: [740] 754 4005

Re: Geotechnical Engineering Report
Village of Dresden – Wastewater Treatment Plant Improvements
30 Lock Street
Dresden – Muskingum County, Ohio
Terracon Project No. N4115067

Dear Mr. Mathew:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. These services were performed in general accordance with our proposal number PN4110202 dated May 26, 2011 and written authorization dated June 8, 2011 provided by the Village of Dresden. The field exploration phase of the project was completed on June 21, 2011.

This report is an update to our Geotechnical Engineering Report issued August 20, 2012. This report includes updated recommendations based on the revised site layout and updated structural loading information.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please do not hesitate to contact us.

Sincerely,
Terracon Consultants, Inc.

Alma K. Baratta, P.E.
Project Engineer

Lynda Hill for
Kevin M. Ernst, P.E.
Geotechnical Department Manager

TABLE OF CONTENTS

EXECUTIVE SUMMARY

A geotechnical exploration has been performed for the Village of Dresden – Wastewater Treatment Plant (WWTP) Improvements project located at 30 Lock Street in Dresden – Muskingum County, Ohio. Thirteen (13) soil test borings, designated B-1 through B-13, were performed to a depth range of approximately 14 to 40 feet below existing surface grades.

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed project. The following geotechnical considerations were identified:

- The test borings indicated the presence of a native soil profile in all of the borings except Boring B-2. Granular fill with loose to medium dense relative density was encountered in Boring B-2 to a depth of about 8 feet below existing grade and underlain by native cohesive and granular soils. The native soils were of loose to medium dense relative density or medium stiff to stiff consistency and extended to a depth of about 13 to 22 feet below existing grade. The native cohesive and granular soils were underlain by native cohesive soils with soft to very stiff consistency on the central and north portions of the site, or shale and sandstone bedrock with very soft to moderately hard bedrock hardness rating on the south and southeast portions of the site. These materials were encountered to the termination depths of the borings.

- Based on the borings, the fill is not suitable for direct support of building foundations due to the potential for excessive total and differential settlement response. The proposed structures can be supported on structural mat slabs. However, the excavations should extend through the existing fill and bear on the underlying native soils, or on structural fill that extends to approved native soils.

- Due to site constraints, we anticipate that temporary excavation support will be required for support of the proposed excavations and to protect nearby existing structures at the WWTP.

- Groundwater was encountered at a depth range of about 8 to 13 feet below the existing ground surface in all of the borings. Seepage may occur in excavations for this project. However, groundwater levels fluctuate over time and should be evaluated at the time of construction. The contractor is responsible for employing appropriate dewatering methods to control seepage and facilitate construction.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained

herein. Section **5.0 GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
WASTEWATER TREATMENT PLANT IMPROVEMENTS
30 LOCK STREET
DRESDEN – MUSKINGUM COUNTY, OHIO

Terracon Project No. N4115067
April 8, 2016

1.0 INTRODUCTION

A geotechnical exploration has been performed for the Village of Dresden – Wastewater Treatment Plant (WWTP) Improvements project located at 30 Lock Street in Dresden – Muskingum County, Ohio. Thirteen (13) soil test borings, designated B-1 through B-13, were performed to a depth range of approximately 14 to 40 feet below existing surface grades. Logs of the borings along with a Boring Location Plan (Exhibit A-2) are included in Appendix A. A description of the field exploration is also included in the Appendix.

The purpose of these services is to provide information relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork
- seismic considerations
- foundation design and construction
- lateral earth pressure recommendations

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Site layout	See Appendix A, Exhibit A-2, Boring Location Plan
Wastewater treatment plant improvements	The planned improvements will include a screen/press building, aeration basin/oxidation ditch, clarifier/splitter box, RAS pump station (with valve pit and meter pit), sludge bed, and UV disinfection tank (with a blower pad).
Grading	Based on the site grading plan, it appears minimal cut/fill (less than about 2 feet) will be required to establish design grades.

ITEM	DESCRIPTION
Structural loading information	■ Screen Building: 300 psf (main building) 950 psf (screen channel) ■ Aeration Basin: 1,500 psf ■ Clarifier/Splitter Box: 800 psf ■ RAS Pump Station: 500 psf ■ Sludge Bed: 300 psf ■ UV Disinfection Tank: 900 psf
Provided structure elevations	Screen Building: ■ Finished floor: 720.5 feet ■ Bottom of footer: 716 feet ■ Bottom of screen channel: 703 feet (screen channel is 3 feet wide) Aeration Basin: ■ Top of wall 723.4 feet ■ Surrounding grade 720 feet ■ Bottom of slab 708.5 feet Clarifier/Splitter Box: ■ Top of wall 720.5 feet ■ Surrounding grade 720 feet ■ Bottom of slab 712.8 feet RAS Pump Station: ■ Top of tank 720.5 feet ■ Bottom of slab 698.3 feet (wet well) 712.8 (valve pit) 713 feet (meter pit) Sludge Bed: ■ Finished floor 720.5 feet UV Disinfection Tank: ■ Top of tank 718 feet ■ Bottom of slab 698.9 feet (UV tank) 717.3 (blower slab)

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	The project is located at the existing Village of Dresden Wastewater Treatment Plant located at 30 Lock Street in Dresden, Ohio.
Existing site features	Wastewater treatment plant (WWTP) with associated drives and infrastructure.
Current ground cover	Grass and pavements
Site topography	Overall, the site is relatively level to slightly sloping. The existing ground surface elevations across the site range from about elevation 713 feet to 721 feet.

Should any of the above information or assumptions be inconsistent with the planned construction, please let us know so we can review our recommendations and provide any necessary modifications to this report.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Subsurface Profile

Specific conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs included in Appendix A. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows.

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density/ Hardness
Surface	1 to 4 inches	Topsoil/4 inches of granular aggregate base in Boring B-3	N/A
Fill (only at Boring B-12)	8 feet	Granular material consisting of silty sand and clayey sand with various proportions of gravel size constituents, cinder and slag fragments	Loose to medium dense

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density/ Hardness
Native cohesive and granular soils (in Borings B-1, B-2, B-4, B-5, B-6, B-7, B-11 and B-13)	3 to 13 feet	Sandy lean clay, lean clay and silty clay with various proportions of sand size constituents, and clayey sand	Cohesive: medium stiff to stiff Granular: loose to medium dense
Native granular soils	13 to 22 feet	Silty sand and poorly graded sand with various proportions of silt and gravel size constituents and rock fragments; silty gravel with sand	Loose to medium dense
Native cohesive soils (in Borings B-1, B-2, B-4, B-5, B-6, B-7, B-12, and B-13)	Below a depth range of 20 to 40 feet (test boring termination depth)	Fat clay, lean clay, and sandy lean clay	Soft to very stiff
Bedrock (in Borings B-3, B-8, B-9, B-10, and B-11)	Below a depth range of 13.1 to 25 feet (test boring termination depth)	Shale and sandstone	Shale: very soft to soft bedrock hardness rating Sandstone: medium to moderately hard bedrock hardness rating

3.2 Groundwater

The boreholes were observed while drilling and after completion for the presence and level of groundwater. In addition, delayed water levels were also obtained in some of the borings where temporary groundwater observation wells had been installed. The water levels observed in the boreholes are noted on the attached boring logs, and are summarized below:

Boring Number	Depth to groundwater while drilling, ft.	Depth to groundwater after drilling, ft.
B-1	12	Not encountered
B-2	12	Not encountered
B-3	13	Not encountered
B-4	12	Not encountered
B-5	12	Not encountered
B-6	12	Not encountered
B-7	12	Not encountered
B-8	8	Not encountered

B-9	13	8.5
B-10	13	Not encountered
B-11	9	8.5
B-12	13	11.7
B-13	12	Not encountered

The water levels summarized above do not necessarily represent stable groundwater levels. Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The test borings indicated the presence of a native soil profile in all of the borings except Boring B-2. Granular fill with loose to medium dense relative density was encountered in Boring B-2 to about 8 feet below existing grade and underlain by native cohesive and granular soils. The native soils were of loose to medium dense relative density or medium stiff to stiff consistency and extended to a depth of about 13 to 22 feet below existing grade. The native cohesive and granular soils were underlain by native cohesive soils with soft to very stiff consistency on the central and north portions of the site, or shale and sandstone bedrock with very soft to moderately hard bedrock hardness rating on the south and southeast portions of the site. These materials were encountered to the termination depths of the borings.

Based on the borings, the fill is not suitable for direct support of building foundations due to the potential for excessive total and differential settlement response. The proposed structures can be supported on shallow foundations. We anticipate the Screen Building will be supported on spread footings with a slab-on-grade floor, and the remaining structures will be supported on structural mat slabs. The excavations for the foundations should extend through the existing fill and bear on the underlying native soils, or on structural fill that extends to approved native soils.

To provide suitable floor slab support, we recommend that existing fill materials encountered within the proposed Screen Building structure be undercut and replaced with properly compacted structural fill material. The undercut area should extend at least 5 feet beyond the footprint of the proposed building.

Due to site constraints, we anticipate that temporary excavation support will be required for support of the proposed excavations and to protect nearby existing structures at the WWTP.

Groundwater was encountered at a depth range of about 8 to 13 feet below the existing ground surface in all of the borings. Seepage may occur in excavations for this project. However, groundwater levels fluctuate over time and should be evaluated at the time of construction. The contractor is responsible for employing appropriate dewatering methods to control seepage and facilitate construction.

4.2 Earthwork

Provided information indicates that the existing ground surface ranges between approximate elevations 713 and 721 feet. Based on preliminary information, it appears minimal site grading (cut or fill up to 2 feet) would need to be performed to establish the proposed finished grades.

4.2.1 Site Preparation

As an initial measure of site preparation, any topsoil, vegetation, or other surficial deleterious material (e.g. debris, desiccated soil, frozen soil, etc.) should be completely stripped to expose the underlying soil subgrade in areas that will receive fill or support the proposed structures. The required depth of removal should be determined in the field by a representative of the geotechnical engineer.

Removal and/or relocation of any "to be abandoned" utilities, as well as installation of new underground utilities, should be performed once the topsoil and any deleterious material is removed. Any abandoned underground pipes left in place should be fully grouted. Excavations created due to utility relocations should be backfilled with granular structural fill material, placed and compacted in accordance with the recommendations provided in the following paragraphs, or with lean concrete or flowable fill. If lean concrete is used as backfill, the contractor should refer to all of the new build Mechanical-Electrical-Plumbing (MEP) and foundation drawings to confirm that the concrete backfill materials will not conflict with any new item installations or construction.

We understand that the existing imhoff tank will be demolished prior to the beginning of this phase of construction. We anticipate that as part of the initial site preparation, all remnants of the demolished structure including below-grade walls, foundation elements, floor slabs, and any deleterious material encountered within the proposed construction limits will be completely removed as a part of the initial site preparation phase.

To provide suitable foundation and floor slab support, we recommend that existing fill materials encountered within the proposed structure areas be undercut and replaced with properly

compacted structural fill material. The undercut area should extend at least 5 feet beyond the footprint of the proposed building.

After performing the initial site preparation activities and performing the recommended undercut, the exposed soils within the limits of the proposed structures should be proofrolled in the presence of a representative of the geotechnical engineer. The exposed granular soils should be proofrolled with several passes of a vibratory roller (minimum dead weight of 8 tons on the drum). Cohesive soils, where encountered, should be proofrolled with a fully loaded, tandem axle dump truck or other suitable equipment weighing at least 20 tons.

Any soft, loose or yielding areas encountered during proofrolling operations should be undercut to expose firm stable soils or reworked in place to a stable acceptable condition. It should be noted that undercut depths somewhat greater than normal may be needed if the construction occurs during periods of inclement weather. The actual amount of undercut would need to be determined in the field during construction and is dependent on weather conditions and equipment used in the construction.

The rough soil subgrade elevation should be established with quality controlled cohesive or granular fill placed and compacted in accordance with requirements provided in section **4.2.3 Structural Fill Material Requirements** and section **4.2.4 Structural Fill Placement and Compaction Requirements**.

4.2.2 Excavations

It is expected that the excavation related to the construction of the foundations will be performed in conjunction with or following the initial site preparation activities. The proposed structures appear to be located in close proximity to the existing structures, which may pose constraints to laying back excavation slopes in some parts of the excavation. Due to the site constraints associated with this existing infrastructure, open cut excavations may not be feasible and temporary earth retention system(s) should be considered.

These retention systems will have to be appropriately designed to prevent lateral and vertical movements of any existing structures, foundations, and utilities located adjacent to the excavation area. Monitoring of the retention system performance should be required during the entire time the excavation is left open.

The limits of movement for the earth retention system would be directly related to how much movement the existing site features can tolerate. We would expect that only very small deflections (e.g., less than 1 inch) would be acceptable, however, this should be evaluated by the designer. We also recommend that a preconstruction survey of the area in the immediate vicinity of the excavation be performed to allow comparison of any changes in the site features due to excavation activities in front of the temporary retaining wall. We can provide assistance in developing a temporary retention system monitoring program if requested.

There are various construction methods that can be used to provide for temporary ground support during construction. Bracing using sheet piling or soldier beams and wood lagging are methods that are generally considered. Excavations deeper than about 8 to 10 feet may also require intermediate levels of tiebacks/bracing for the retention system. A temporary retention system is generally designed by a contractor who specializes in this field. We would be available to review and comment on the contractor's retention system design upon request.

For the purposes of construction ingress/egress, an area along one or two sides of the excavation may need to be "open cut" type. Based on the encountered soil profile, it is recommended that the temporary cut slopes be excavated using no steeper than 1.5H:1V slopes. Intermediate horizontal benches might also be required, especially when the height of the cut exceeds about 15 feet. The toe of the cut slope should be located a minimum distance of 5 feet from the exterior face of the structure wall.

Based on the borings, wet bottom conditions will likely be encountered in the deeper foundation excavations at this site. These exposed surfaces may also require stabilization with free draining stone to allow for construction of the mat foundations. Depending on conditions encountered during construction, stabilization could include placement of a suitable lift (e.g. estimated 1 to 2 feet thick) of No. 1 and No. 2 stone choked off at the top with crushed No. 57 stone. For areas that exhibit significant instability, the use of ODOT "dump rock" could be considered in lieu of using No. 1 and No. 2 stone as stabilizing material. Areas where dump rock is used should also be suitably choked off with No. 1 and No. 2 stone capped with No. 57 stone.

Some minor seepage should be expected in shallow excavations at the site. In such an event, sump and pumping methods are expected to be adequate for temporary dewatering. In deeper excavations, the construction dewatering program will likely need to be modified to handle higher seepage rates. Groundwater was encountered at a depth range of about 8 to 13 feet below the existing ground surface in all of the borings

After performing the foundation excavations and other equipment-accessible excavations, the exposed subgrade should be reviewed by a representative of the geotechnical engineer. Wet or unstable bottom conditions, if present, should be stabilized as described above.

A lean concrete mudmat or working mat of crushed stone aggregate could be considered for placement at the bottoms of excavations to minimize disturbance of the subgrade during construction activities.

4.2.3 Structural Fill Material Requirements

Structural fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Lean clay	CL (LL<40)	All locations and elevations
Medium to high plasticity lean clay [2]	CL/CH (40<LL<50)	> 1.5 feet below building finished grade unless tested and meets low volume change material criteria
Fat clay	CH (LL >50)	Not recommended for use as structural fill
Well graded granular	SW, GW [3]	All locations and elevations
Low Volume Change Material [4]	CL (LL<40 & PI<22) or SW, GW [3]	All locations and elevations
On-Site Soils	CL, CH, CL-ML, SC, SM, SP, GM	The on-site fill and soils generally appear suitable for use as structural fill; however, any fill placed should meet the low volume change requirements and be free of deleterious materials such as organics; also significant moisture conditioning (drying) of the existing cohesive soils will be required prior to its use as a structural fill material. CH materials should not be used as structural fill.

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the geotechnical engineer for evaluation.
2. Delineation of medium to high plasticity lean clay and fat clay should be performed in the field by a qualified geotechnical engineer or their representative.
3. Crushed limestone aggregate, limestone screenings, or granular material such as sand, gravel or crushed stone containing at least 18% low plasticity fines.
4. Low plasticity cohesive soil or granular soil having at least 18% low plasticity fines.

4.2.4 Structural Fill Placement and Compaction Requirements

Item	Description
Fill Lift Thickness (Structural Areas)	8 inches or less in loose thickness if heavy, self-propelled compaction equipment is used 4 inches or less if hand compaction equipment used
Minimum Compaction Requirements [1] (Structural Areas)	Minimum 98% of the material's Standard Proctor maximum dry density (ASTM D 698)

Minimum Compaction Requirements (Landscape Areas)	Minimum 95% of Standard Proctor maximum dry density (ASTM D 698) provided long-term plans do not include a structure in these areas
Moisture Content - Cohesive Soil (Low Plasticity)	Within -2 to +3% of optimum moisture content (OMC) as determined by the Standard Proctor test at the time of placement and compaction
Moisture Content [2] - Granular Material	Workable moisture levels

1. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.
3. All materials to be used as structural fill should be tested in the laboratory to determine their suitability and compaction characteristics.

4.2.5 Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Small compaction equipment, such as a vibratory plate, jumping jack or walk-behind vibratory roller may be necessary. In these cases, compactive energy levels are lower and require smaller lift thicknesses to achieve compaction throughout the lift. Lift thicknesses should be maintained at 4 inches or less when using these types of small compaction equipment and the backfill should be compacted to the same criteria as presented for structural fill.

Compaction requirements for bedding and backfilling around utilities may need to be adjusted to the pipe material type and the pipe manufacturer's bedding and backfill material recommendations. If utility trenches are backfilled with relatively clean granular material, they should be capped with at least 18 inches of cohesive fill in non-pavement areas to reduce the infiltration and conveyance of surface water through the trench backfill.

Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the structure areas should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the structure.

4.2.6 Grading and Drainage

During construction, grades should be developed to direct surface water flow away from or around the site. Exposed subgrades should be sloped to provide positive drainage so that saturation of subgrades is avoided. Surface water should not be permitted to accumulate on the site.

Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water. Gutters and downspouts that drain water a minimum of 10 feet beyond the footprint of the proposed structures are recommended. This can be accomplished through the use of splash-blocks, downspout extensions, and flexible pipes that are designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water. Splash-blocks should also be considered below hose bibs and water spigots.

Groundwater seepage may also occur during the excavation and construction of the proposed structures. Due to the granular nature of the soil profile, trapped water infiltration or groundwater seepage may be encountered, particularly after periods of precipitation. In such an event, sump and pumping methods may be used for temporary dewatering.

4.2.7 Earthwork Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. The use of light construction equipment would aid in reducing subgrade disturbance. The use of remotely operated equipment, such as a backhoe, would be beneficial to perform cuts and reduce subgrade disturbance, particularly in silts and silty sand soils. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of the mat foundations. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to mat foundation construction.

All excavations should comply with applicable local, state and federal safety regulations, including the current Occupational Health and Safety Administration (OSHA) Excavation and Trench Safety Standards. As a minimum, any temporary excavations should be sloped or braced as required by current OSHA regulations to provide stability and safe working conditions. Temporary excavations may be required during grading operations and installation of utilities. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom.

Under no circumstances should the information provided in this report be interpreted to mean that Terracon is responsible for construction site safety or the contractor's activities.

Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods, and sequencing of the construction operations.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs.

4.3 Foundations

It is recommended the proposed Screen Building be supported on spread footing foundations, and the remaining structures be supported on mat/slab foundations. Design recommendations for shallow foundations to support the proposed structures are presented below.

4.3.1 Spread Footing Foundation Design Recommendations

Description	Column	Wall
Net allowable bearing pressure [1]	3,000 psf	3,000 psf
Minimum dimensions	30 inches	18 inches
Minimum embedment below finished grade for frost protection [2]	36 inches	36 inches
Approximate total settlement [3]	<1 inch	<1 inch
Allowable coefficient of sliding friction	0.30	0.30

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable or soft soils, if encountered, will be undercut and replaced with structural fill.
2. and to reduce the effects of seasonal moisture variations in the subgrade soils. For perimeter footing and footings beneath unheated areas.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations.

The allowable foundation bearing pressures apply to dead loads plus design live load conditions. The weight of the foundation concrete below grade may be neglected in dead load computations. Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.

We also recommend that the building foundations be suitably reinforced to resist movement from potential differential settlement. Walls and slabs should incorporate control joints to minimize effects of differential settlement, particularly where significant cut/fill transitions will occur, or in areas where bearing elevations of foundations transition in depth.

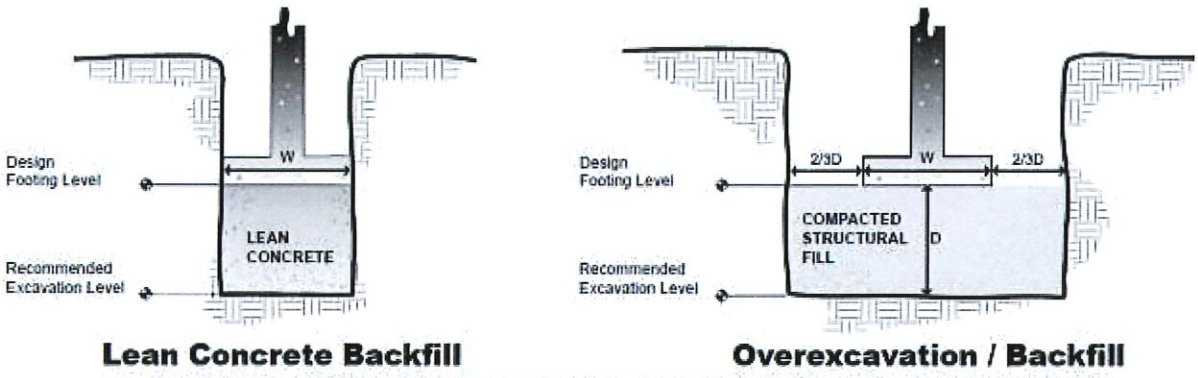
Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ from those presented in this report, supplemental recommendations will be required.

4.3.2 Spread Footing Foundation Construction Considerations

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. If the soils at bearing level become excessively dry, disturbed, saturated, or frozen, the affected soil should be removed prior to placing concrete. Placement of a lean concrete mud-mat over the bearing soils should be considered if the excavations must remain open overnight or for an extended period of time.

Exposed subgrade soils should be examined by geotechnical personnel to determine that suitable bearing materials have been encountered. If loose granular soils are encountered at the foundation bearing elevation, or if the bearing soils are disturbed, the bearing surface should be thoroughly compacted using suitable compaction equipment to achieve at least medium dense relative density. If sufficient compaction cannot be achieved in place, or if soft cohesive materials are encountered, the unsuitable soils should be removed and replaced with structural fill. The base of the footing excavations should be protected from excessive foot traffic, or other disturbance.

If unsuitable bearing soils are encountered in footing excavations, the excavation could be extended deeper to suitable soils and the footing could bear directly on these soils at the lower level, or on lean concrete backfill placed in the excavations. As an alternative, the footings could also bear on properly compacted structural backfill extending down to the suitable soils. Overexcavation for compacted structural fill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with well-graded granular material placed in lifts of 8 inches or less in loose thickness (4 inches or less if using hand-guided compaction equipment) and compacted to at least 98 percent of the material's standard effort maximum dry density (ASTM D 698). The overexcavation and backfill procedure is described in the following figure.



Lean Concrete Backfill **Overexcavation / Backfill**

NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

4.3.3 Mat/Slab Foundation Design Recommendations

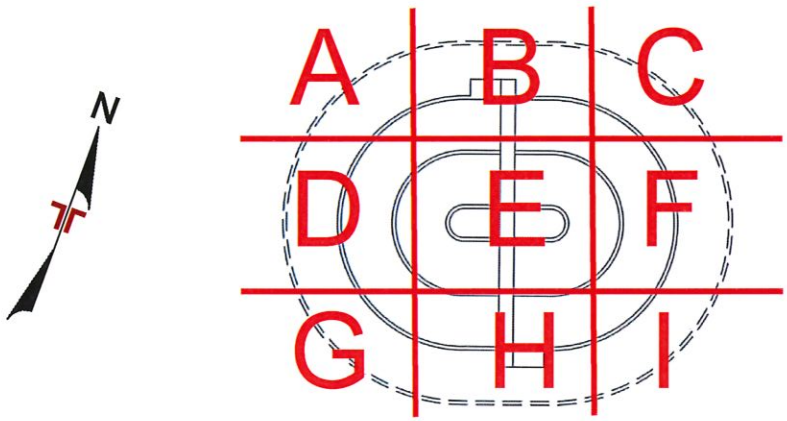
As described in section **4.3.4 Mat/Slab Foundation Construction Considerations,** the mat/slab foundations should be supported on a competent granular structural fill bed at least 1 foot thick.

The mat design can assume a theoretical soil bearing capacity of 3,000 psf. A modulus of subgrade reaction design value should be based on anticipated soil contact pressure and theoretical vertical displacements. Due to the presence of bedrock approximately 13 to 22 feet beneath the current grade (3 to 7 feet beneath the proposed bearing elevations) on the south and southeastern portions of the site, modulus of subgrade reaction values vary across the site. Computed values of modulus of subgrade reaction are as follows:

Structure	Contact Stress, psf	Anticipated settlement, in	Modulus of subgrade reaction, pci
Screen Building (screen channel)	950	½	13
Clarifier/Splitter Box	800	½	11
RAS Pump Station	500	¼	14
Sludge Bed	300	½	4
UV Disinfection Tank	900	½	13
Aeration Basin (section A [1])	1,500	½	21
Aeration Basin (section B [1])	1,500	½	21
Aeration Basin (section C [1])	1,500	½	21
Aeration Basin (section D [1])	1,500	½	21

Aeration Basin (section E [1])	1,500	¾	14
Aeration Basin (section F [1])	1,500	½	21
Aeration Basin (section G [1])	1,500	½	21
Aeration Basin (section H [1])	1,500	½	21
Aeration Basin (section I [1])	1,500	½	21

1. Aeration basin sections are defined as follows:



If exposed to the exterior grade, the sides of the mat foundation should be backfilled with compacted soil and consideration should be made with regard to frost protection. A minimum 3 feet foundation embedment should be used for frost consideration if that is the case.

If lateral load resistance is required, an allowable coefficient of friction between the bottom of the concrete mat and the underlying structural granular fill can be assumed to be 0.3. This value includes a theoretical safety factor of about 1.5 against sliding. It is recommended that passive pressure resistance due to the uppermost 3 feet of the soil profile along the sides of the foundation be neglected.

4.3.4 Mat/Slab Foundation Construction Considerations

It is anticipated that the proposed structures will be supported on a mat foundation system. The areas encompassed by these foundation systems and 5 feet beyond should be undercut such that at least a 1 foot thick layer of granular structural fill exists beneath the bottom of foundation level. For mats that bear within soils above the groundwater elevation, this granular fill should consist of ODOT 304 crushed limestone. For mats that bear within soils below the groundwater table, this granular layer should consist of free draining stone such as No. 57 crushed

limestone. If soils with marginal consistency or relative density are encountered at the bottom of the 1 foot foundation undercut, further undercut may be required until competent soils are exposed. In areas where wet bottom conditions are encountered, the soils may need stabilization below mats as outlined in section **4.2.2 Excavations**. A summary of foundation bearing conditions is presented below. Although wet bottom conditions are not anticipated for the Screen Building (main building) or the Clarifier/Splitter Box, wet bottom conditions may occur due to fluctuations in the groundwater table, precipitation, or other factors not present at the time the test borings were performed.

Structure	Approximate bottom of mat elevation, ft	Anticipated bearing material	Approximate groundwater elevation, ft	Anticipated bottom of undercut elevation, ft	Wet bottom conditions anticipated?
Screen Building (screen channel)	703	Fat clay	707.3	702	Yes
Clarifier/Splitter Box	712.8	Silty sand with gravel	709.5	711.8	No
RAS Pump Station (wet well)	698.3	Sandstone	709.5	697.3	Yes
Aeration Basin	708.5	Poorly graded or silty sand with gravel	709.5	707.5	Yes
Sludge Bed	717	Lean clay or structural fill	706	716	No
UV Disinfection Tank	698.9	Sandstone	707.5	697.9	Yes

To minimize disturbance of granular soils, excavation should be performed with a smooth-lipped excavator bucket. Once the undercut excavation is made, the exposed subgrade soils should be examined by geotechnical personnel to determine that suitable bearing materials have been encountered. Should the undercut excavation expose materials that require stabilization with #2 stone or durable dump-rock prior to fill placements, provisions should be made to "drain" these materials to a nearby storm sewer or other drainage outlet, if possible.

The undercut areas should be backfilled with granular structural fill in accordance with requirements provided in section **4.2.3 Structural Fill Material Requirements** and section **4.2.4 Structural Fill Placement and Compaction Requirements**.

Where possible, we recommend the area underlying the mat foundation be rough graded and then thoroughly proofrolled using a vibratory roller (minimum dead weight of 8 tons on the drum) for granular soils, or a fully loaded, tandem axle dump truck weighing at least 20 tons for cohesive soils prior to final grading and placement of aggregate base. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All mat foundation subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the aggregate base and concrete.

4.4 Seismic Considerations

Code Used	Site Classification
Ohio Building Code (OBC) [1]	D [2]

1. In general accordance with the *Ohio Building Code,* Table 1613.5.2.
2. The Ohio Building Code requires a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope requested does not include the required 100 foot soil profile determination. Borings for this report extended to a maximum depth of approximately 40 feet and this seismic site class assignment considers that sandstone and shale bedrock continues below the maximum depth of the subsurface exploration. Additional exploration to greater depths could be considered to confirm the conditions below the current depth of exploration. Alternatively, a geophysical exploration could be utilized in order to attempt to justify a more favorable seismic site class.

4.5 Floor Slab-on-Grade

4.5.1 Design Recommendations

Item	Description
Interior floor system	Slab-on-grade concrete
Floor slab support	Native lean clay soils or structural fill meeting low volume change requirements (minimum 18-inch thick layer of low volume change material) [1]
Modulus of subgrade reaction	110 pounds per square inch per inch (psi/in) for point loading conditions
Aggregate base course/capillary break [2]	Minimum 4 inches of free draining granular material

1. Floor slabs should be structurally independent of any building footings or walls to reduce the possibility of floor slab cracking caused by differential movement between the slab and foundation. The slabs should be appropriately reinforced to support the proposed loads.

   Any structural fill placed in the upper 18 inches beneath the structure floor slab areas should meet the requirements for Low Volume Change material which is defined in section **4.2 Earthwork**.

   We recommend subgrades be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompacted. Upon completion of grading operations in the structure areas, care should be taken to maintain the recommended subgrade moisture content and density until construction of the structure floor slabs.
2. The floor slab design should include a capillary break, comprised of free-draining, compacted, granular material at least 4 inches thick and can be considered as part of the low volume change zone. Free-draining granular material should have less than 5 percent fines (material passing the #200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or any cracks that develop should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

4.5.2 Floor Slab-on-Grade Construction Considerations

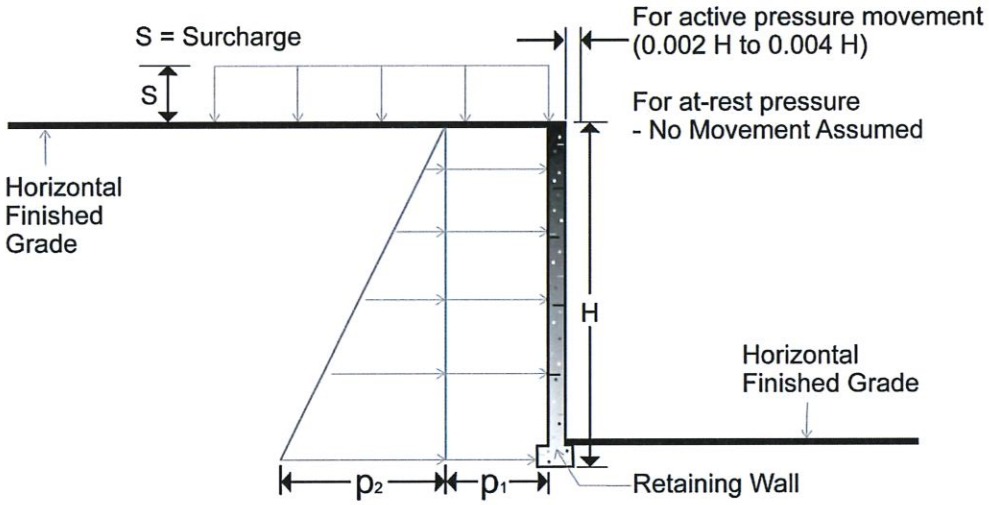
On most project sites, the site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of aggregate base and concrete and corrective action will be required.

Where possible, we recommend the area underlying the floor slabs be rough graded and then thoroughly proofrolled using a vibratory roller (minimum dead weight of 8 tons on the drum) for granular soils, a fully loaded, tandem axle dump truck weighing at least 20 tons for cohesive soils, or other suitable construction equipment as determined by the geotechnical engineer prior to final grading and placement of aggregate base. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and

replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the aggregate base and concrete.

4.6 Lateral Earth Pressures

The proposed structures are planned to have walls below the final design grade. Reinforced concrete walls (e.g. basement walls, below grade tank walls) with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Coefficients

Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (Ka)	Granular - 0.33	40	(0.33)S	(40)H
	Lean Clay - 0.42	50	(0.42)S	(50)H
At-Rest (Ko)	Granular - 0.46	55	(0.46)S	(55)H
	Lean Clay - 0.58	70	(0.58)S	(70)H
Passive (Kp)	Granular - 3.0	360	---	---
	Lean Clay - 2.4	290	---	---

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about the base, with top lateral movements of about 0.002 **H** to 0.004 **H**, where **H** is wall height
- For passive earth pressure to develop, the wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 120 pcf
- Horizontal backfill, compacted to at least 98 percent of standard Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No dynamic loading
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.3 should be used as the allowable coefficient of friction between the footing and the underlying soil.

To control hydrostatic pressure behind the wall, we recommend that a drain be installed at the foundation wall with a collection pipe leading to a reliable discharge. If this is not possible, then combined hydrostatic and lateral earth pressures should be calculated for lean clay backfill using an equivalent fluid weighing 90 and 100 pcf for active and at-rest conditions, respectively. For granular backfill, an equivalent fluid weighing 85 and 90 pcf should be used for active and at-rest conditions, respectively. These pressures do not include the influence of surcharge, equipment or floor loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

Field Exploration Description

The subsurface exploration consisted of drilling and sampling thirteen (13) borings at the site to a depth range of approximately 13 to 40 feet below existing grades. The boring locations were laid out by GGC Engineers personnel. Ground surface elevations at the test boring locations were determined based on site topographic plans provided by GGC Engineers. Ground surface elevations indicated on the boring logs are rounded to the nearest ½ foot. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them. The approximate boring locations are indicated on the attached Boring Location Plan.

The borings were drilled with an ATV-mounted rotary drill rig using hollow stem augers to advance the boreholes. Representative soil samples were obtained by the split-barrel sampling procedure. In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). These values are indicated on the boring logs at the depths of occurrence. This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. The sampling depths and penetration distance, plus the standard penetration resistance values, are shown on the boring logs. The samples were sealed and taken to the laboratory for testing and classification.

An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed at this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT values and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the standard penetration resistance blow count (N) value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method.

Rock coring was performed at one test boring location. Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

The samples were classified in the laboratory based on visual observation, texture and plasticity. The descriptions of the soils indicated on the boring logs are in general accordance with the enclosed General Notes and the Unified Soil Classification System. Estimated group symbols according to the Unified Soil Classification System are given on the boring logs. A brief description of this classification system is attached to this report.

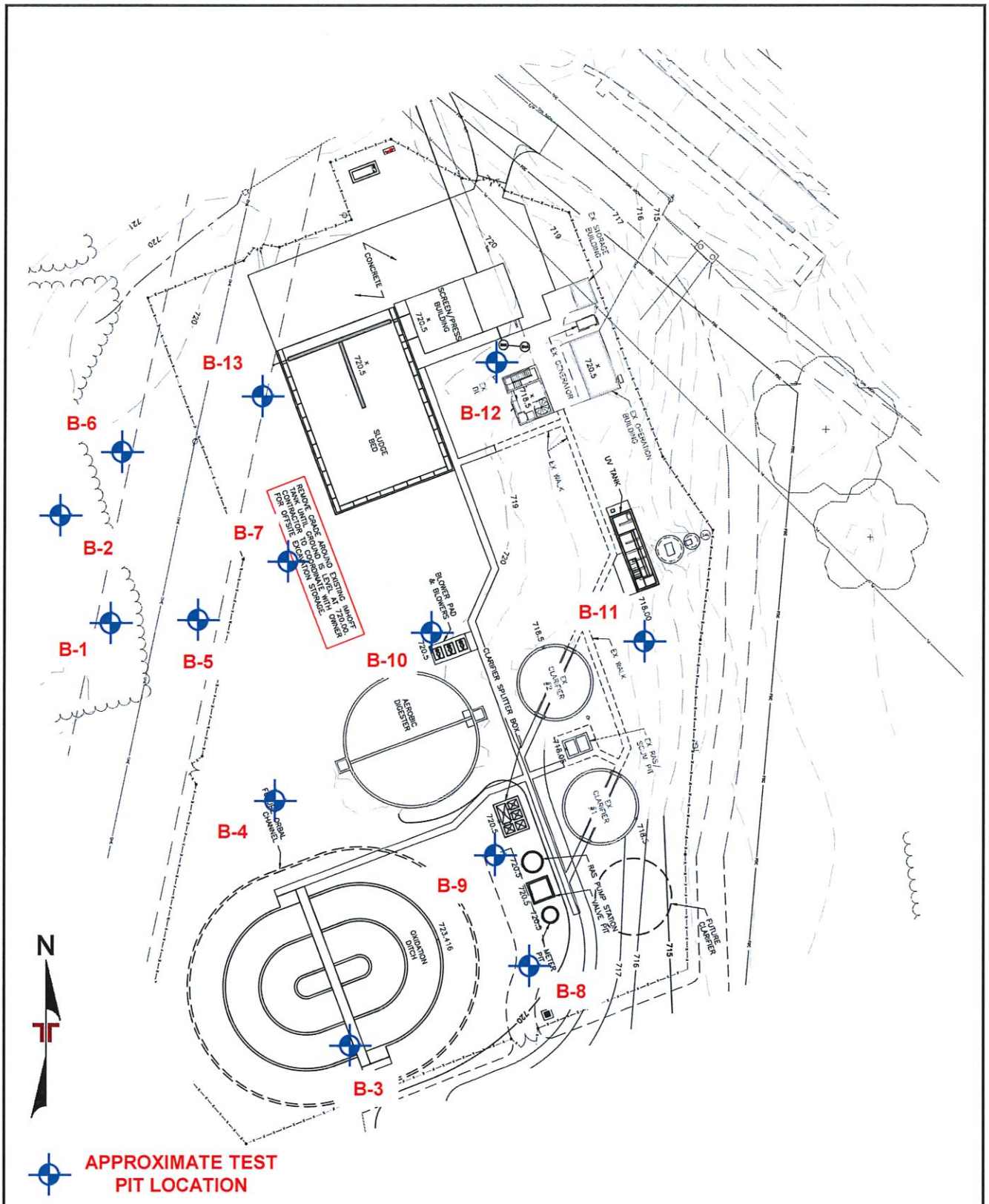


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: KME	Project No. N4115067
Drawn by: AKB	Scale: N.T.S.
Checked by: KME	File Name: N4115067
Approved by: KME	Date: April 2016

Terracon
Consulting Engineers & Scientists
790 Morrison Road Columbus, Ohio 43230
PH. (614) 863-3113 FAX. (614) 863-0475

BORING LOCATION PLAN

WASTEWATER TREATMENT PLANT IMPROVEMENTS

VILLAGE OF DRESDEN

DRESDEN, OHIO

Exhibit

A-2

LOG OF BORING NO. B-1

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

Approx. Surface Elev.: 720 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.3 **TOPSOIL** (4") 719.5									
	LEAN CLAY WITH SAND, trace organics,noted silt layers		CL	1	SS	18	5	20		5000*
	3 Brown and gray, stiff 717									
	SANDY LEAN CLAY, noted silt layer Dark reddish brown and gray, medium stiff		CL	2	SS	18	5	22		1500*
	5.5 714.5	5								
	CLAYEY SAND Brown, loose		SC	3	SS	18	9	21		
	8 712									
	SILTY SAND WITH GRAVEL and rock fragments Brown, medium dense ▽		SM	4	SS	18	10			
		10								
			SM	5	SS	16	7			
		15								
	17 703									
	FAT CLAY Brownish gray, soft		CH	6	SS	18	4	40		500*
	20 700	20								
	Boring terminated at 20 feet									
	Note: Boring offset approximately 20 feet S due to overhead utilities.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▼ N/E	ACR
WL	▽		▼	
WL	DCI - 10'			

Terracon

TEST BORING STARTED	6-21-11		
TEST BORING COMPLETED	6-21-11		
RIG CME 550 (93)	FOREMAN	KH	
Exhibit A-3	JOB #	N4115067	

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-2

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf	
	Approx. Surface Elev.: 720 ft										
	0.3 **TOPSOIL** (3") 719.5										
	LEAN CLAY WITH SAND, trace rock fragments		CL	1	SS	18	2	26		500*	
	3 Brown, gray and yellowish brown, soft 717										
	LEAN CLAY WITH SAND, trace gravel, noted silt layers		CL	2	SS	18	6	19		4000*	LL = 32 PI = 16
	5.5 Mottled brown and gray, stiff 714.5	5									
	LEAN CLAY WITH SAND, trace rock fragments		CL	3	SS	18	7	23		3000*	
	8 Gray and reddish brown, medium stiff 712										
	POORLY GRADED SAND WITH SILT, trace gravel Brown, loose ▽		SP	4	SS	18	7				
	13 707	10									
	SILTY SAND, trace gravel Brown, loose		SM	5	SS	18	4				
	17 703	15									
	FAT CLAY Brownish gray, soft		CH	6	SS	18	2	40		500*	
	23 697	20									
	FAT CLAY, trace sand Brownish gray, very stiff		CH	7	SS	18	22			7000*	
	25 695	25									
	Boring terminated at 25 feet										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▼ N/E	ACR
WL	▼		▼	
WL	DCI - 12'			

Terracon

TEST BORING STARTED	6-21-11		
TEST BORING COMPLETED	6-21-11		
RIG CME 550 (93)	FOREMAN	KH	
Exhibit A-4	JOB #	N4115067	

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-3

CLIENT **Village of Dresden**

SITE **30 Lock Street**
Dresden, Ohio

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 719 ft									
	0.3 **AGGREGATE BASE** (4") 718.5									
	POORLY GRADED SAND WITH SILT Reddish brown, loose 3 716		SP	1	SS	18	8			
	POORLY GRADED SAND WITH SILT, trace gravel Light reddish brown, loose		SP	2	SS	16	7			
		5	SP	3	SS	8	6			
	8 711									
	POORLY GRADED SAND WITH GRAVEL Light brown, loose ▽		SP	4	SS	12	5			
		10								
			SP	5	SS	8	9			
		15								
	16.5 702.5									
	16.7 **SHALE**, arenaceous, gray, very severely weathered, very soft 702.5		SP	6	SS	2	50/2"			
	Auger and sampler refusal on shale bedrock Boring terminated at 16.7 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 13	WD	▼ N/E	ACR
WL	▽		▼	
WL	DCI - 7'			

Terracon

TEST BORING STARTED	6-21-11
TEST BORING COMPLETED	6-21-11
RIG CME 550 (93)	FOREMAN KH
Exhibit A-5	JOB # N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-4

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

Approx. Surface Elev.: 720 ft

DEPTH, ft.	DESCRIPTION	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
0.3 / 719.5	**TOPSOIL** (3")								
	SILTY SAND WITH GRAVEL Reddish brown, medium dense	SM	1	SS	18	23			
3 / 717									
	CLAYEY SAND, trace gravel and rock fragments Reddish brown, loose	SC	2	SS	18	4	16		
5.5 / 714.5									
	POORLY GRADED SAND WITH SILT, trace gravel Brown, medium dense	SP	3	SS	18	10			
8 / 712									
	SILTY SAND WITH GRAVEL and rock fragments Brown, loose ▽	SM	4	SS	16	7			
		SM	5	SS	10	5			
19 / 701									
	FAT CLAY Gray, soft	CH	6	SS	18	3	39		500*
22 / 698									
	SANDY LEAN CLAY, with sandstone fragments (completely weathered sandstone) Gray, trace yellowish brown, stiff to very stiff	CL	7	SS	16	46	17		
25 / 695									
	Boring terminated at 25 feet								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 12	WD	▼ N/E ACR
WL	▽		▼
WL	DCI - 15'		

Terracon

TEST BORING STARTED	6-21-11
TEST BORING COMPLETED	6-21-11
RIG CME 550 (93)	FOREMAN KH
Exhibit A-6	JOB # N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-5

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

Approx. Surface Elev.: 720 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.2 **TOPSOIL** (2") 720									
	SILTY CLAY WITH SAND, trace rock fragments		CL ML	1	SS	18	5	19		3000*
	3 Brown and light gray, medium stiff to stiff 717									
	SANDY LEAN CLAY, trace rock fragments Brown and light gray, medium stiff		CL	2	SS	18	5	19		2000*
	5.5 714.5	5								
	CLAYEY SAND		SC	3	SS	18	8	34		
	7 Brown, loose 713									
	POORLY GRADED SAND WITH SILT Brown, loose		SP	4	SS	18	8			
	▽	10								
	13 707									
	SILTY SAND WITH GRAVEL Brown, medium dense		SM	5	SS	4	13			
		15								
	19.5 700.5		CH	6	SS	18	8	34		1000*
	20 **FAT CLAY** 700 Brownish gray, medium stiff	20								
	Boring terminated at 20 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL ▽ 12	WD ▼ N/E	ACR	
WL ▽	▼		
WL	DCI - 12'		

Terracon

TEST BORING STARTED	6-21-11
TEST BORING COMPLETED	6-21-11
RIG CME 550 (93)	FOREMAN KH
Exhibit A-7	JOB # N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-6

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

Approx. Surface Elev.: 720 ft

DEPTH, ft.	GRAPHIC LOG	DESCRIPTION	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf	
0.2 / 720		**TOPSOIL** (2")									
3 / 717		**SILTY CLAY** Light brownish gray and reddish brown, stiff	CL ML	1	SS	18	5	19		5000*	
5.5 / 714.5		**LEAN CLAY WITH SAND**, trace rock fragments Dark reddish brown, stiff	CL	2	SS	18	10	20		3000*	
5											
8 / 712		**SANDY LEAN CLAY**, trace rock fragments Reddish brown, stiff	CL	3	SS	18	11	23		3500*	LL = 30 PI = 13
13 / 707		**POORLY GRADED SAND WTIH SILT**, trace gravel Brown, medium dense ▽	SP	4	SS	18	10				
10											
18 / 702		**POORLY GRADED SAND** Brown, loose	SP	5	SS	18	7				
15											
22 / 698		**FAT CLAY** Brownish gray, soft	CH	6	SS	18	3	42		500*	LL = 59 PI = 36
20											
28 / 692		**LEAN CLAY**, trace sand Gray, medium stiff to stiff	CL	7	SS	18	7	22		3000*	
25											
30 / 690		**CLAYEY SILT** Gray, medium dense	ML	8	SS	18	14	27			
30											
		Boring terminated at 30 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▼ N/E	ACR
WL	▼		▼	
WL	DCI - 11'			

Terracon

TEST BORING STARTED	6-21-11
TEST BORING COMPLETED	6-21-11
RIG CME 550 (93)	FOREMAN KH
Exhibit A-8	JOB # N4115067

LOG OF BORING NO. B-7

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

Approx. Surface Elev.: 720 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf	
	0.3 **TOPSOIL** (3") 719.5										
	SILTY CLAY WITH SAND, trace gravel Brown and light brown, medium stiff to stiff		CL ML	1	SS	16	6	20		4000*	
	3 717										
	SANDY LEAN CLAY Brown, trace gray, medium stiff		CL	2	SS	18	7	19		2000*	
	5.5 714.5	5									
	CLAYEY SAND 7 Brown, medium dense 713		SC	3	SS	18	14	15			
	SANDY LEAN CLAY Brown, medium stiff		CL	4	SS	18	4	22		2000*	
	▽	10									
	13 707										
	SILTY SAND WITH GRAVEL Brown, loose		SM	5	SS	12	7				
		15									
			SM	6	SS	18	9				
		20									
	22 698										
	FAT CLAY Gray, medium stiff to soft		CH	7	SS	18	7	40		1000*	
		25									
			CH	8	SS	18	4	44		500*	LL = 62 PI = 38
		30									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▼ N/E	ACR
WL	▽		▼	
WL	DCI - 13'			

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-21-11		
RIG CME 550 (93)	FOREMAN	KH	
Exhibit A-9	JOB #	N4115067	

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-7

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	FAT CLAY Gray, medium stiff to soft		CH	9	SS	18	5	42		500*
		35								
	38 682									
	LEAN CLAY, trace sand, trace gravel Gray, very stiff		CL	10	SS	18	25	18		8000*
	40 680	40								
	Boring terminated at 40 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▼ N/E	ACR
WL	▼		▼	
WL	DCI - 13'			

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-21-11		
RIG CME 550 (93)	FOREMAN	KH	
Exhibit A-9	JOB #	N4115067	

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-8

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 716.5 ft									
	0.3 **TOPSOIL**, with gravel (3") 716									
	POORLY GRADED SAND, trace gravel Light reddish brown, loose		SP	1	SS	16	7			
	- noted clay seam below 3.5 feet		SP	2	SS	16	5			
	5.5 711	5								
	SILTY SAND WITH GRAVEL Brown, loose ▽		SM	3	SS	8	5			
			SM	4	SS	10	8			
		10								
	13.5 703									
	13.7 **SHALE**, arenaceous, gray, very severely weathered, soft 703			5	SS	2	50/2"			
	Auger and sampler refusal on shale bedrock									
	Boring terminated at 13.7 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 8	WD	▼ N/E	ACR
WL	▽		▼	
WL	DCI - 7'			

Terracon

TEST BORING STARTED	6-21-11
TEST BORING COMPLETED	6-21-11
RIG CME 550 (93)	FOREMAN KH
Exhibit A-10	JOB # N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-9

CLIENT: **Village of Dresden**

SITE: **30 Lock Street, Dresden, Ohio**

PROJECT: **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

Approx. Surface Elev.: 718 ft

DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf	DESCRIPTION
0.2 / 718									**TOPSOIL** (2")
	SM	1	SS	16	20				**SILTY SAND WITH GRAVEL** and rock fragments, Brown, medium dense
	SM	2	SS	18	13				
5.5 / 712.5									
	SM	3	SS	10	4				**SILTY SAND WITH GRAVEL** and rock fragments, Brown, loose
	SM	4	SS	9	6				
13 / 705									▽
	SM	5	SS	12	50/5"				**SILTY GRAVEL WITH SAND**, Brown, very dense
15 / 703									
		6	NQ2	6	RQD 0%				**SHALE**, arenaceous, gray, moderately severely weathered, soft
		7	NQ2	57	RQD 61%				
17.8 / 700									
19.1 / 699									**SANDSTONE**, brownish gray, moderately severely weathered, soft
20.7 / 697.5									**SANDSTONE**, gray and brown, moderately severely weathered, medium
22 / 696									**SHALE**, arenaceous, gray, severely weathered, soft
		8	NQ2	58	RQD 34%				
23.4 / 694.5									**SANDSTONE**, gray, moderately severely weathered, moderately hard
25 / 693									**SHALE**, arenaceous, gray, very severely weathered, very soft
									Boring terminated at 25 feet

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 13	WD ▼ 8.5	ACR
WL	▼	▼	
WL	WCI - 9'		

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-20-11		
RIG CME 550 (93)	FOREMAN	KH	
Exhibit A-11	JOB #	N4115067	

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-10

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 720 ft									
	0.3 **TOPSOIL** (3) 719.5									
	SILTY SAND, trace gravel, noted cobbles Brown, loose		SM	1	SS	14	6			
			SM	2	SS	0	3			
		5	SM	3	SS	2	5			
			SM	4	SS	2	4			
	13 ▽ 707	10								
	POORLY GRADED SAND WITH SILT, trace gravel Brown, loose		SP	5	SS	8	9			
	17 703	15								
	17.1 **SHALE**, arenaceous, gray, very severely weathered, soft 703			6	SS	2	50/2"			
	Auger and sampler refusal on shale bedrock Boring terminated at 17.1 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL ▽ 13	WD ▼ N/E	ACR	
WL ▼	▼		
WL	DCI - 11'		

Terracon

TEST BORING STARTED	6-20-11
TEST BORING COMPLETED	6-20-11
RIG CME 550 (93)	FOREMAN KH
Exhibit A-12	JOB # N4115067

LOG OF BORING NO. B-11

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	Approx. Surface Elev.: 716 ft									
	0.1 **TOPSOIL** (1") 716									
	SANDY LEAN CLAY WITH GRAVEL Brown, medium stiff to stiff		CL	1	SS	14	5	13		2500*
	3 713									
	SILTY SAND WITH GRAVEL and rock fragments Brown, medium dense		SM	2	SS	18	23			
	5.5 710.5	5								
	SILTY SAND WTH GRAVEL and rock fragments Brown, loose		SM	3	SS	3	5			
	8 708									
	SILTY GRAVEL WITH SAND Light brown, loose		GM	4	SS	16	7			
		10								
	13 703									
	13.1 **SHALE**, arenaceous, brownish gray, very severely weathered, soft 703			5	SS	1	50/1"			
	Auger and sampler refusal on shale bedrock									
	Boring terminated at 13.1 feet									
	Note: Boring offset approximately 20 feet NW due to underground utilities under direction of WTP supervisor.									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 9	WD ▼ 8.5	ACR
WL	▽	▼	
WL	WCI - 9'		

Terracon

TEST BORING STARTED	6-20-11
TEST BORING COMPLETED	6-20-11
RIG CME 550 (93)	FOREMAN KH
Exhibit A-13	JOB # N4115067

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-12

CLIENT **Village of Dresden**

SITE **30 Lock Street, Dresden, Ohio**

PROJECT **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

Approx. Surface Elev.: 719 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf
	0.2 **TOPSOIL** (2") 719									
	FILL: Silty sand with gravel Brown, medium dense to loose - noted clay seam			1	SS	14	10			
				2	SS	18	8			
	5.5 713.5	5								
	FILL: Clayey sand, trace gravel, trace slag and cinders Brown, loose			3	SS	16	6	16		
	8 711									
	SILTY SAND WITH GRAVEL Brown, loose		SM	4	SS	10	3			
	▼	10								
	13 ▽ 706									
	POORLY GRADED SAND WITH SILT, trace gravel Brown, loose		SP	5	SS	10	5			
	17 702	15								
	FAT CLAY Gray, stiff		CH	6	SS	18	16			2500*
	20 699	20								
	Boring terminated at 20 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 13	WD	▼ 11.7	ACR
WL	▽		▼	
WL	WCI - 12'			

Terracon

TEST BORING STARTED	6-20-11		
TEST BORING COMPLETED	6-20-11		
RIG CME 550 (93)	FOREMAN	KH	
Exhibit A-14	JOB #	N4115067	

REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

LOG OF BORING NO. B-13

CLIENT: **Village of Dresden**

SITE: **30 Lock Street, Dresden, Ohio**

PROJECT: **Waste Water Treatment Plant Improvements**

Boring Location: See Boring Location Plan

Approx. Surface Elev.: 719 ft

DEPTH, ft.	DESCRIPTION	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS UNIT WEIGHT	TESTS UNCONFINED STRENGTH, psf	
0.3	**TOPSOIL** (3") 718.5									
	LEAN CLAY, trace sand, trace organics, noted iron oxide staining	CL	1	SS	18	3	28		1500*	
3	Mottled reddish brown and gray, medium stiff 716									
	LEAN CLAY, trace sand, trace organics	CL	2	SS	18	9	22		4000*	
5.5	Mottled dark brown and gray, stiff 713.5									
	SANDY LEAN CLAY Dark brown and gray, medium stiff	CL	3	SS	18	10	22		1500*	LL = 30 PI = 15
8	711									
	SILTY SAND, trace gravel Brown, loose	SM	4	SS	18	8				
13	▽ 706									
	SILTY SAND WITH GRAVEL Brown, loose	SM	5	SS	18	7				
17	702									
	FAT CLAY Brownish gray, soft	CH	6	SS	18	4	37		500*	
20	699									
	Boring terminated at 20 feet									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer

WATER LEVEL OBSERVATIONS, ft				
WL	▽ 12	WD	▼ N/E	ACR
WL	▽		▼	
WL	DCI - 11'			

Terracon

TEST BORING STARTED	6-21-11		
TEST BORING COMPLETED	6-21-11		
RIG CME 550 (93)		FOREMAN	KH
Exhibit A-15		JOB #	N4115067

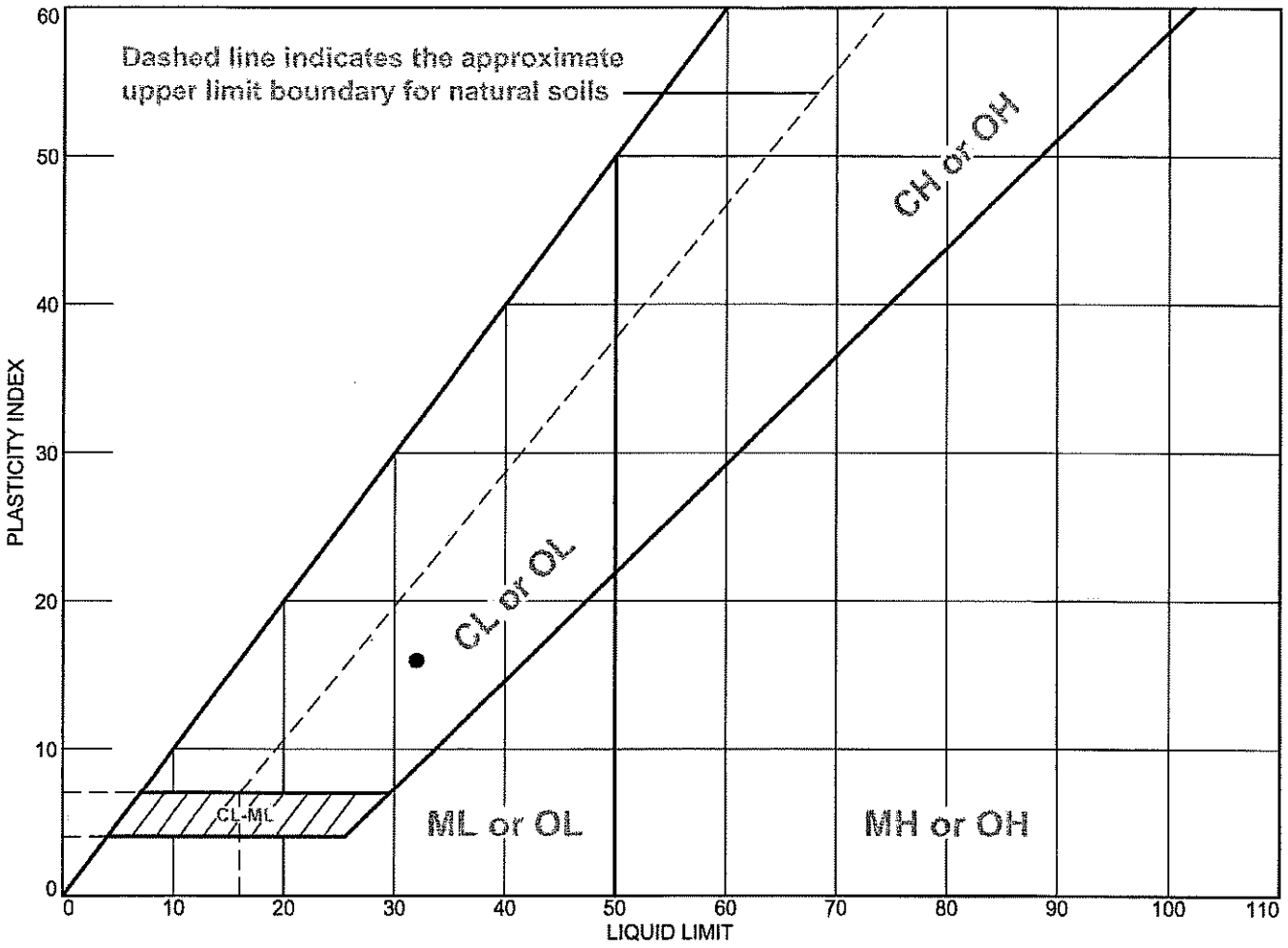
REVISED BORING LOGS N4115067 DRESDEN WWTP IMPROVEMENTS.GPJ TERRACON.GDT 8/20/12

APPENDIX B
LABORATORY INFORMATION

Laboratory Testing

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification System Symbols. A brief description of this classification system is attached to this report. Classification was performed by visual and manual procedures. Atterberg Limits (plasticity) tests and grain size distribution tests were performed on selected samples. The data sheets for this laboratory testing are included in Appendix B.

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Mottled brown and gray LEAN CLAY with sand, trace gravel	32	16	16			CL

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-2 **Depth:** 3.5'-5.0' **Sample Number:** S-2

Remarks:

● Lab No. 473
Date: 7-5-11

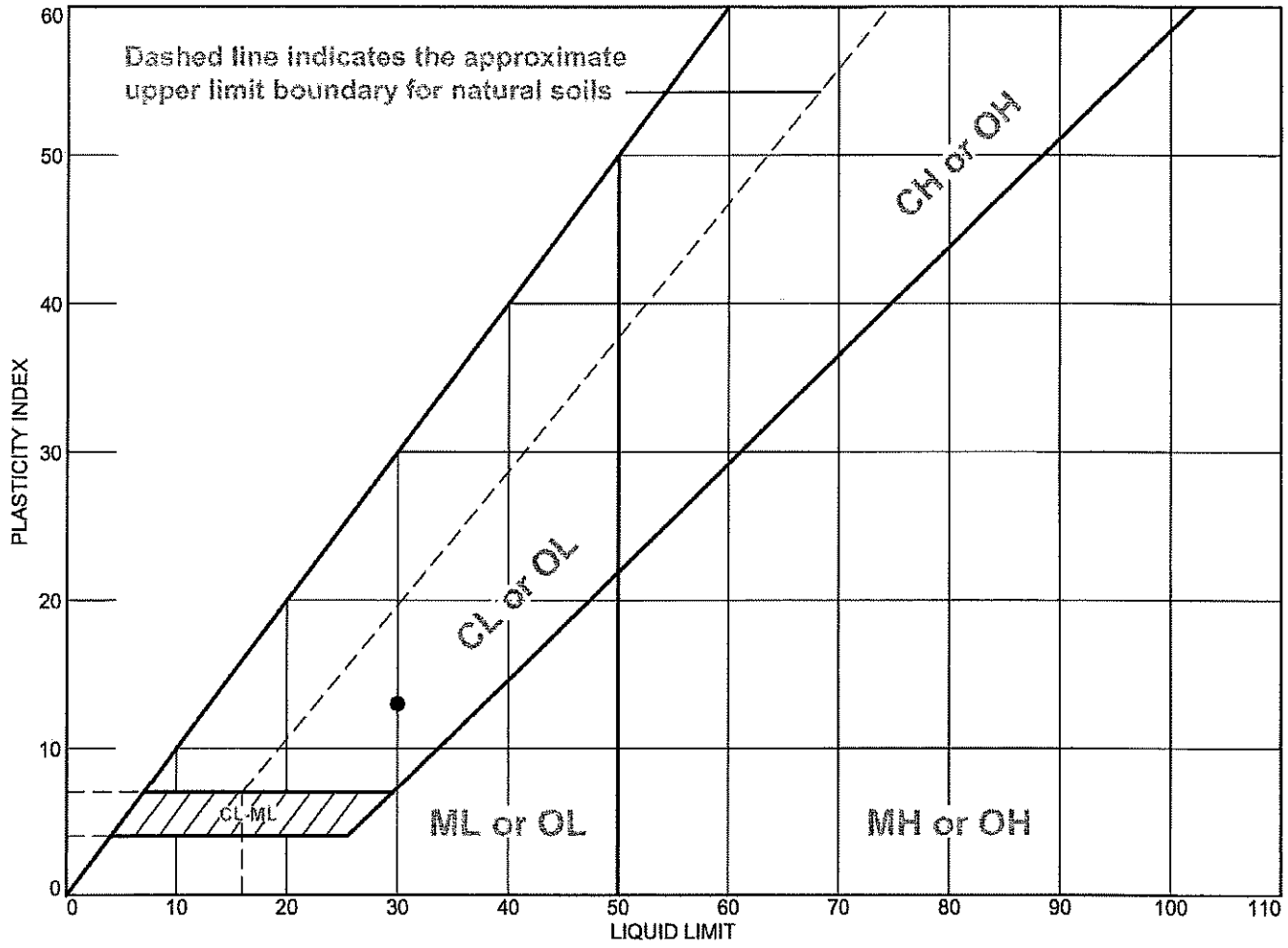
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-2

Tested By: DS **Checked By:** AM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Reddish brown SANDY LEAN CLAY, trace rock fragments	30	17	13			CL

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-6 **Depth:** 6.0'-7.5' **Sample Number:** S-3

Remarks:

● Lab No. 474
Date: 7-5-11

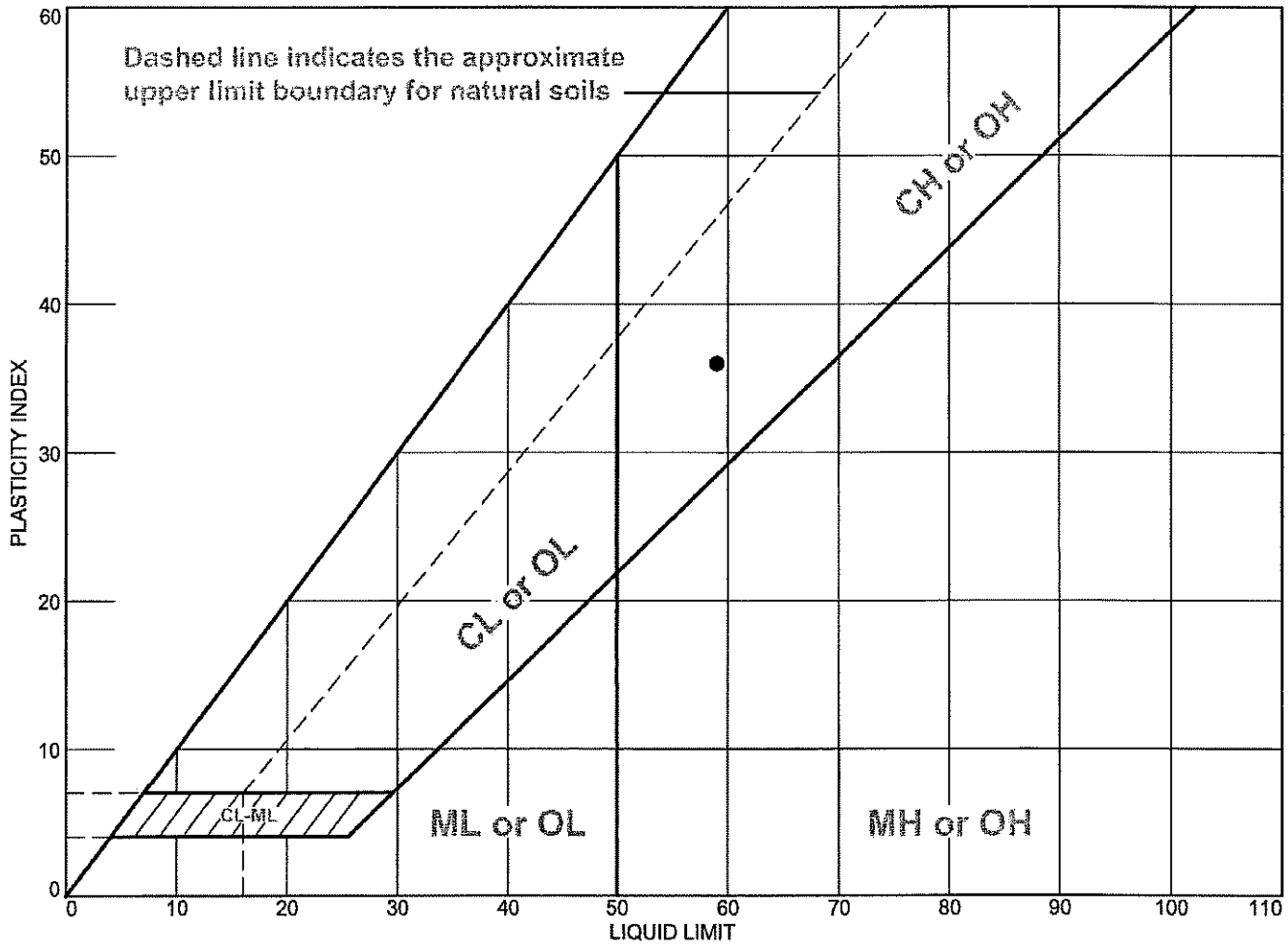
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-3

Tested By: DS **Checked By:** AM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brownish gray FAT CLAY	59	23	36			CH

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-6 **Depth:** 18.5'-20.0' **Sample Number:** S-6

Remarks:

● Lab No. 475
Date: 7-5-11

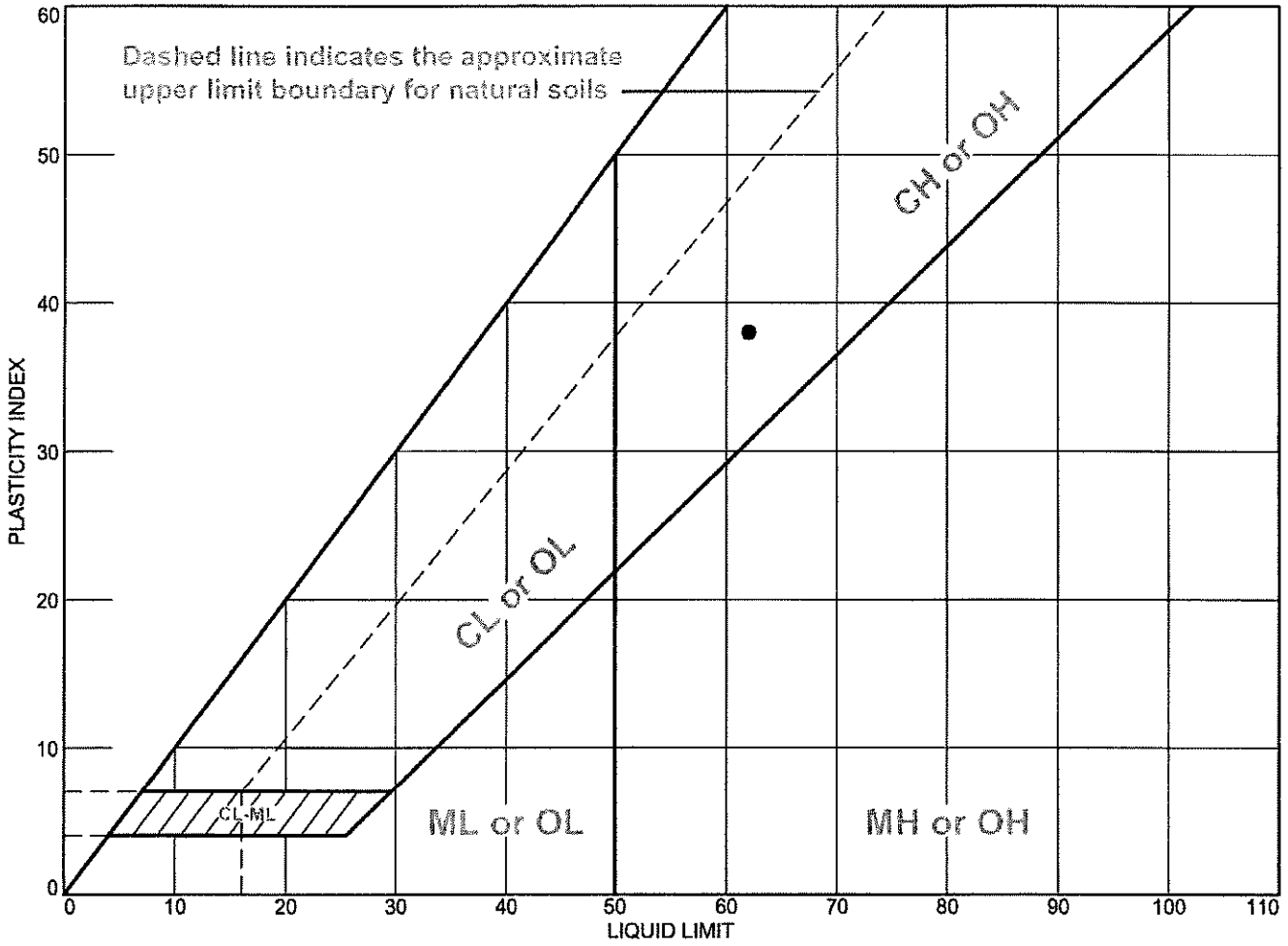
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-4

Tested By: DS **Checked By:** AM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray FAT CLAY	62	24	38			CH

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-7 **Depth:** 28.5'-30.0' **Sample Number:** S-8

Remarks:

● Lab No. 476
Date: 7-5-11

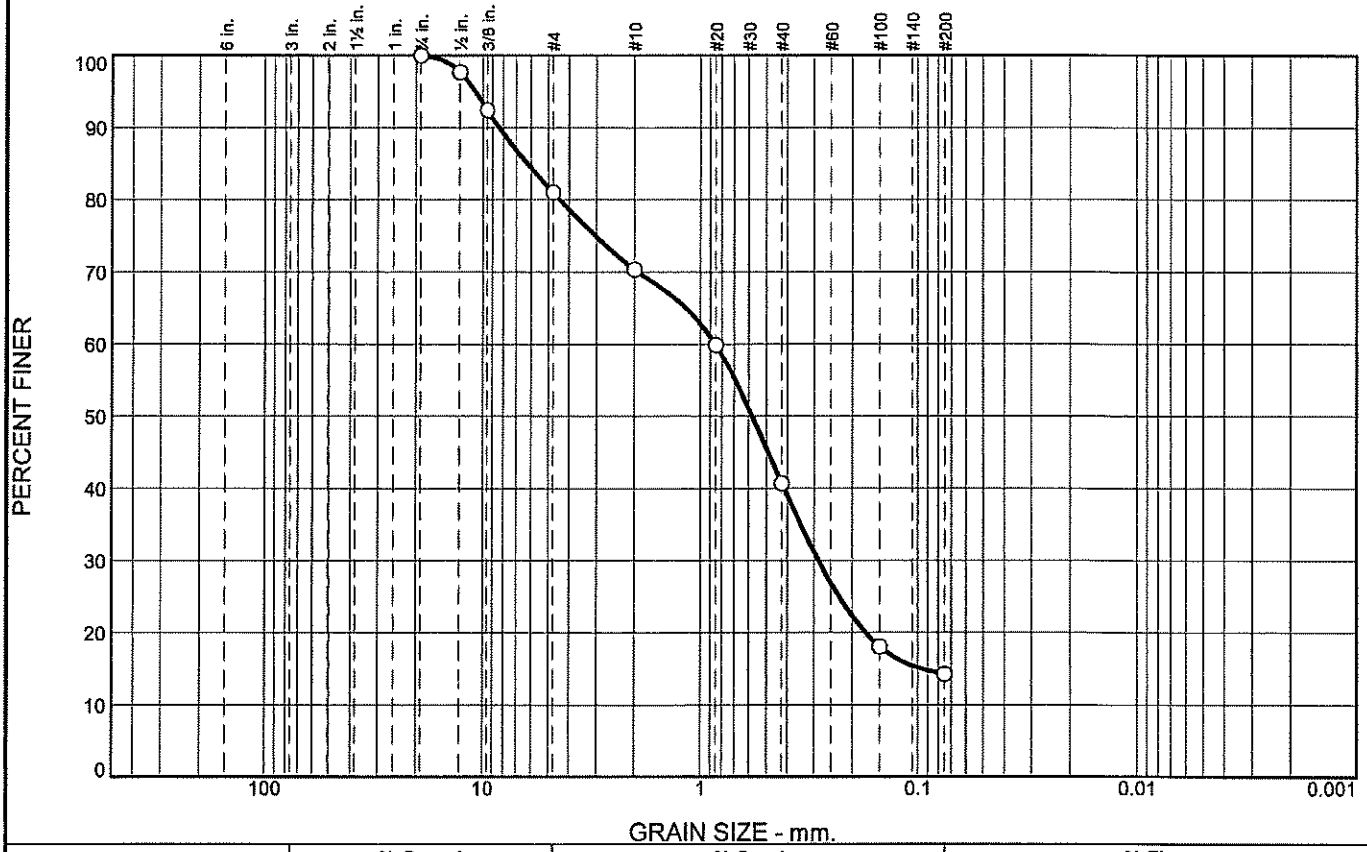
TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-5

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	19.0	10.7	29.6	26.4	14.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	97.7		
3/8	92.4		
#4	81.0		
#10	70.3		
#20	59.8		
#40	40.7		
#100	18.1		
#200	14.3		

* (no specification provided)

Material Description

Brown SILTY SAND with fine gravel

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 8.3942 D_{85}= 6.2289 D_{60}= 0.8564
D_{50}= 0.5800 D_{30}= 0.2861 D_{15}= 0.0965
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Lab No. 477
F.M.=2.89

Source of Sample: B-8 **Depth:** 6.0'-7.5'
Sample Number: S-3

Date: 7-5-11

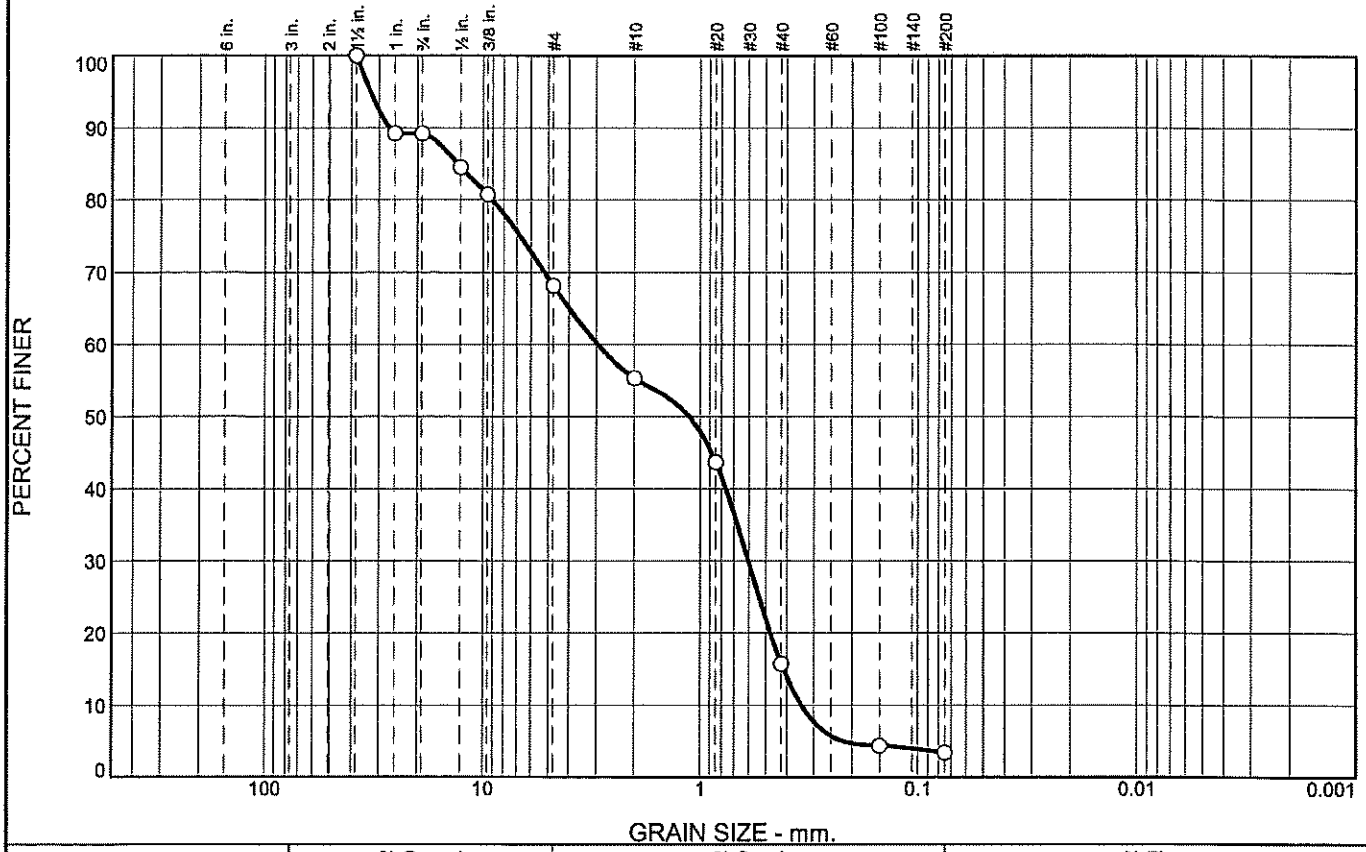
TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: Village of Dresden
Project: WWTP Improvements

Project No: N4115067 **Exhibit** B-6

Tested By: DS **Checked By:** AM

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.8	21.1	12.8	39.6	12.3	3.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1.0	89.2		
3/4	89.2		
1/2	84.5		
3/8	80.7		
#4	68.1		
#10	55.3		
#20	43.7		
#40	15.7		
#100	4.4		
#200	3.4		

* (no specification provided)

Material Description

Brown poorly graded SAND with fine to coarse gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 27.0209 D_{85}= 13.1161 D_{60}= 2.9677
D_{50}= 1.1222 D_{30}= 0.6028 D_{15}= 0.4156
D_{10}= 0.3430 C_u= 8.65 C_c= 0.36

Classification

USCS= SP AASHTO=

Remarks

Lab No. 478
F.M.=4.12

Source of Sample: B-10 **Depth:** 13.5'-15.0'
Sample Number: S-5

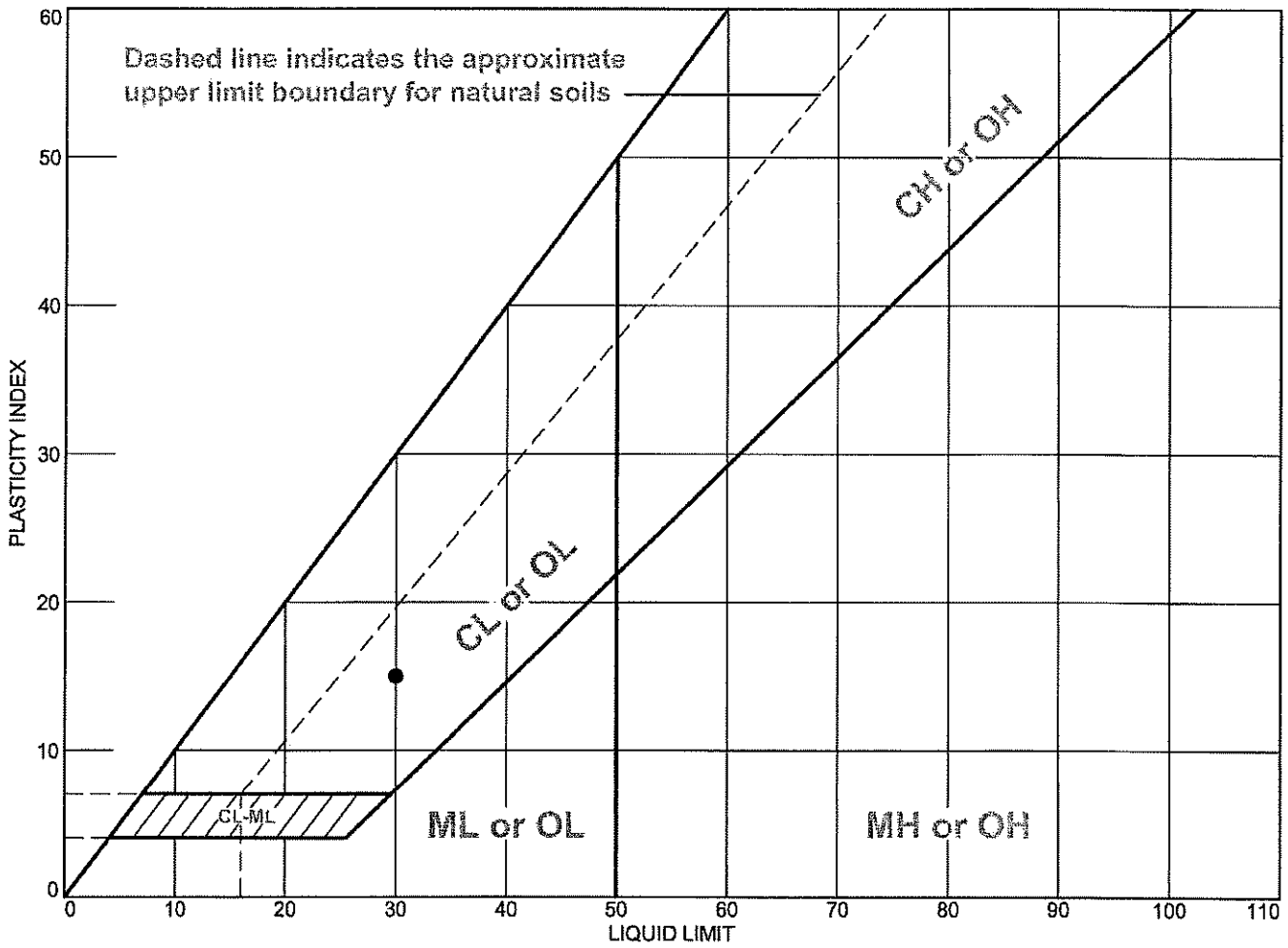
Date: 7-5-11

TERRACON
CONSULTANTS, INC.
Columbus, Ohio

Client: Village of Dresden
Project: WWTP Improvements
Project No: N4115067 **Exhibit** B-7

Tested By: DS **Checked By:** AM

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown and gray SANDY LEAN CLAY	30	15	15			CL

Project No. N4115067 **Client:** Village of Dresden

Project: WWTP Improvements

● **Source of Sample:** B-13 **Depth:** 6.0'-7.5' **Sample Number:** S-3

Remarks:

● Lab No. 479
Date: 7-5-11

TERRACON CONSULTANTS, INC.

Columbus, Ohio

Exhibit B-8

Tested By: DS **Checked By:** AM

APPENDIX C
SUPPORTING INFORMATION

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling		
DCI:	Dry Cave in	BCR:	Before Casing Removal		
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0-1	Very Soft
500 – 1,000	2-4	Soft
1,000 – 2,000	4-8	Medium Stiff
2,000 – 4,000	8-15	Stiff
4,000 – 8,000	15-30	Very Stiff
8,000+	>30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
>50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	>30

Exhibit C-1

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

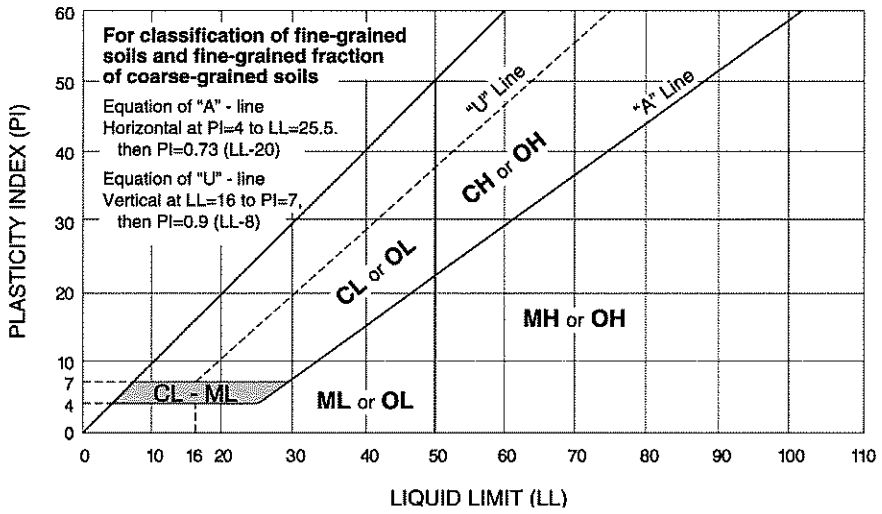


Exhibit C-2

GENERAL NOTES

Description of Rock Properties

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding and Foliation Spacing in Rock[a]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

Rock Quality Designator (RQD)[b]		Joint Openness Descriptors	
RQD, as a percentage	Diagnostic description	Openness	Descriptor
Exceeding 90	Excellent	No Visible Separation	Tight
90 – 75	Good	Less than 1/32 in.	Slightly Open
75 – 50	Fair	1/32 to 1/8 in.	Moderately Open
50 – 25	Poor	1/8 to 3/8 in.	Open
Less than 25	Very poor	3/8 in. to 0.1 ft.	Moderately Wide
		Greater than 0.1 ft.	Wide

a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.
b. RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976.
U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

April 29, 2016

Village of Dresden
904 Chestnut Street
Dresden, Ohio 43821

Attn: Mr. David Mathew
Mayor
P: [740] 754 3151
F: [740] 754 4005

Re: Geotechnical Engineering Report Addendum
Village of Dresden – Wastewater Treatment Plant Improvements
30 Lock Street
Dresden – Muskingum County, Ohio
Terracon Project No. N4115067

Dear Mr. Mathew:

Terracon Consultants, Inc. (Terracon) is pleased to present this addendum to our Geotechnical Engineering Report dated April 11, 2016. Information provided by Mr. Gene Smithberger, structural engineer for the project, on April 28, 2016, was used to develop this addendum.

We understand the excavation for the RAS pump station will extend into bedrock, including shale layers. Some shales contain pyrite and have the potential for expansion due to chemical reactions that occur when the rock is exposed to air and moisture. Thus, special construction considerations have to be implemented for excavations that penetrate into pyritic shale layers in order to reduce the potential for expansion of the shale to create damage to structural elements.

The shale encountered at the project site was not tested for pyritic sulfur content; however, recommendations have been requested to mitigate the effects of pyritic shale expansion. Pyritic sulfur content tests could be performed on samples of the shale to determine if pyrite is present in the on-site shale. This testing could be performed by advancing a test boring at the proposed RAS pump station site to collect a rock core sample for testing in the laboratory. As requested by Mr. Smithberger, the following additional considerations/recommendations are provided relative to earthwork design and construction considering potentially expansive shale:

- Excavate the shale with the least possible disturbance below subgrade. Shattering the bedrock and creating very rough trench walls only add to the ability for water and oxygen exposure. Line drilling before excavating can help reduce disturbance.

- Seal the bottoms and sides of utility trenches or other excavations that extend into shale with shotcrete, sprayed or mopped-on bitumen, or some other sealant. Some have

suggested that pyritic shale-related expansion is only a primary concern within the top 5 or 6-feet of the bedrock subgrade; however, exceptions can occur, especially if water, oxygen, and/or heat are present within the excavation. Therefore, treatment of excavations might only be confined to that degree of depth. Another consideration for utility trenches is to backfill the upper few feet of the trench with flowable fill (CDF) to achieve full seal and contact with the sidewalls, thus preventing oxygen exposure and water infiltration.

- Constructability issues should be addressed in the project specifications as appropriate, such as using compressed air to clean the vertical and horizontal bedrock surfaces before sealing. Also, care should be taken to avoid punctures or damage to the sealant once it has been applied to the bedrock face. The sealant should be maintained as required in areas of exposed shale until the trench is backfilled.

- Avoid constructing structures over badly shattered shale subgrades, such as that formed by overbreak. The porous nature of the shattered upper material provides greater avenue for exposure to water and oxygen.

- Avoid the use of pyritic shale as a structural fill/backfill material, especially within the upper 3 feet beneath the final subgrade elevation.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please do not hesitate to contact us.

Sincerely,
Terracon Consultants, Inc.

Alma K. Baratta, P.E.
Geotechnical Department Manager

Kevin M. Ernst, P.E.
Senior Associate/Office Manager