**Purchasing Division**

# Invitation for Bid

IFB-4006-15-DH
Leach Creek Flood Control Dam Project

**Responses Due:**
March 4, 2015 prior to 3:00pm
250 N. 5th Street
City Clerk's Office, Room #111
Grand Junction, CO 81501

**Purchasing Representative:**
Duane Hoff Jr., Senior Buyer
duaneh@gjcity.org
970-244-1545

This document has been developed specifically to solicit competitive responses for this solicitation, and may not be the same as previous City of Grand Junction/Mesa County solicitations. All vendors are urged to thoroughly review this solicitation prior to responding. Submittal by **FAX OR E-MAIL IS NOT ACCEPTABLE** for this solicitation.

# Invitation for Bids

## Leach Creek Flood Control Dam Project

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# 1. Instructions to Bidders

**1.1.** **Purpose:** The City of Grand Junction is soliciting competitive bids from qualified and interested companies for all labor, equipment, and materials required to complete the Leach Creek Flood Control Dam Project. All dimensions and scope of work should be verified by Contractors prior to submission of bids.

**1.2.** **Site Visit/Briefing: Mandatory Site Visit/Briefing: Prospective bidders are required to attend a site visit/briefing on February 20, 2015 at 10:00am**. Meeting location shall be at the intersection of 27 ¼ Road and H Road. The purpose of this visit will be to inspect and to clarify the contents of this Invitation for Bids (IFB).

**1.3.** **The Owner:** The Owner is the City of Grand Junction and/or Mesa County, Colorado and is referred to throughout this Solicitation. The term Owner means the Owner or his authorized representative.

**1.4.** **Prequalification Requirement: CITY ONLY** Contractors submitting bids over $50,000 must be pre-qualified in accordance with the City's *"Rules and Procedures for Pre-qualification of Contractors*". All bids received by the specified time will be opened, but the City will reject bids over $50,000 from contractors who have not been prequalified. Application forms for prequalification are available at the Administration Office of the Department of Public Works and Planning, City Hall, 250 North Fifth Street, Room 245. Call 970-256-4126 or 970-244-1555 for additional information. Due to the time required to process applications, *all applications must be submitted no later than two weeks prior to the Response Due Date*. Application link: http://www.gjcity.org/PreQualification.aspx

**1.5.** **Delivery of Bids:** Contractor shall submit a copy of their bid in a sealed envelope marked **Leach Creek Flood Control Dam Project IFB-4006-15-DH, due date, and the bidders name** clearly indicated on the envelope. The due date, time, and address are listed on the front page of this IFB. Late bids will not be considered. Bids will be received and publicly acknowledged at the location, date and time stated. Bidders, their representatives and interested persons may be present. Bids shall be received and acknowledged only so as to avoid disclosure of process. However, all bids shall be open for public inspection after the contract is awarded. Trade secrets and confidential information contained in the bid so identified by Offeror as such will be treated as confidential by the City of Grand Junction (City)/ Mesa County (County) to the extent allowable in the Open Records Act.

**1.6.** **Printed Form for Price Bid:** All Price Bids must be made upon the Contractor's Bid Form attached, and should give the amounts both in words and in figures, and must be signed and acknowledged by the bidder.

**1.7.** **Exclusions:** No oral, telephonic, emailed, or facsimile bid will be considered

**1.8. Contract Documents:** The complete IFB and bidder's response compose the Contract Documents. Copies of these documents can be obtained from the City Purchasing website, http://www.gjcity.org/BidOpenings.aspx.

**1.9. Examination of Specifications:** Bidders shall thoroughly examine and be familiar with the project Statement of Work. The failure or omission of any Offeror to receive or examine any form, addendum, or other document shall in no way relieve any Offeror from any obligation with respect to his bid. The submission of a bid shall be taken as evidence of compliance with this section.

**1.10. Questions Regarding Statement of Work:** Any information relative to interpretation of Scope of Work or specifications shall be requested of the Purchasing Representative, in writing, in ample time prior to the response time.

**1.11. Addenda & Interpretations:** If it becomes necessary to revise any part of this solicitation, a written addendum will be posted electronically on the City's website at http://www.gjcity.org/BidOpenings.aspx. The Owner is not bound by any oral representations, clarifications, or changes made in the written specifications by Owner, unless such clarification or change is provided in written addendum form from the City Purchasing Representative.

**1.12. Taxes:** The Owner is exempt from State retail and Federal tax. The bid price must be net, exclusive of taxes.

**1.13. Offers Binding 60 Days:** Unless otherwise specified, all formal offers submitted shall be binding for sixty (60) calendar days following opening date, unless the Bidder, upon request of the Purchasing Representative, agrees to an extension.

**1.14. Collusion Clause:** Each bidder by submitting a bid certifies that it is not party to any collusive action or any action that may be in violation of the Sherman Antitrust Act. Any and all bids shall be rejected if there is evidence or reason for believing that collusion exists among bidders. The Owner may, or may not, accept future bids for the same services or commodities from participants in such collusion.

**1.15. Public Disclosure Record:** If the bidder has knowledge of their employee(s) or sub-contractors having an immediate family relationship with a City/County employee or elected official, the bidder must provide the Purchasing Representative with the name(s) of these individuals. These individuals are required to file an acceptable "Public Disclosure Record", a statement of financial interest, before conducting business with the City/County.

## 2. General Contract Conditions for Construction Projects

**2.1. The Contract:** This Invitation for Bid, submitted documents, and any negotiations, when properly accepted by the City/County, shall constitute a contract equally binding between the City/County and Contractor. The contract represents the entire and integrated agreement between the parties hereto and supersedes all

prior negotiations, representations, or agreements, either written or oral. The contract may be amended or modified with Change Orders, Field Orders, or Addendums.

**2.2. The Work:** The term Work includes all labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in such construction.

**2.3. Execution, Correlation, Intent, and Interpretations:** The Contract Documents shall be signed in not less than triplicate by the Owner (City/County) and Contractor. City/County will provide the contract. By executing the contract, the Contractor represents that he/she has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents. The Contract Documents are complementary, and what is required by any one, shall be as binding as if required by all. The intention of the documents is to include all labor, materials, equipment and other items necessary for the proper execution and completion of the scope of work as defined in the technical specifications and drawings contained herein. All drawings, specifications and copies furnished by the City/County are, and shall remain, City/County property. They are not to be used on any other project, and with the exception of one contract set for each party to the contract, are to be returned to the owner on request at the completion of the work.

**2.4. The Owner:** The Owner is the City of Grand Junction and/or Mesa County, Colorado and is referred to throughout the Contract Documents. The term Owner means the Owner or his authorized representative. The Owner shall, at all times, have access to the work wherever it is in preparation and progress. The Contractor shall provide facilities for such access. The Owner will make periodic visits to the site to familiarize himself generally with the progress and quality of work and to determine, in general, if the work is proceeding in accordance with the contract documents. Based on such observations and the Contractor's Application for Payment, the Owner will determine the amounts owing to the Contractor and will issue Certificates for Payment in such amounts, as provided in the contract. The Owner will have authority to reject work which does not conform to the Contract documents. Whenever, in his reasonable opinion, he considers it necessary or advisable to insure the proper implementation of the intent of the Contract Documents, he will have authority to require the Contractor to stop the work or any portion, or to require special inspection or testing of the work, whether or not such work can be then be fabricated, installed, or completed. The Owner will not be responsible for the acts or omissions of the Contractor, and sub-Contractor, or any of their agents or employees, or any other persons performing any of the work.

**2.5. Contractor:** The Contractor is the person or organization identified as such in the Agreement and is referred to throughout the Contract Documents. The term Contractor means the Contractor or his authorized representative. The Contractor shall carefully study and compare the General Contract Conditions of the Contract, Specification and Drawings, Scope of Work, Addenda and Modifications and shall at once report to the Owner any error, inconsistency or omission he may discover.

Contractor shall not be liable to the Owner for any damage resulting from such errors, inconsistencies or omissions. The Contractor shall not commence work without clarifying Drawings, Specifications, or Interpretations.

**2.6. Sub-Contractors:** A sub-contractor is a person or organization who has a direct contract with the Contractor to perform any of the work at the site. The term sub-contractor is referred to throughout the contract documents and means a sub-contractor or his authorized representative.

**2.7. Award of Sub-Contractors & Other Contracts for Portions of the Work:** As soon as practicable after bids are received and prior to the award of the contract, the successful Contractor shall furnish to the Owner, in writing for acceptance, a list of the names of the sub-contractors or other persons or organizations proposed for such portions of the work as may be designated in the proposal requirements, or, if none is so designated, the names of the sub-contractors proposed for the principal portions of the work. Prior to the award of the contract, the Owner shall notify the successful Contractor in writing if, after due investigation, has reasonable objection to any person or organization on such list. If, prior to the award of the contract, the Owner has a reasonable and substantial objection to any person or organization on such list, and refuses in writing to accept such person or organization, the successful Contractor may, prior to the award, withdraw their proposal without forfeiture of proposal security. If the successful Contractor submits an acceptable substitute with an increase in the proposed price to cover the difference in cost occasioned by the substitution, the Owner may, at their discretion, accept the increased proposal or may disqualify the Contractor. If, after the award, the Owner refuses to accept any person or organization on such list, the Contractor shall submit an acceptable substitute and the contract sum shall be increased or decreased by the difference in cost occasioned by such substitution and an appropriate Change Order shall be issued. However, no increase in the contract sum shall be allowed for any such substitution unless the Contractor has acted promptly and responsively in submitting a name with respect thereto prior to the award.

**2.8. Supervision and Construction Procedures:** The Contractor shall supervise and direct the work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the work under the contract.

**2.9. Warranty:** The Contractor warrants to the Owner that all materials and equipment furnished under this contract will be new unless otherwise specified, and that all work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All work not so conforming to these standards may be considered defective. If required by Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. If within ten (10) days after written notice to the Contractor requesting such repairs or replacement, the Contractor should neglect to make or undertake with due diligence to the same, the City may make such repairs or replacements. All indirect and direct costs of such correction or removal or replacement shall be at the Contractor's expense.

The Contractor will also bear the expenses of making good all work of others destroyed or damaged by the correction, removal or replacement of his defective work.

**2.10. Permits, Fees, & Notices:** The Contractor shall secure and pay for all permits, governmental fees and licenses necessary for the proper execution and completion of the work. The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the work. If the Contractor observes that any of the Contract Documents are at variance in any respect, he shall promptly notify the Owner in writing, and any necessary changes shall be adjusted by approximate modification. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Owner, he shall assume full responsibility and shall bear all costs attributable.

**2.11. Responsibility for Those Performing the Work:** The Contractor shall be responsible to the Owner for the acts and omissions of all his employees and all sub-contractors, their agents and employees, and all other persons performing any of the work under a contract with the Contractor.

**2.12. Use of the Site:** The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents, and shall not unreasonably encumber the site with any materials or equipment.

**2.13. Cleanup:** The Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of work he shall remove all his waste materials and rubbish from and about the project, as well as all his tools, construction equipment, machinery and surplus materials.

**2.14. Insurance Requirements:** The selected Bidder agrees to procure and maintain, at its own cost, policy(s) of insurance sufficient to insure against all liability, claims, demands, and other obligations assumed by the Bidder pursuant to this Section. Such insurance shall be in addition to any other insurance requirements imposed by this Contract or by law. The Bidder shall not be relieved of any liability, claims, demands, or other obligations assumed pursuant to this Section by reason of its failure to procure or maintain insurance in sufficient amounts, durations, or types.
Bidder shall procure and maintain and, if applicable, shall cause any Subcontractor of the Bidder to procure and maintain insurance coverage listed below. Such coverage shall be procured and maintained with forms and insurers acceptable to the Owner. All coverage shall be continuously maintained to cover all liability, claims, demands, and other obligations assumed by the Bidder pursuant to this Section. In the case of any claims-made policy, the necessary retroactive dates and extended reporting periods shall be procured to maintain such continuous coverage. Minimum coverage limits shall be as indicated below unless specified otherwise in the Special Conditions:

(a) Worker Compensation insurance to cover obligations imposed by applicable laws for any employee engaged in the performance of work under this Contract, and Employers' Liability insurance with minimum limits of:

One Million Dollars ($1,000,000) each accident,
One Million Dollars ($1,000,000) disease - policy limit, and
One Million Dollars ($1,000,000) disease - each employee

(b) General Liability insurance with minimum combined single limits of:

One Million Dollars ($1,000,000) each occurrence and
One Million Dollars ($1,000,000) per job aggregate.

The policy shall be applicable to all premises and operations. The policy shall include coverage for bodily injury, broad form property damage (including completed operations), personal injury (including coverage for contractual and employee acts), blanket contractual, products, and completed operations. The policy shall include coverage for explosion, collapse, and underground hazards. The policy shall contain a severability of interests provision.

(c) Comprehensive Automobile Liability insurance with minimum combined single limits for bodily injury and property damage of not less than:

One Million Dollars ($1,000,000) each occurrence and
One Million Dollars ($1,000,000) aggregate

This policy shall provide coverage to protect the contractor against liability incurred as a result of the professional services performed as a result of responding to this Solicitation.

With respect to each of Bidder's owned, hired, or non-owned vehicles assigned to be used in performance of the Work. The policy shall contain a severability of interests provision. The policies required by paragraphs (b), and (c) above shall be endorsed to include the City and/or County, and the City's and/or County's officers and employees as additional insureds. Every policy required above shall be primary insurance, and any insurance carried by the Owner, its officers, or its employees, or carried by or provided through any insurance pool of the Owner, shall be excess and not contributory insurance to that provided by Bidder. No additional insured endorsement to any required policy shall contain any exclusion for bodily injury or property damage arising from completed operations. The Bidder shall be solely responsible for any deductible losses under any policy required above.

**2.15. Indemnification:** The Contractor shall defend, indemnify and save harmless the Owner, and all its officers, employees, insurers, and self-insurance pool, from and against all liability, suits, actions, or other claims of any character, name and description brought for or on account of any injuries or damages received or sustained by any person, persons, or property on account of any negligent act or

fault of the Contractor, or of any Contractor's agent, employee, sub-contractor or supplier in the execution of, or performance under, any contract which may result from proposal award. Contractor shall pay any judgment with cost which may be obtained against the Owner growing out of such injury or damages.

**2.16. Miscellaneous Conditions:** Material Availability: Contractors must accept responsibility for verification of material availability, production schedules, and other pertinent data prior to submission of bid. It is the responsibility of the bidder to notify the Owner immediately if materials specified are discontinued, replaced, or not available for an extended period of time. OSHA Standards: All bidders agree and warrant that services performed in response to this invitation shall conform to the standards declared by the US Department of Labor under the Occupational Safety and Health Act of 1970 (OSHA). In the event the services do not conform to OSHA standards, the Owner may require the services to be redone at no additional expense to the Owner.

**2.17. Time:** The Contract Time is the period of time allotted in the Contract Documents for completion of the work. The date of commencement of the work is the date established in a Notice to Proceed. If there is no Notice to Proceed, it shall be the date of the Contract or such other date as may be established therein, or as established as entered on the Bid Form. The Date of Substantial Completion of the work or designated portions thereof is the date certified by the Owner when construction is sufficiently complete, in accordance with the Contract Documents.

**2.18. Progress & Completion:** The Contractor shall begin work on the date of commencement as defined in the Contract, and shall carry the work forward expeditiously with adequate forces and shall complete it within the contract time.

**2.19. Payment & Completion:** The Contract Sum is stated in the Contract and is the total amount payable by the Owner to the Contractor for the performance of the work under the Contract Documents. Upon receipt of written notice that the work is ready for final inspection and acceptance and upon receipt of application for payment, the Owner's Project Manager will promptly make such inspection and, when he finds the work acceptable under the Contract Documents and the Contract fully performed, the Owner shall make payment in the manner provided in the Contract Documents.

**2.20. Quantities of Work and Unit Price:** Materials or quantities stated as unit price items in the Bid are supplied only to give an indication of the general scope of the Work. The City does not expressly or by implication agree that the actual amount of Work or material will correspond therewith, and reserves the right after award to increase or decrease the quantity of any unit item of the Work without a change in the unit price. The City also reserves the right to make changes in the Work including the right to delete any bid item in its entirety or add additional bid items.

**2.21. Bid Bond:** Each Bid shall as a guaranty of good faith on the part of the Bidder be accompanied by a Bid Guaranty consisting of: a certified or cashier's check drawn on an approved national bank or trust company in the state of Colorado, and made

payable without condition to the City; or a **Bid Bond** written by an approved corporate surety in favor of the City. The amount of the Bid Guaranty shall not be less than 5% of the total Bid amount. Once a Bid is accepted and a Contact is awarded, the apparent successful bidder has ten calendar days to enter into a contractor in the form prescribed and to furnish the bonds with a legally responsible and approved surety. Failure to do so will result I forfeiture of the Bid Guaranty to the City as Liquidated Damages.

**2.22. Performance & Payment Bonds:** Contractor shall furnish a Performance and a Payment Bond, each in an amount at least equal to that specified for the contract amount as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. These bonds shall remain in effect for the duration of the Warranty Period (as specified in the Special Conditions). Contractor shall also furnish other bonds that may be required by the Special Conditions. All bonds shall be in the forms prescribed by the Contract Documents and be executed by such sureties as (1) are licensed to conduct business in the State of Colorado and (2) are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Accounts, U.S. Treasury Department. All bonds singed by an agent must be accompanied by a certified copy of the Authority Act. If the surety on any bond furnished by the Contractor is declared bankrupt, or becomes insolvent, or its rights to do business in Colorado are terminated, or it ceases to meet the requirements of clauses (1) and (2) of this section, Contractor shall within five (5) days thereafter substitute another bond and surety, both of which shall be acceptable to the City.

**2.23. Retention:** The Owner will deduct money from the partial payments in amounts considered necessary to protect the interest of the Owner and will retain this money until after completion of the entire contract. The amount to be retained from partial payments will be five (5) percent of the value of the completed work, and not greater than five (5) percent of the amount of the Contract. When the retainage has reached five (5) percent of the amount of the Contract no further retainage will be made and this amount will be retained until such time as final payment is made.

**2.24. Liquidated Damages for Failure to Enter Into Contract: CITY ONLY** Should the Successful Bidder fail or refuse to enter into the Contract within ten Calendar Days from the issuance of the Notice of Award, the City shall be entitled to collect the amount of such Bidder's Bid Guaranty as Liquidated Damages, not as a penalty but in consideration of the mutual release by the City and the Successful Bidder of all claims arising from the City's issuance of the Notice of Award and the Successful Bidder's failure to enter into the Contract and the costs to award the Contract to any other Bidder, to readvertise, or otherwise dispose of the Work as the City may determine best serves its interest.

**2.25. Liquidated Damages for Failure to Meet Project Completion Schedule: CITY ONLY** If the Contractor does not achieve Final Completion by the required date, whether by neglect, refusal or any other reason, the parties agree and stipulate that

the Contractor shall pay liquidated damages to the City for any additional costs to the City incurred by such delays. As provided elsewhere, this provision does not apply for delays caused by the City. The date for Final Completion may be extended in writing by the Owner.

The Contractor agrees that as a part of the consideration for the City's awarding of this Contract liquidated damages that are reasonable and necessary to pay for the actual damages resulting from such delay. The parties agree that the real costs and injury to the City for such delay include hard to quantify items such as: additional engineering, inspection and oversight by the City and its agents; additional contract administration; inability to apply the efforts of those employees to the other work of the City; perceived inefficiency of the City; citizens having to deal with the construction and the Work, rather than having the benefit of a completed Work, on time; inconvenience to the public; loss of reputation and community standing for the City during times when such things are very important and very difficult to maintain.

The Contractor must complete the Work and achieve final completion included under the Bid Schedule in the number of consecutive calendar days after the City gives is written Notice to Proceed. When the Contractor considers the entire Work ready for its intended use, Contractor shall certify in writing that the Work is substantially complete. In addition to the Work being substantially complete, Final Completion date is the date by which the Contractor shall have fully completed all clean-up, and all items that were identified by the City in the inspection for final completion. Unless otherwise stated in the Special Conditions, for purposes of this liquidated damages clause, the Work shall not be finished and the Contract time shall continue to accrue until the City gives its written Final Acceptance.

If the Contractor shall fail to pay said liquidated damages promptly upon demand thereof after having failed to achieve Final Completion on time, the City shall first look to any retainage or other funds from which to pay said liquidated damages; if retainage or other liquid funds are not available to pay said liquidated damages amounts, the Surety on the Contractor's Performance Bond and Payment Bond shall pay such liquidated damages. In addition, the City may withhold all, or any part of, such liquidated damages from any payment otherwise due the Contractor.
Liquidated damages as provided do not include any sums to reimburse the City for extra costs which the City may become obligated to pay on other contracts which were delayed or extended because of the Contractor's failure to complete the Work within the Contract Time. Should the City incur additional costs because of delays or extensions to other contracts resulting from the Contractor's failure of timely performance, the Contractor agrees to pay these costs that the City incurs because of the Contractor's delay, and these payments are separate from and in addition to any liquidated damages.

The Contractor agrees that the City may use its own forces or hire other parties to obtain Substantial or Final Completion of the work if the time of completion has elapsed and the Contractor is not diligently pursuing completion. In addition to the Liquidated Damages provided for, the Contractor agrees to reimburse the City for all expenses thus incurred.

**2.26. Contingency/Force Account:** Contingency/Force Account work will be authorized by the Owner's Project Manager and is defined as minor expenses to cover miscellaneous or unforeseen expenses related to the project. The expenses are not included in the Drawings, Specifications, or Scope of Work and are necessary to accomplish the scope of this contract. Contingency/Force Account Authorization will be directed by the Owner through an approved form. Contingency/Force Account funds are the property of the Owner and any Contingency/Force Account funds, not required for project completion, shall remain the property of the Owner. Contractor is not entitled to any Contingency/Force Account funds, that are not authorized by Owner or Owner's Project Manager.

**2.27. Protection of Persons & Property:** The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. Contractor shall erect and maintain, as required by existing safeguards for safety and protection, and all reasonable precautions, including posting danger signs or other warnings against hazards promulgating safety regulations and notifying owners and users of adjacent utilities. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct by the Contractor in the execution of the work, or in consequence of the non-execution thereof by the Contractor, he shall restore, at his own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, rebuilding, or otherwise restoring as may be directed, or it shall make good such damage or injury in an acceptable manner.

**2.28. Changes in the Work:** The Owner, without invalidating the contract, may order changes in the work within the general scope of the contract consisting of additions, deletions or other revisions, the contract sum and the contract time being adjusted accordingly. All such changes in the work shall be authorized by Change Order and shall be executed under the applicable conditions of the contract documents. A Change Order is a written order to the Contractor signed by the Owner issued after the execution of the contract, authorizing a change in the work or an adjustment in the contract sum or the contract time. The contract sum and the contract time may be changed only by Change Order.

**2.29. Claims for Additional Cost or Time:** If the Contractor wishes to make a claim for an increase in the contract sum or an extension in the contract time, he shall give the Owner written notice thereof within a reasonable time after the occurrence of the event giving rise to such claim. This notice shall be given by the Contractor before proceeding to execute the work, except in an emergency endangering life or property in which case the Contractor shall precede in accordance with the regulations on safety. No such claim shall be valid unless so made. Any change in the contract sum or contract time resulting from such claim shall be authorized by Change Order.

**2.30. Minor Changes in the Work:** The Owner shall have authority to order minor changes in the work not involving an adjustment in the contract sum or an

extension of the contract time and not inconsistent with the intent of the contract documents.

**2.31. Field Orders:** The Owner may issue written Field Orders which interpret the Contract Documents in accordance with the specifications, or which order minor changes in the work in accordance with the agreement, without change in the contract sum or time. The Contractor shall carry out such Field Orders promptly.

**2.32. Uncovering & Correction of Work:** The Contractor shall promptly correct all work rejected by the Owner as defective or as failing to conform to the contract documents whether observed before or after substantial completion and whether or not fabricated installed or competed. The Contractor shall bear all costs of correcting such rejected work, including the cost of the Owner's additional services thereby made necessary. If within one (1) year after the date of completion or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the contract documents, any of the work found to be defective or not in accordance with the contract documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discover of condition. All such defective or non-conforming work under the above paragraphs shall be removed from the site where necessary and the work shall be corrected to comply with the contract documents without cost to the Owner. The Contractor shall bear the cost of making good all work of separate Contractors destroyed or damaged by such removal or correction. If the Owner prefers to accept defective or non-conforming work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect an appropriate reduction in the payment or contract sum, or, if the amount is determined after final payment, it shall be paid by the Contractor.

**2.30. Amendment:** No oral statement of any person shall modify or otherwise change, or affect the terms, conditions or specifications stated in the resulting contract. All amendments to the contract shall be made in writing by the Owner.

**2.31. Assignment:** The Contractor shall not sell, assign, transfer or convey any contract resulting from this IFB, in whole or in part, without the prior written approval from the Owner.

**2.32. Compliance with Laws:** Bids must comply with all Federal, State, County and local laws governing or covering this type of service and the fulfillment of all ADA (Americans with Disabilities Act) requirements.

**2.33. Confidentiality:** All information disclosed by the Owner to the Contractor for the purpose of the work to be done or information that comes to the attention of the Contractor during the course of performing such work is to be kept strictly confidential.

**2.34. Conflict of Interest:** No public official and/or City/County employee shall have interest in any contract resulting from this IFB.

**2.35. Contract Termination**: This contract shall remain in effect until any of the following occurs: (1) contract expires; (2) completion of services; (3) acceptance of services or, (4) for convenience terminated by either party with a written *Notice of Cancellation* stating therein the reasons for such cancellation and the effective date of cancellation.

**2.36. Employment Discrimination:** During the performance of any services per agreement with the Owner, the Contractor, by submitting a Bid, agrees to the following conditions:

**2.36.1.** The Contractor shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, age, handicap, or national origin except when such condition is a legitimate occupational qualification reasonably necessary for the normal operations of the Contractor. The Contractor agrees to post in conspicuous places, visible to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

**2.36.2.** The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, shall state that such Contractor is an Equal Opportunity Employer.

**2.36.3.** Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

**2.37. Immigration Reform and Control Act of 1986 and Immigration Compliance:** The Offeror certifies that it does not and will not during the performance of the contract employ illegal alien workers or otherwise violate the provisions of the Federal Immigration Reform and Control Act of 1986 and/or the immigration compliance requirements of State of Colorado C.R.S. § 8-17.5-101, *et.seq.* (House Bill 06-1343).

**2.38. Ethics:** The Contractor shall not accept or offer gifts or anything of value nor enter into any business arrangement with any employee, official, or agent of the Owner.

**2.39. Failure to Deliver:** In the event of failure of the Contractor to deliver services in accordance with the contract terms and conditions, the Owner, after due oral or written notice, may procure the services from other sources and hold the Contractor responsible for any costs resulting in additional purchase and administrative services. This remedy shall be in addition to any other remedies that the Owner may have.

**2.40. Failure to Enforce:** Failure by the Owner at any time to enforce the provisions of the contract shall not be construed as a waiver of any such provisions. Such failure

to enforce shall not affect the validity of the contract or any part thereof or the right of the Owner to enforce any provision at any time in accordance with its terms.

**2.41. Force Majeure:** The Contractor shall not be held responsible for failure to perform the duties and responsibilities imposed by the contract due to legal strikes, fires, riots, rebellions, and acts of God beyond the control of the Contractor, unless otherwise specified in the contract.

**2.42. Independent Contractor:** The Contractor shall be legally considered an Independent Contractor and neither the Contractor nor its employees shall, under any circumstances, be considered servants or agents of the Owner. The Owner shall be at no time legally responsible for any negligence or other wrongdoing by the Contractor, its servants, or agents. The Owner shall not withhold from the contract payments to the Contractor any federal or state unemployment taxes, federal or state income taxes, Social Security Tax or any other amounts for benefits to the Contractor. Further, the Owner shall not provide to the Contractor any insurance coverage or other benefits, including Workers' Compensation, normally provided by the Owner for its employees.

**2.43. Nonconforming Terms and Conditions:** A bid that includes terms and conditions that do not conform to the terms and conditions of this Invitation for Bid is subject to rejection as non-responsive. The Owner reserves the right to permit the Contractor to withdraw nonconforming terms and conditions from its bid prior to a determination by the Owner of non-responsiveness based on the submission of nonconforming terms and conditions.

**2.44. Ownership:** All plans, prints, designs, concepts, etc., shall become the property of the Owner.

**2.45. Oral Statements:** No oral statement of any person shall modify or otherwise affect the terms, conditions, or specifications stated in this document and/or resulting agreement. All modifications to this request and any agreement must be made in writing by the Owner.

**2.46. Patents/Copyrights:** The Contractor agrees to protect the Owner from any claims involving infringements of patents and/or copyrights. In no event shall the Owner be liable to the Contractor for any/all suits arising on the grounds of patent(s)/copyright(s) infringement. Patent/copyright infringement shall null and void any agreement resulting from response to this IFB.

**2.47. Remedies**: The Contractor and Owner agree that both parties have all rights, duties, and remedies available as stated in the Uniform Commercial Code.

**2.48. Venue**: Any agreement as a result of responding to this IFB shall be deemed to have been made in, and shall be construed and interpreted in accordance with, the laws of the City of Grand Junction, Mesa County, Colorado.

**2.49. Expenses:** Expenses incurred in preparation, submission and presentation of this IFB are the responsibility of the company and cannot be charged to the Owner.

**2.50. Sovereign Immunity:** The Owner specifically reserves its right to sovereign immunity pursuant to Colorado State Law as a defense to any action arising in conjunction to this agreement.

**2.51. Non-Appropriation of Funds:** The contractual obligation of the Owner under this contract is contingent upon the availability of appropriated funds from this fiscal year budget as approved by the City Council or Board of County Commissioners from this fiscal year only. State of Colorado Statutes prohibit obligation of public funds beyond the fiscal year for which the budget was approved. Anticipated expenditures/obligations beyond the end of the current Owner's fiscal year budget shall be subject to budget approval. Any contract will be subject to and must contain a governmental non-appropriation of funds clause.

**2.52. Cooperative Purchasing:** Purchases as a result of this solicitation are primarily for the City/County. Other governmental entities may be extended the opportunity to utilize the resultant contract award with the agreement of the successful provider and the participating agencies. All participating entities will be required to abide by the specifications, terms, conditions and pricings established in this Bid. The quantities furnished in this bid document are for only the City/County. It does not include quantities for any other jurisdiction. The City or County will be responsible only for the award for its jurisdiction. Other participating entities will place their own awards on their respective Purchase Orders through their purchasing office or use their purchasing card for purchase/payment as authorized or agreed upon between the provider and the individual entity. The City/County accepts no liability for payment of orders placed by other participating jurisdictions that choose to piggy-back on our solicitation. Orders placed by participating jurisdictions under the terms of this solicitation will indicate their specific delivery and invoicing instructions.

**2.53. Keep Jobs in Colorado Act:** Contractor shall be responsible for ensuring compliance with Article 17 of Title 8, Colorado Revised Statutes requiring 80% Colorado labor to be employed on public works. Contractor shall, upon reasonable notice provided by the Owner, permit the Owner to inspect documentation of identification and residency required by C.R.S. §8-17-101(2)(a). If Contractor claims it is entitled to a waiver pursuant to C.R.S. §8-17-101(1), Contractor shall state that there is insufficient Colorado labor to perform the work such that compliance with Article 17 would create an undue burden that would substantially prevent a project from proceeding to completion, and shall include evidence demonstrating the insufficiency and undue burden in its response.

Unless expressly granted a waiver by the Owner pursuant to C.R.S. §8-17-101(1), Contractor shall be responsible for ensuring compliance with Article 17 of Title 8, Colorado Revised Statutes requiring 80% Colorado labor to be employed on public works. Contractor shall, upon reasonable notice provided by the Owner, permit the Owner to inspect documentation of identification and residency required by C.R.S. §8-17-101(2)(a).

**2.53.1.** "Public project" is defined as:

(a) any construction, alteration, repair, demolition, or improvement of any land, building, structure, facility, road, highway, bridge, or other public improvement suitable for and intended for use in the promotion of the public health, welfare, or safety and any maintenance programs for the upkeep of such projects

(b) for which appropriate or expenditure of moneys may be reasonably expected to be $500,000.00 or more in the aggregate for any fiscal year

(c) except any project that receives federal moneys.

# 3. Statement of Work

**3.1. Project Description:** The work scope for this project includes completion of an earthen flood control dam. The dam when completed will be 28 feet in height, 1,438 feet in length, 280 feet wide at the base. The outlet pipe, head walls, and sand diaphragm filter have been previously constructed. A portion of the dam has been constructed over the last three years by the US Army National Guard. The City of Grand Junction would like to complete the dam with this project. The remaining work includes placement of 66,580 cubic yards of embankment, 33,670 cubic yards of cut in the spillway, associated soil conditioning, and surveying. The borrow and spoil sites are immediately adjacent to the dam site.

**3.2. Special Conditions & Provisions:**

**3.2.1 Working Schedule:** Work shall be permitted 7 days per week, sunrise to sunset. Contractor shall coordinate scheduling with project engineer.

**3.2.2 Project Schedule:** The anticipated project start date is March 30, 2015. However, Contractor shall begin work upon dated noted of receipt of Notice to Proceed and shall have final project completion of all work no later than 60 calendar days from the Notice to Proceed.

**3.2.3 Contractor Staging Area:** Awarded Contractor shall coordinate with Owner for proposed project staging area (if required).

**3.2.4 Pricing:** Pricing shall be all inclusive to include, but not be limited to: all labor, equipment, supplies, materials, freight (F.O.B. Destination – Freight Pre-paid and Allowed to each site), travel, and all other costs related to the successful completion of each project site.

The Owner shall not pay nor be liable for any other additional costs including but not limited to: taxes, shipping charges, insurance, interest, penalties, termination payments, attorney fees, liquidated damages, etc.

**3.2.5 Freight/Shipping:** All freight/shipping shall be F.O.B. Destination – Freight Pre-Paid and Allowed to the project site.

**3.2.6 Product/Materials Quantities:** Contractor shall be responsible for determining all measurements for correctness, and all quantities of products/materials required for successful project completion.

**3.2.7 Product Ordering:** Upon Contract Award, Contactor(s) may begin order product prior to the project start times in order to have products and supplies ready and available when project is scheduled to begin.

**3.2.8** Contractor shall provide proper disposal of existing equipment and materials that meet all Federal, State, County, and City regulations.

**3.2.9 Licenses and Permits:** Contractor is responsible for obtaining all necessary licenses and permits required for Construction, at Contractors expense. See Section 2.10

**3.2.10 Warranty:** Contractor shall submit manufacturer warranty information with their proposal. In addition, Contractor shall provide a minimum 1 year Contractors warranty.

**3.2.11 Sub-Contractor's List:** See Section 2.7 "Award of Sub-Contractors & Other Contracts for Portions of the Work".

**3.2.12 Bid Response Submittal:** Contractor shall provide the following information with their bid response:

- Contractor's Bid Form

- Price Bid Schedule Form

- Bid Bond

- Manufacturer's Product/Equipment warranty information (if any).

**3.2.13 Award Criteria:** Award criteria shall include the following:
- The lowest responsive and responsible bidder(s).
- Attendance of Mandatory Site Visit.
- Pre-Qualified through the City of Grand Junction
- Bid Bond submitted with Bid Response.

**3.2.14 Contract:** A binding contract shall consist of: (1) the IFB and any amendments thereto, (2) the bidder's response (bid) to the IFB, (3) clarification of the bid, if any, and (4) the City's Purchasing Department's acceptance of the bid by "Notice of Award" or by "Purchase Order". All Exhibits and Attachments included in the IFB shall be incorporated into the contract by reference.

A. The contract expresses the complete agreement of the parties and, performance shall be governed solely by the specifications and requirements contained therein.

B. Any change to the contract, whether by modification and/or supplementation, must be accomplished by a formal contract amendment signed and approved by and between the duly authorized representative of the bidder and the City Purchasing Division or by a modified Purchase Order prior to the effective date of such modification. The bidder expressly and explicitly understands and agrees that no other method and/or no other document, including acts and oral communications by or from any person, shall be used or construed as an amendment or modification to the contract.

**3.2.16 Mandatory Site Visit/Briefing: Prospective bidders are required to attend a site visit/briefing on February 20, 2015 at 10:00am**. Meeting location shall be at the intersection of 27 ¼ Road and H Road. The purpose of this visit will be to inspect and to clarify the contents of this Invitation for Bids (IFB).

**3.3. Scope of Work:**

# Construction Specifications

CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION

**Leach Creek Flood Control Dam**

## SPECIAL CONDITIONS

The performance of the Work for this Project shall conform to the General Contract conditions presented in the City of Grand Junction's *Standard Contract Documents for Capital Improvements Construction,* revised July 2010, except as specifically modified or supplemented herein or on the Construction Drawings.

The Plans and specifications previously approved by the State Engineers Office, Division of Water Resources – Dam Safety Branch Govern for this project. The approved plans and specifications are included in Appendix A and B respectively of this specification. Appendix C includes the geotechnical report for this project and Appendix D includes Rule 9 & 10 for construction of dams. Scope of work for the completion of the project is included in the Special Conditions and Special Provisions that follow:

SC-1 Project Description: The project generally consists of completing construction of a 1,438 foot long, 29 foot high dam to provide stormwater detention on the main stem of the Leach Creek Drainage. This will include excavation of approximately 66,680 CY, Placement of 66,580 CY Dam embankment, surface grading of disturbed areas including; spoil piles, dam, and access roads

SC-2 Permits: The following permits/approvals are required for the Project and will be obtained by the City at no cost to the Contractor:

State Engineers Office, Division of Water Resources - Dam Safety Branch Approval
Bureau of Land Management ROW Permit

US Army Corps of Engineers Nationwide 43 Permit
Storm Water Discharge Permit

SC- 3 City Furnished Materials/ Services: The City will furnish the following materials/services for the Project:

Water source for material processing

SC-4 Project Newsletters: Project newsletters will not be required for this project.

SC-5 Project Sign: Project signs, if any, will be furnished and installed by the City.

SC-6 Authorized Representatives of the City: Those authorized to represent the City shall include engineers and inspectors employed by the City, only.

SC-7 Uranium Mill Tailings: It is anticipated that no radioactive mill tailings will be encountered on this Project.

SC-8 Fugitive Petroleum or Other Contamination: It is anticipated that soil contamination from fugitive petroleum or other contaminants will not be encountered with the Project.

SC-9 Existing Permanent Easements: The existing permanent easement areas shall be restored as noted on the approved construction plans.

SC-10 Temporary Construction Easements: All construction activity shall be limited to the areas of disturbance indicated as embankment, borrow, or spoil as indicated on the approved plans.

SC-11 Traffic Control: The Contractor shall be aware that 27 ¼ Road is a public ROW and shall be regarded as such. The City will provide traffic control signage for this project.

1. The Contractor shall adhere to all traffic control requirements when working within City right-of-way.

SC-12 Excess Material: All excess materials shall be disposed at the two spoil areas designated on the approved plan set.

SC-13 Existing Property Pins and Survey Monuments: There are no property pins or survey monuments within the disturbance area associated with this project. The Contractor will be held responsible for replacement of damaged survey monuments or property pins that are located outside the construction area as shown on the approved construction drawings.

SC-14 Interruption of Utilities and Services: There are no existing utilities within the work zone.

CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION

## Leach Creek Flood Control Dam

# SPECIAL PROVISIONS

**GENERAL:**

There are no listed pay items or Bid Schedule for this Project. The project scope includes site preparation and placement of embankment for an earthen flood control dam. Work performed, as required in the Contract Documents, will be in accordance with the items and units included on the approved construction plan set and these specifications.

All construction and oversight will be accomplished in accordance with current rules and regulations for construction of earth embankment dams as defined by the Colorado Division of Water Resources Dam Safety Branch Rule 5 as follows:

The construction plans and specifications cannot be materially changed without the written approval of the State Engineer (Rule 5.3.4)

Construction will not be considered complete until accepted in writing by the State Engineer (Rule 5.3.5)

The owner's engineer will monitor the quality of construction (Rule 5.3.6)

**STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION:**

The ***City of Grand Junction Standard Specifications for Road and Bridge Construction*** are hereby modified or supplemented for this Project by the following modifications to ***The Standard Specifications for Road and Bridge Construction***, State Department of Highways, Division of Highways, State of Colorado:

SP-1 Section 201 – Clearing and Grubbing

The contractor shall remove all vegetative mater from the dam footprint prior to preparing the area for cutoff wall and initial placement of embankment materials. All work shall be completed in accordance with the recommendations identified in the Geotechnical Investigation found in Appendix C of this document.

SP-2 Section 208 – Erosion Control

The Contractor shall be responsible for erosion control measures taken with this project. The City will be responsible for maintenance of the Storm Water BMP's upon completion of the project.

SP-3 Section 203 – Excavation and Embankment

Section 203 shall be amended as follows:

The Contractor shall be responsible for materials preparation and placement per recommendations in the Geotechnical Investigation included in Appendix C.

Sub-grade preparation, embankment material preparation and placement shall be accomplished as described in Item 2, Page 23, of the Geotechnical Investigation – Proposed Leach Creek Detention Basin – Alternate Location 1A (dated August 23, 2003 – Job No. 1,276) and completed by Geotechnical Engineering Group, Inc. (GEG) included in Appendix C.

Measurement – Measurement for Unclassified Excavation and Embankment Complete in Place shall be neat line items and shall be based on the estimate of work needed to complete the project established by as-built topo collected upon completion of the 2014 work effort.

Payment – Payment shall be based on the cubic yard quantities as listed in the bid schedule.

SP-4 Construction Observation Plan

The City will have full time geotechnical observation for this project. We anticipate placement of approximately 66,680 cubic yards of embankment material remaining to complete this structure. Moisture/density compliance testing will be accomplished by an independent Geotechnical Engineer for this project. Moisture/density tests will be taken for each 200 cubic yards of material placed (roughly one test / one foot lift of material / 100 lineal feet of embankment placed). This testing schedule may be more frequent during the initial processing and placement of material in order to establish a viable procedure to process material to a point that it will meet the required moisture/density specification.

Sand cone confirmation of the in place moisture/density tests will be prepared for each ten (10) moisture/density tests taken during the few days of construction in order to confirm that the compaction specification is being met. Sand cone tests will be conducted for each 50 moisture/density tests upon confirmation of the specification.

The geotechnical Engineer will also be responsible for providing laboratory verification of test results that will include a minimum of samples taken to confirm / adjust the testing criteria for this project:

| Sample Number | Laboratory Test |
|---|---|
| 6 | Soil Classification |
| 3 | Hydrometer |
| 6 | Standard Proctor |
| 20 | Oven Dried Moisture |
| 20 | In-Place Moisture/ Density (sand cone confirmation per ASTM D1556-07) |

SP-5 Section 209 – Watering and Dust Pallatives

The City of Grand Junction has coordinated with the Ute Water Conservancy District to provide water for this project. Water will be available at a fill hydrant located in the Bookcliff Tech Park subdivision located at the north east corner of the intersection of 27 ¼ Road and

H Road. There will be no cost to the Contract for water.

Measurement – Water to be utilized for dust control and material processing will not be measured separately but will be included with excavation and embankment bid items.

Payment – Payment for dust control and material processing will be included in the cubic yard items for excavation and embankment.

SP-6 Site Access

Site access shall be limited to areas shown on the Approved Construction Drawings.

Temporary construction staging areas are also limited to the locations shown on the construction drawings or to areas within the borrow and spoil limits.

**3.4. IFB Tentative Time Schedule:**

| | |
|---|---|
| Invitation For Bids available | February 14, 2015 |
| Site Visit/Briefing | February 20, 2015 |
| Inquiry deadline, no questions after this date | February 26, 2015 |
| Addendum Posted | February 27, 2015 |
| Submittal deadline for proposals | March 4, 2015 |
| City Council or Board of Commissioners Approval | March 18, 2015 |
| Contract execution (unless Council approval required) | March 19, 2015 |
| Bonding & Insurance Cert due | March 20, 2015 |
| Work begins no later than | March 30, 2015 |
| Final Completion | May 29, 2015 |

**3.5. Questions Regarding Scope of Services:**

Duane Hoff Jr., Senior Buyer
City of Grand Junction
duaneh@gjcity.org

# 4. Contractor's Bid Form

**Bid Date:** _____

**Project: IFB-4006-15-DH "Leach Creek Flood Control Dam Project"**

**Bidding Company:** _____

**Name of Authorized Agent:** _____

**Email** _____

**Telephone**_____ **Address**_____

**City**_____**State**_____**Zip**_____

The undersigned Bidder, in compliance with the Invitation for Bids, having examined the Instruction to Bidders, General Contract Conditions, Statement of Work, Specifications, and any and all Addenda thereto, having investigated the location of, and conditions affecting the proposed work, hereby proposes to furnish all labor, materials and supplies, and to perform all work for the Project in accordance with Contract Documents, within the time set forth and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this Contractor's Bid Form is a part.

The undersigned Contractor does hereby declare and stipulate that this offer is made in good faith without collusion or connection to any person(s) providing an offer for the same work, and that it is made in pursuance of, and subject to, all terms and conditions of the Instructions to Bidders, the Specifications, and all other Solicitation Documents, all of which have been examined by the undersigned.

The Contractor also agrees that if awarded the Contract, to provide insurance certificates within ten (10) working days of the date of Notification of Award. Submittal of this offer will be taken by the Owner as a binding covenant that the Contractor will be prepared to complete the project in its entirety.

The Owner reserves the right to make the award on the basis of the offer deemed most favorable, to waive any formalities or technicalities and to reject any or all offers. It is further agreed that this offer may not be withdrawn for a period of sixty (60) calendar days after closing time. Submission of clarifications and revised offers automatically establish a new thirty day (30) period.

RECEIPT OF ADDENDA: the undersigned Contractor acknowledges receipt of Addenda to the Solicitation, Specifications, and other Contract Documents.

State number of Addenda received: _____.

It is the responsibility of the Bidder to ensure all Addenda have been received and acknowledged.

**PRICE BID SCHEDULE: IFB-4006-15-DH Leach Creek Flood Control Dam Project**

| Item No. | CDOT, City Ref. | Description | Qty | Units | Unit Price | Extended Price |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1 | 203 | Embankment (Complete in Place) | 66,580 | CY | | |
| 2 | 203 | Spillway (Unclassified Excavation) | 33,670 | CY | | |
| 3 | 625 | Construction Surveying | 1 | LS | | |
| 4 | 626 | Mobilization and De-Mobilization | 1 | LS | | |
| 5 | 620 | Portable Sanitary Facility | 1 | LS | | |
| MCR | | Minor Contract Revisions | | | $10,000 | $10,000 |
| | | TOTAL BID | | | | |

**Total Bid Price Written:**

_____

*By signing below*, the Undersigned agree to comply with all terms and conditions contained herein.

**Company:** _____

**Authorized Signature:** _____

**Title:** _____

PROJECT NO. 202-F001925

# SPECIFICATION DRAWINGS
# FOR CONSTRUCTION OF THE
# LEACH CREEK DETENTION BASIN

## WATER DIVISION 5
## WATER DISTRICT 72
## MESA COUNTY, COLORADO
## DAM ID 720422



ENGINEER CERTIFICATION

I, S. BRET GUILLORY, CERTIFY THAT THESE PLANS AND ACCOMPANYING SPECIFICATIONS WERE PROVIDED BY ME OR UNDER MY DIRECT SUPERVISION.

COLORADO LICENSED STEVEN BRET GUILLORY 31675 PROFESSIONAL ENGINEER

SIGNATURE 31675 LICENSE NO. 7/18/12 DATE

OWNER ACCEPTANCE

AS OWNER OF LEACH CREEK DETENTION BASIN WE ACKNOWLEDGE THAT THESE PLANS AND ACCOMPANYING SPECIFICATIONS HAVE BEEN REVIEWED AND ACCEPTED BY US. AND WE REQUEST CONSIDERATION FOR APPROVAL BY THE OFFICE OF THE STATE ENGINEER.

SIGNATURE Public Works & Planning Director TITLE 7-18-12 DATE

STATE ENGINEER APPROVAL

APPROVED ON THE 31st DAY OF August 2012

Dick Wolfe
STATE ENGINEER

BY: William T. McCormick, III
For: DEPUTY
William T. McCormick, III
Chief, Dam Safety Branch
CO PE 29122

STATE ENGINEER OF COLORADO

AS-BUILT CERTIFICATION

THESE PLANS REPRESENT THE AS-CONSTRUCTED CONDITIONS OF THE LEACH CREEK DETENTION BASIN TO THE BEST OF OUR KNOWLEDGE AND JUDGEMENT, BASE IN PART ON INFORMATION FURNISHED BY OTHERS AS OF THE ____ DAY OF ____ 2012.

ENGINEERS PRINTED NAME SIGNATURE

*Department of Public Works & Planning*
*Engineering and Technical Services Divisions*
*City of Grand Junction, Colorado*
*July 2012*

STATE ENGINEERS FILE NO. C-2010



LEACH CREEK DETENTION BASIN, May, 2012, Plan Set No. —

PROJECT NO. 202-F001925

# SPECIFICATION DRAWINGS
# FOR CONSTRUCTION OF THE
# LEACH CREEK DETENTION BASIN

## WATER DIVISION 5
## WATER DISTRICT 72
## MESA COUNTY, COLORADO
## DAM ID 720422



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SIGNATURE TITLE DATE

STATE ENGINEER APPROVAL

APPROVED ON THE _____ DAY OF _____ 2012

STATE ENGINEER

BY:

DEPUTY

AS-BUILT CERTIFICATION

THESE PLANS REPRESENT THE AS-CONSTRUCTED CONDITIONS OF THE LEACH CREEK DETENTION BASIN TO THE BEST OF OUR KNOWLEDGE AND JUDGEMENT, BASE IN PART ON INFORMATION FURNISHED BY OTHERS AS OF THE _____ DAY OF _____ 2012.

ENGINEERS PRINTED NAME SIGNATURE

*Department of Public Works & Planning*
*Engineering and Technical Services Divisions*
*City of Grand Junction, Colorado*
*July 2012*

STATE ENGINEERS FILE NO. C-2010

1 OF 16

LEACH CREEK DETENTION BASIN, May, 2012, Plan Set No. —

PROJECT NO. xxxx-Fxxxxx

# ABBREVIATIONS

| | |
|---|---|
| AASHTO | AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS |
| ABC | AGGREGATE BASE COURSE |
| AC | ASBESTOS CEMENT |
| AP | ANGLE POINT |
| ASB | ANCHORED STRAW BALES |
| ASP | ALUMINIZED STEEL PIPE |
| ASTM | AMERICAN SOCIETY FOR TESTING MATERIALS |
| AWWA | AMERICAN WATER WORKS ASSOCIATION |
| BC | BACK OF CURB |
| BF | BUTTERFLY VALVE |
| BOW | BACK OF WALK |
| BCR | BEGIN CURB RETURN |
| BOT | BOTTOM |
| BSWMP | BETTER STORM WATER MANAGEMENT PRACTICES |
| CH | CHORD |
| CAP | CORRUGATED ALUMINUM PIPE |
| CDOT | COLORADO DEPARTMENT OF TRANSPORTATION |
| CI | CAST IRON |
| C,G,& SW | CURB, GUTTER & SIDEWALK |
| ℄ | CENTER LINE |
| CL | CLEAR |
| CMP | CORRUGATED METAL PIPE |
| CO | CLEAN OUT |
| COMB | COMBINATION (AS IN STORM SEWER AND SANITARY SEWER) |
| CONC | CONCRETE |
| CSM | CITY SURVEY MONUMENT |
| CSP | CORRUGATED STEEL PIPE |
| CU | COPPER |
| DI | DUCTILE IRON |
| DWY | DRIVEWAY |
| E | ELECTRIC |
| ECR | END CURB RETURN |
| EG | EDGE OF GUTTER |
| EL | ELEVATION |
| EP | EDGE OF PAVEMENT |
| EX | EXISTING |
| FB | FULL BODY |
| FC | FACE OF CURB |
| FG | FINISHED GRADE |
| ℄ | FLOW LINE |
| FL | FLANGE |
| FM | FORCE MAIN |
| FO | FIBER OPTICS |
| FS | FAR SIDE |
| FTG | FOOTING |
| G | GAS |
| GB | GRADE BREAK |
| GM | GAS METER |
| GV | GATE VALVE |
| HBP | HOT BITUMINOUS PAVEMENT |
| HDPE | HIGH DENSITY POLYETHYLENE |
| INV | INVERT |
| IRR | IRRIGATION |
| L | LENGTH OF ARC |
| LC | LONG CHORD |
| LF | LINEAR FEET |
| LL | LONG ARC |
| LS | SHORT ARC |
| LT | LEFT |
| MB | MAILBOX |
| MCSM | MESA COUNTY SURVEY MONUMENT |
| MH | MANHOLE |
| MJ | MECHANICAL JOINT |
| MW | MILL WRAP |
| N/A | NOT APPLICABLE |
| NIC | NOT IN CONTRACT |
| NOP | NO ONE PERSON |
| NRCP | NON-REINFORCED CONCRETE PIPE |
| NS | NEAR SIDE |
| NTS | NOT TO SCALE |
| OHP | OVERHEAD POWER |
| OHT | OVERHEAD TELEPHONE |
| PC | POINT OF CURVATURE |
| PCC | POINT OF COMPOUND CURVATURE |
| PE | POLYETHYLENE |
| PERF | PERFORATED |
| PI | POINT OF INTERSECTION |
| PIP | PLASTIC IRRIGATION PIPE |
| POC | POINT ON CURVE |
| POT | POINT ON TANGENT |
| PR | PROPOSED |
| PRC | POINT OF REVERSE CURVATURE |
| PT | POINT OF TANGENCY |
| PVC | POLYVINYL CHLORIDE |
| R | RADIUS |
| RCP | REINFORCED CONCRETE PIPE |
| REQ'D | REQUIRED |
| RG | RESTRAINED GLANDS |
| RL | LONG RADIUS |
| ROW | RIGHT OF WAY |
| RP | RADIUS POINT |
| RR | RAIL ROAD |
| RS | SHORT RADIUS |
| RT | RIGHT |
| S | SLOPE |
| SAN | SANITARY |
| SC | SHORT CHORD |
| SCD | STANDARD CONTRACT DOCUMENTS |
| SCH | SCHEDULE |
| SF | SILT FENCE |
| SL | SECTION LINE |
| SSRB | STANDARD SPECIFICATIONS FOR ROAD & BRIDGE CONSTRUCTION |
| SSUU | STANDARD SPECIFICATIONS FOR CONSTRUCTION OF UNDERGROUND UTILITIES |
| STA | STATION |
| STL | STEEL |
| STM | STORM |
| T | TELEPHONE |
| TAN | LENGTH OF TANGENT |
| TC | TOP OF CURB |
| TH | TEST HOLE |
| TV | TELEVISION |
| (TYP) | TYPICAL |
| UU | UNDERGROUND UTILITIES |
| VC | VERTICAL CURVE |
| VCP | VITRIFIED CLAY PIPE |
| VPC | VERTICAL POINT OF CURVATURE |
| VPCC | VERTICAL POINT OF COMPOUND CURVATURE |
| VPRC | VERTICAL POINT OF REVERSE CURVATURE |
| VPI | VERTICAL POINT OF INTERSECTION |
| VPT | VERTICAL POINT OF TANGENCY |
| W | WATER |
| Δ | DELTA ANGLE |

# LEGEND

BSWMP DRAINAGE BASIN BOUNDARY

BSWMP ANCHORED STRAW BALES

BSWMP SILT FENCE

BUILDING

CONCRETE CURB AND GUTTER — 2' CURB AND GUTTER

CONCRETE CURB,GUTTER, & SIDEWALK — 7' C, G, & SW

CONCRETE DITCH — CONCRETE

CONCRETE SIDEWALK — 4' SW

CULVERT — 18" RCP

EARTH DITCH

EDGE OF GRAVEL

EDGE OF PAVEMENT

FENCE (BARBED WIRE)

FENCE (CHAIN LINK)

FENCE (IRON)

FENCE (PLASTIC)

FENCE (TEMPORARY CONSTRUCTION)

FENCE (WOOD)

FENCE (WOVEN WIRE)

GUARD RAIL

HATCHING: INDICATES ASPHALT REMOVAL

HATCHING: INDICATES CONCRETE REMOVAL

HATCHING: INDICATES STAGING AREA — ~STAGING AREA~

LINE (CENTER OF IMPROVEMENTS) — CENTERLINE

LINE (CITY LIMITS) — CITY LIMITS

LINE (CONTROL) — CONTROL LINE

LINE (EASEMENT)

LINE (MONUMENT/SECTION) — MONUMENT/SECTION LINE

LINE (PROPERTY)

LINE (RIGHT OF WAY)

MATCH LINE — MATCH LINE SEE SHEET NO ?

PIPE (IRRIGATION)

PIPE (SIPHON)

PROPOSED CONCRETE CURB AND GUTTER

PROPOSED CONCRETE CURB,GUTTER,& SIDEWALK

PROPOSED CONCRETE SIDEWALK

PROPOSED "WET" UTILITIES (CONSTRUCTION NOTE WILL INDICATE TYPE, SIZE, AND MATERIAL OF NEW MAIN) — 8" PVC SANITARY SEWER

ALL PROPOSED FEATURES NOT SHOWN IN LEGEND WILL BE SHOWN THE SAME AS THEIR EXISTING COUNTERPART, BUT INDICATED BY BOLDER LINETYPE

RAIL ROAD

RETAINING WALL — 1' RETAINING WALL

STRIPING (CONTINUOUS WHITE) — WHITE

STRIPING (DASHED WHITE) — WHITE

STRIPING (CONTINUOUS YELLOW) — YELLOW

STRIPING (DASHED YELLOW) — YELLOW

TOP OF SLOPE — 4570

CONTOUR LINES (SHOWN BETWEEN TOP & TOE) — 4580

TOE OF SLOPE — 4570

TRAFFIC DETECTOR LOOP

UTILITY LINE (ABANDON) (THIS CASE A WATER LINE) — (ABANDONED)

UTILITY LINE (CABLE TV)

UTILITY LINE (ELECTRIC)

UTILITY LINE (FIBER OPTIC)

UTILITY LINE (GAS)

UTILITY LINE (HIGH VOLTAGE OVERHEAD POWER)

UTILITY LINE (OVERHEAD POWER)

UTILITY LINE (OVERHEAD TELEPHONE)

UTILITY LINE (SANITARY SEWER)

UTILITY LINE (SANITARY SEWER FORCE MAIN)

UTILITY LINE (SANITARY SEWER SERVICE)

UTILITY LINE (STORM SEWER)

UTILITY LINE (STORM SEWER, PERFORATED)

UTILITY LINE (STORM/SANITARY SEWER SEWER COMBINATION)

UTILITY LINE (TELEPHONE)

UTILITY LINE (WATER)

# SYMBOLS

BENCH MARK — A

CATCH BASIN

CLEAN OUT

CURB STOP

FIRE HYDRANT

GUY WIRE ANCHOR

HEADGATE

IRRIGATION PUMP — P

MAILBOX

MANHOLE (ELECTRIC) — E

MANHOLE (GAS) — G

MANHOLE (SANITARY/STORM)

MANHOLE (TELEPHONE) — T

MANHOLE (TV) — TV

MANHOLE (WATER) — W

METER (GAS) — GM

METER (WATER)

PEDESTAL (TELEPHONE)

PEDESTAL (TV) — TV

PROPERTY PIN

PULL BOX

REDUCER FITTING

SIGN OR POST (SIGN TYPE NOTED) — STOP

SPRINKLER HEAD

STREET LIGHT

SURVEY MONUMENT (CITY) — CSM

SURVEY MONUMENT (TYPE NOTED) — MCSM

TEST HOLE — TH #1

TRAFFIC PAINT MARKING

TRAFFIC SIGNAL POLE AND MAST ARM

UTILITY POLE

VALVE (GAS) — GV

VALVE (IRRIGATION) — IRR

VALVE (WATER)

VEGETATION (HEDGE OR BUSH)

VEGETATION (TREE STUMP)

VEGETATION (TREE) (CALIPER SIZE NOTED) — 6"

WATER HYDRANT — WH

WEIR

YARD LIGHT

NORTH ARROW:

STATE ENGINEERS FILE NO: C-2010

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |
| REVISION 4 | |

DRAWN BY JCS DATE 4-02
DESIGNED BY DATE
CHECKED BY DATE
APPROVED BY DATE

SCALE FEET
HORIZ. 0 12.5 25 50
VERT. 0 5 10 20

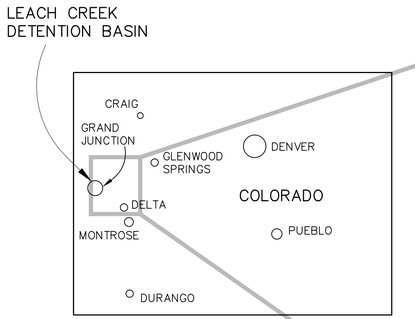
CITY OF Grand Junction COLORADO

PUBLIC WORKS AND PLANNING ENGINEERING DIVISION

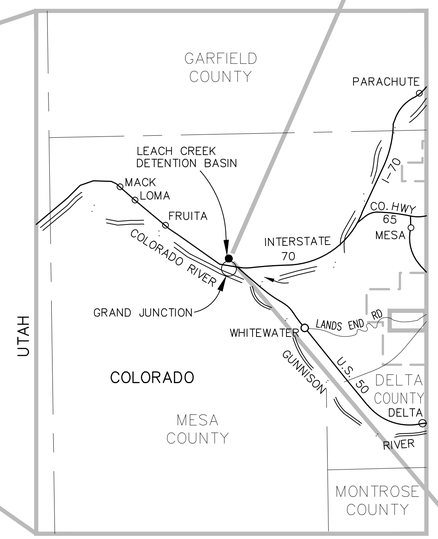
CITY OF GRAND JUNCTION STANDARD ABBREVIATIONS, LEGEND, AND SYMBOLS SHEET

2

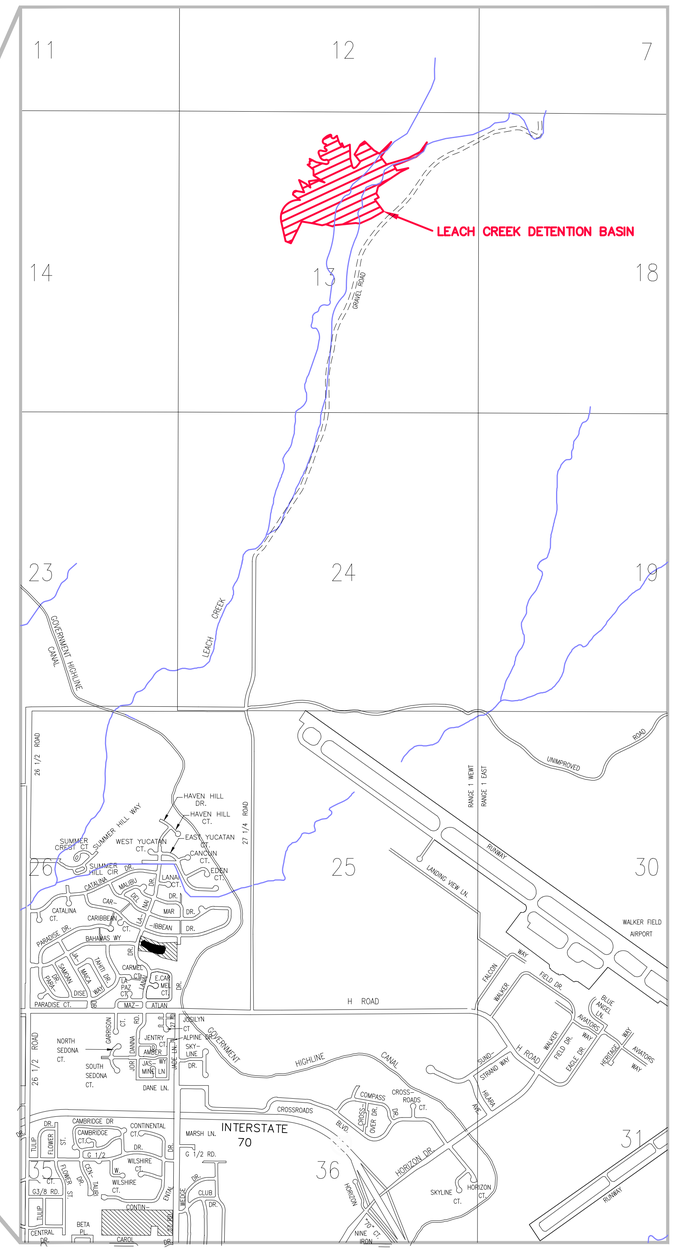
PROJECT NO. 202-F35500




LOCATION MAP
N.T.S.




REGIONAL MAP
N.T.S.




VICINITY MAP
N.T.S.

N.T.S.

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2003
DESIGNED BY JLS DATE 2003
CHECKED BY JLS DATE 2003
APPROVED BY DATE

SCALE
PLAN
HORIZ. NTS

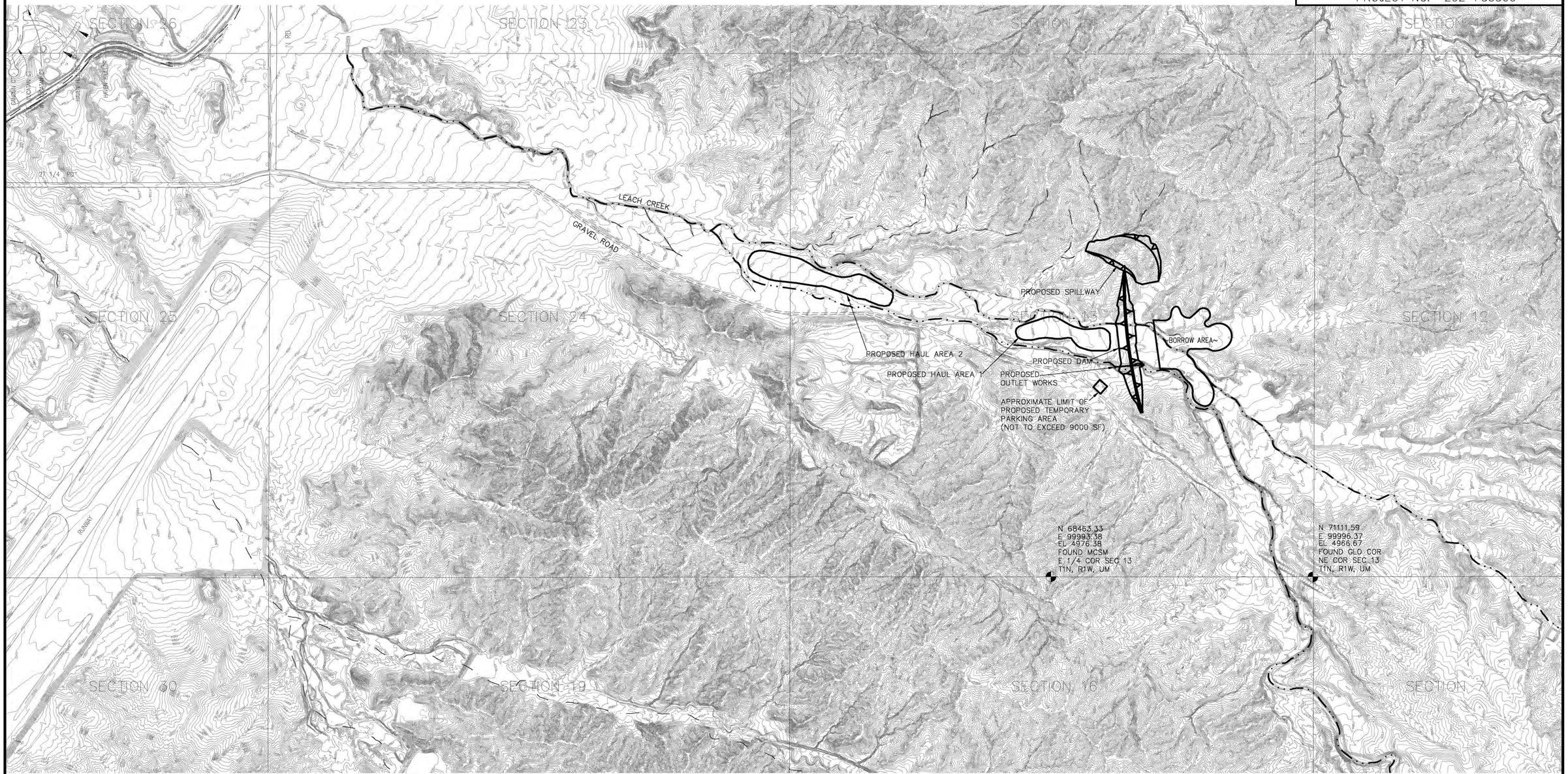
DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
LOCATION, REGIONAL, AND VICINITY MAPS

STATE ENGINEERS FILE NO: C-2010

3 OF 16

PROJECT NO. 202-F35500




## REFERENCE DRAWINGS



## MONUMENT TIES TO IMPROVEMENTS

TIE FROM E 1/4 COR TO STA 14+38.71 AT EAST END OF DAM CL: N 61-01-40 W 1894.57

TIE FROM STA 0+00 AT WEST END OF DAM CL TO NE COR SEC 13: N 58-16-33 E 3625.37

TIE FROM E 1/4 COR TO STA 0+00 AT SOUTH END OF SPILLWAY CL: N 83-41-02 W 3456.84

TIE FROM STA 8+67.03 AT NORTH END OF SPILLWAY CL TO NE COR SEC 13: N 60-09-36 E 3378.13

TIE FROM E 1/4 COR TO STA 0+00 AT SOUTH END OF BORROW AREA WEST ALIGNMENT CL: N 62-03-46 W 2360.98

TIE FROM STA 8+97.74 AT NORTH END OF BORROW AREA WEST ALIGNMENT CL TO NE COR SEC 13: N 71-21-32 E 2545.66

## GENERAL NOTES

1. TOPOGRAPHY TAKEN FROM MESA COUNTY/CITY OF GRAND JUNCTION CIRCA 2001 2' INTERVAL CONTOURS (HORIZONTAL DATUM: NAD 83A, VERTICAL DATUM: NAVD88)
2. COORDINATES SHOWN ARE CITY OF GRAND JUNCTION LOCAL COORDINATE DEFINITION.
3. LIMITS OF PROPOSED TEMPORARY PARKING AREA IS APPROXIMATE

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2003
DESIGNED BY JLS DATE 2003
CHECKED BY JLS DATE 2003
APPROVED BY DATE

SCALE
FEET
0 125 250 500

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
PROJECT AREA MAP

STATE ENGINEERS FILE NO: C-2010

4 OF 16

PROJECT NO. 202-F35500

## GENERAL NOTES

1. TOPOGRAPHY TAKEN FROM MESA COUNTY/CITY OF GRAND JUNCTION CIRCA 2001 2' INTERVAL CONTOURS (DATUM: NAD 83)
2. COORDINATES SHOWN ARE CITY OF GRAND JUNCTION LOCAL COORDINATE DEFINITION.
3. FOR THE LOCATION OF TESTHOLES SEE SHEET 6

## REFERENCE DRAWINGS



LEACH CREEK DETENTION BASIN
100 YR. STORM WS EL = 4914.10
CAPACITY AT WS EL = 249.30 A.F.
PMF = 9880 cfs
WS ELEV = 4918.20
CAPACITY AT 4918.20 = 434 A.F.

~BORROW AREA~

PROPOSED SPILLWAY
SPILL EL = 4914.10

200' MIN.
NO EXCAVATION WITHIN 200'
OF DAM TOE

PROPOSED DAM
CREST = 4923.10

PROPOSED
OUTLET WORKS

GRAVEL ROAD (TO GRAND JUNCTION)

LEACH CREEK

LEACH CREEK

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2003
DESIGNED BY JLS DATE 2003
CHECKED BY JLS DATE 2003
APPROVED BY ____ DATE ____

SCALE
FEET
0 25 50 100

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
DETENTION BASIN SITE PLAN

STATE ENGINEERS FILE NO: C-2010

PROJECT NO. 202-F35500

## GENERAL NOTES

1. FOR SECTIONS OF TESTHOLES SEE SHEET 7
2. FOR LOGS OF TESTHOLES SEE SHEET 8

## REFERENCE DRAWINGS



TESTHOLE LOCATION

LEACH CREEK DETENTION BASIN
WS EL = 4914.10
CAPACITY AT WS EL = 249.30 A.F.

TH#1 TH#2 TH#3 TH#4 TH#5 TH#6 TH#7 TH#8 TH#9 TH#10 TH#11 TH#12 TH#13 TH#14 TH#15 TH#16 TH#17 TH#18 TH#19 TH#20 TH#21 TH#22 TH#23 TH#24 TH#25 TH#26 TH#27 TH#28 TH#29 TH#30 TH#31 TH#32 TH#33 TH#34 TH#35 TH#36 TH#37

~BORROW AREA~

PROPOSED SPILLWAY

PROPOSED DAM

200' MIN.
NO EXCAVATION WITHIN 200'
OF DAM TOE

PROPOSED
OUTLET WORKS

A-A / 7

LEACH CREEK

GRAVEL ROAD (TO GRAND JUNCTION)

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

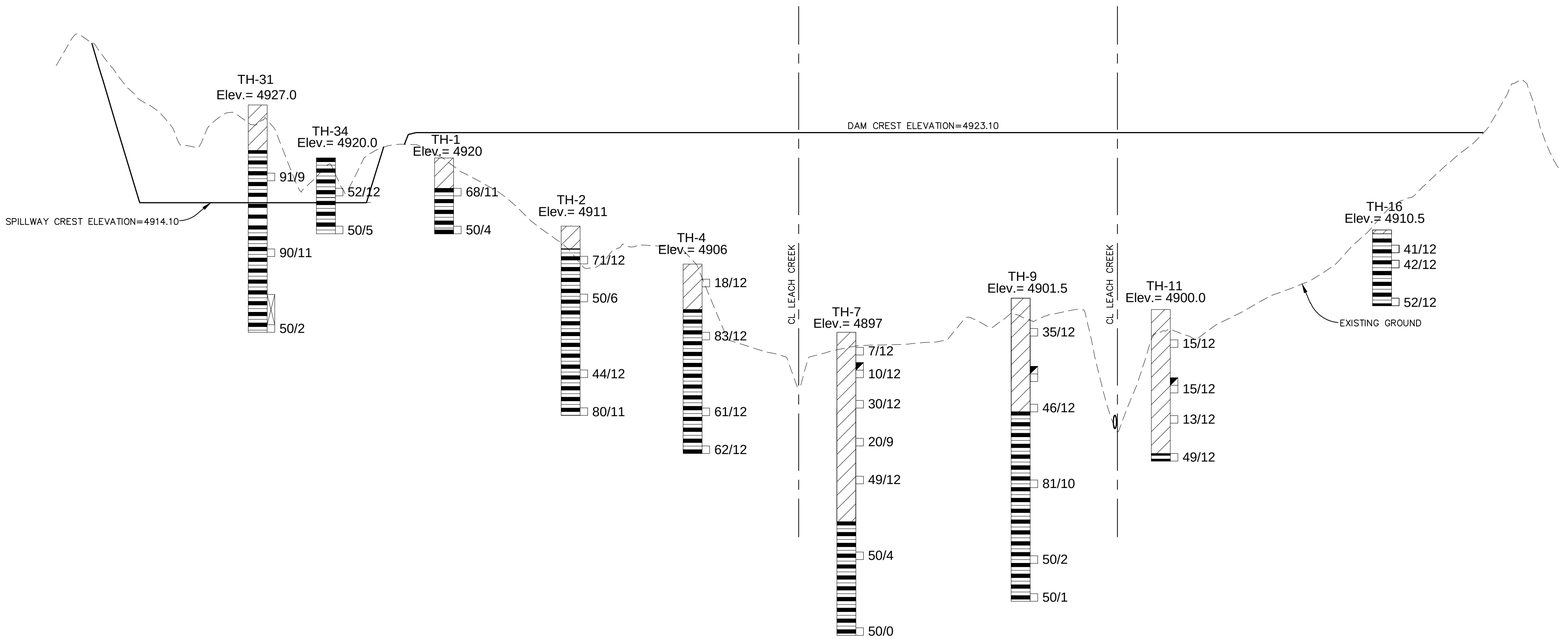
DRAWN BY JCS DATE 2003
DESIGNED BY JLS DATE 2003
CHECKED BY JLS DATE 2003
APPROVED BY DATE

SCALE
FEET
0 25 50 100

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
MATERIALS INVESTIGATIONS AREA MAP

STATE ENGINEERS FILE NO: C-2010




A-A / 6 SECTION A-A

SCALE FEET

HORIZ. 0 25 50 100

VERT. 0 2.5 5 10

## GENERAL NOTES

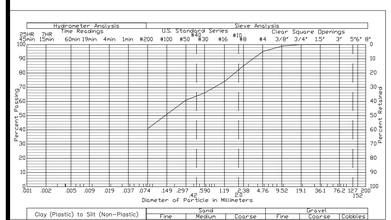
1. FOR LOCATIONS OF TESTHOLES SEE SHEET 6

## REFERENCE DRAWINGS

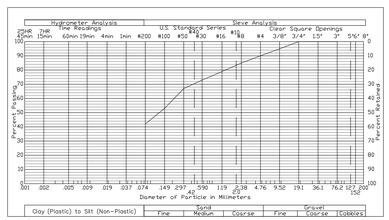
MATERIALS INVESTIGATION AREA MAP ——— 6

## Legend

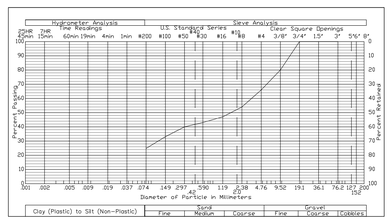
- Clay, silty, sandy, with variable sandy clay, silty to clayey sand and gravelly lenses noted, soft to very stiff, dry, tan, brown (CL, SC, SM)
- Shale, clayey, medium hard to very hard, dry, brown, tan, layered, slightly fractured, sulfates noted.
- Indicates drive sample. The symbol 68/12 indicates that 68 blows of a 140 pound hammer falling 30 inches were required to drive a 2.0 inch O.D. sample barrel 12 inches.
- Indicates location of bulk sample collected from auger cuttings.
- Indicates location of shelby tube (3-inch, O.D.) type sample.



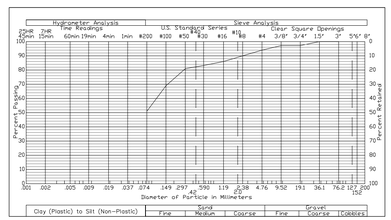

Sample of: Sand, clayey (SC)
From: TH-5 @ 4 foot depth
Gravel: 5 %
Silt & Clay: 41 %
Plasticity Index:
Sand: 54 %
Liquid Limit:



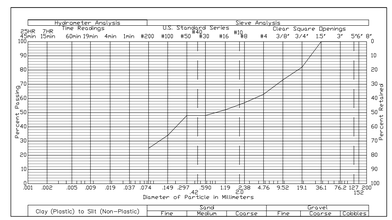

Sample of: Sand, clayey, gravelly (SC)
From: TH-8 @ 9 foot depth
Gravel: 10 %
Silt & Clay: 42 %
Plasticity Index
Sand: 48 %
Liquid Limit:



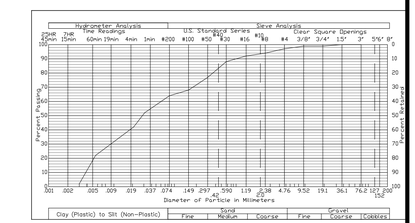

Sample of: Sand, gravelly, clayey (SC)
From: TH-9 @ 14 foot depth
Gravel: 34 %
Silt & Clay: 25 %
Plasticity Index
Sand: 41 %
Liquid Limit:



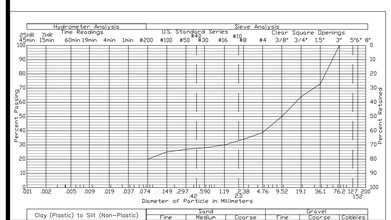

Sample of: Clay, silty, sandy, gravelly (CL)
From: TH-13 @ 14.5 foot depth
Gravel: 6 %
Silt & Clay: 51 %
Plasticity Index:
Sand: 43 %
Liquid Limit:



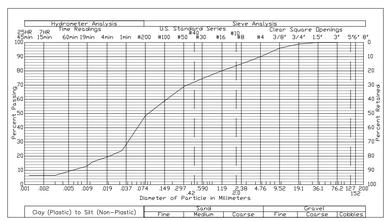

Sample of: Sand, clayey, gravelly (SC)
From: TH-20 @ 9 foot depth
Gravel: 37 %
Silt & Clay: 25 %
Plasticity Index:
Sand: 38 %
Liquid Limit:



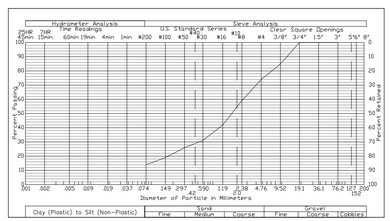

Sample of: Clay, silty, sandy (CL)
From: TH- 35 and 36 @ 0 to 5 foot depth, bulk combined
Gravel: 3 %
Silt & Clay: 63 %
Plasticity Index: 5
Sand: 34 %
Liquid Limit: 30



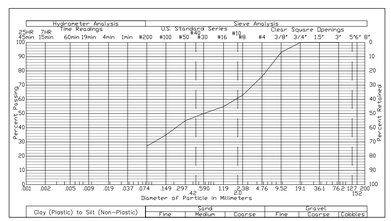

Sample of: Gravel, clayey, sandy (GC)
From: TH-7 @ 14 foot depth
Gravel: 61 %
Silt & Clay: 20 %
Plasticity Index:
Sand: 19 %
Liquid Limit:



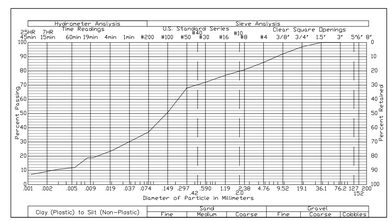

Sample of: Clay, silty, sandy, gravelly (CL)
From: TH-7 and 8 @ 0-5 foot depth
Gravel: 10 %
Silt & Clay: 48 %
Plasticity Index: 5
Sand: 42 %
Liquid Limit: 21



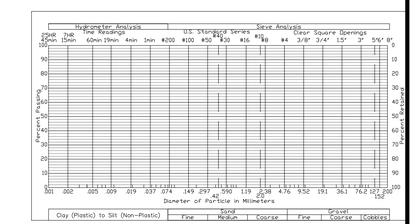

Sample of: Sand, gravelly, clayey (SC)
From: TH-11 @ 14 foot depth
Gravel: 26 %
Silt & Clay: 14 %
Plasticity Index
Sand: 60 %
Liquid Limit:




Sample of: Sand, clayey, gravelly (SC)
From: TH-14 @ 9 foot depth
Gravel: 24 %
Silt & Clay: 27 %
Plasticity Index:
Sand: 49 %
Liquid Limit:




Sample of: Sand, silty gravelly (SM)
From: TH-25 and 26 @ 0 to 5 foot depth, bulk combined
Gravel: 14 %
Silt & Clay: 34 %
Plasticity Index: 3
Sand: 52 %
Liquid Limit: 20




Sample of:
From:
Gravel: %
Silt & Clay: %
Plasticity Index:
Sand: %
Liquid Limit:

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2004
DESIGNED BY DATE
CHECKED BY DATE
APPROVED BY DATE

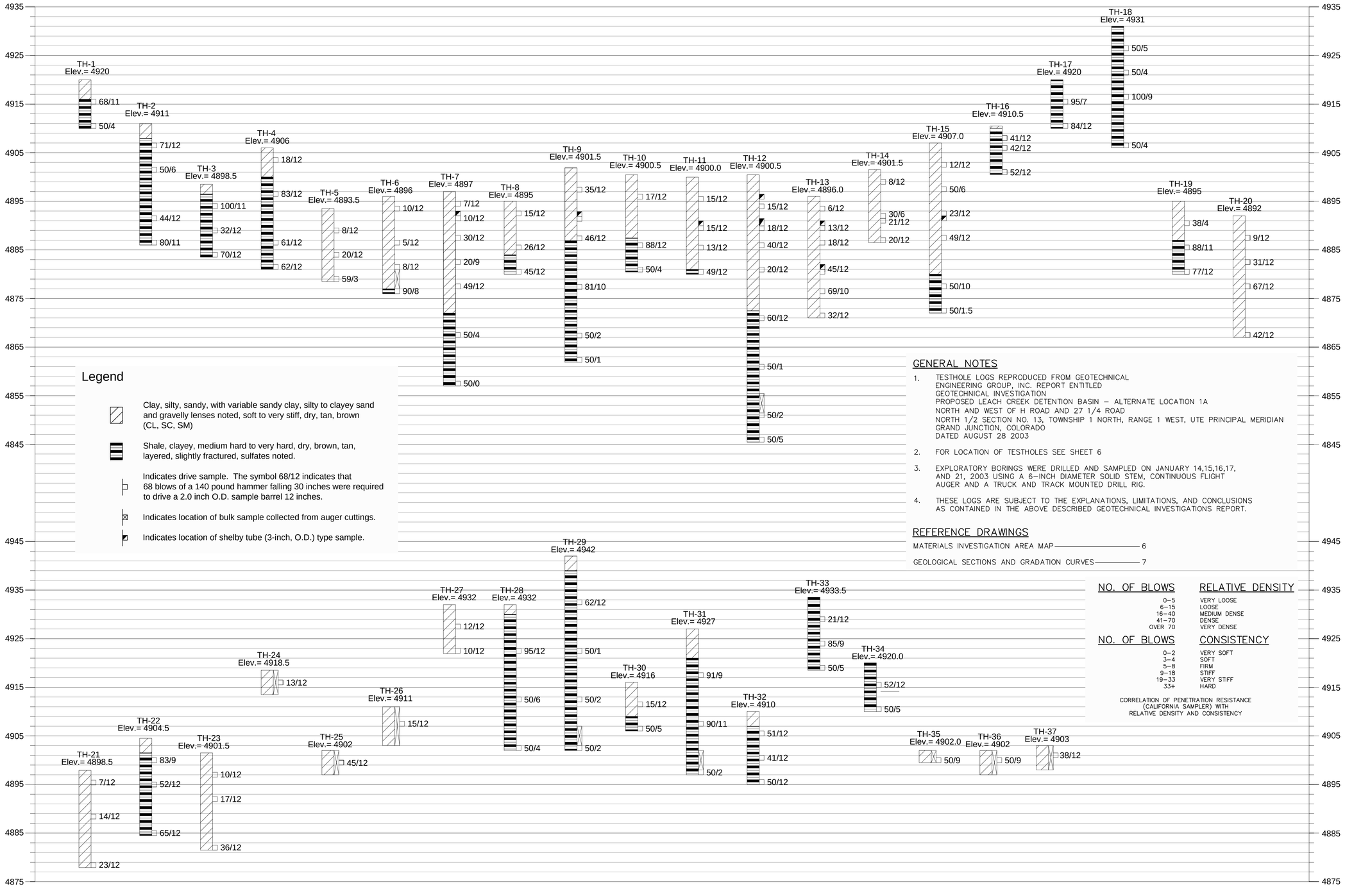
SCALE
AS SHOWN

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
GEOLOGICAL SECTIONS AND GRADATION CURVES

STATE ENGINEERS FILE NO: C-2010

7 OF 16




## Legend

Clay, silty, sandy, with variable sandy clay, silty to clayey sand and gravelly lenses noted, soft to very stiff, dry, tan, brown (CL, SC, SM)

Shale, clayey, medium hard to very hard, dry, brown, tan, layered, slightly fractured, sulfates noted.

Indicates drive sample. The symbol 68/12 indicates that 68 blows of a 140 pound hammer falling 30 inches were required to drive a 2.0 inch O.D. sample barrel 12 inches.

Indicates location of bulk sample collected from auger cuttings.

Indicates location of shelby tube (3-inch, O.D.) type sample.

## GENERAL NOTES

1. TESTHOLE LOGS REPRODUCED FROM GEOTECHNICAL ENGINEERING GROUP, INC. REPORT ENTITLED GEOTECHNICAL INVESTIGATION PROPOSED LEACH CREEK DETENTION BASIN – ALTERNATE LOCATION 1A NORTH AND WEST OF H ROAD AND 27 1/4 ROAD NORTH 1/2 SECTION NO. 13, TOWNSHIP 1 NORTH, RANGE 1 WEST, UTE PRINCIPAL MERIDIAN GRAND JUNCTION, COLORADO DATED AUGUST 28 2003
2. FOR LOCATION OF TESTHOLES SEE SHEET 6
3. EXPLORATORY BORINGS WERE DRILLED AND SAMPLED ON JANUARY 14,15,16,17, AND 21, 2003 USING A 6-INCH DIAMETER SOLID STEM, CONTINUOUS FLIGHT AUGER AND A TRUCK AND TRACK MOUNTED DRILL RIG.
4. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS, AND CONCLUSIONS AS CONTAINED IN THE ABOVE DESCRIBED GEOTECHNICAL INVESTIGATIONS REPORT.

## REFERENCE DRAWINGS






| NO. OF BLOWS | RELATIVE DENSITY |
|---|---|
| 0–5 | VERY LOOSE |
| 6–15 | LOOSE |
| 16–40 | MEDIUM DENSE |
| 41–70 | DENSE |
| OVER 70 | VERY DENSE |

| NO. OF BLOWS | CONSISTENCY |
|---|---|
| 0–2 | VERY SOFT |
| 3–4 | SOFT |
| 5–8 | FIRM |
| 9–18 | STIFF |
| 19–33 | VERY STIFF |
| 33+ | HARD |

CORRELATION OF PENETRATION RESISTANCE (CALIFORNIA SAMPLER) WITH RELATIVE DENSITY AND CONSISTENCY

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2004
DESIGNED BY DATE
CHECKED BY DATE
APPROVED BY DATE

SCALE
AS SHOWN

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
LOGS OF TESTHOLES

STATE ENGINEERS FILE NO: C-2010

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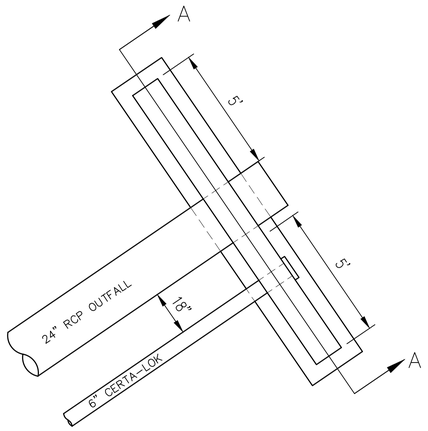
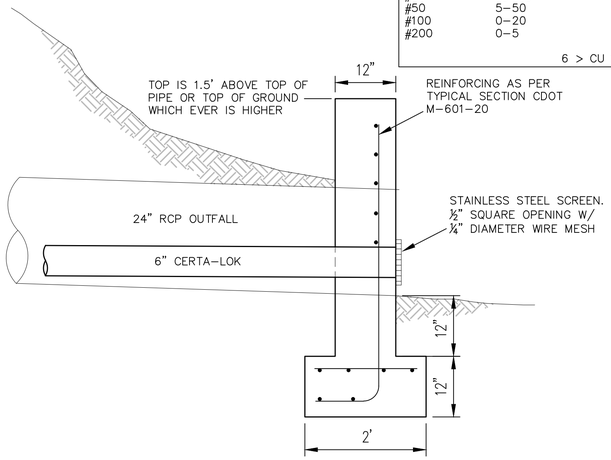



A/13 OUTLET DISCHARGE PLAN VIEW

GRADATION FOR FILTER DIAPHRAGM

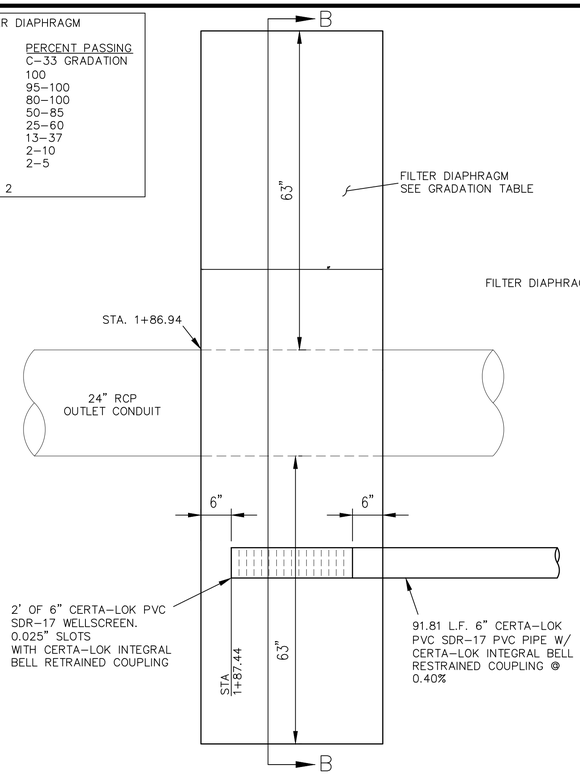
| SIEVE # | PERCENT PASSING CALCULATED GRADATION | PERCENT PASSING C-33 GRADATION |
|---|---|---|
| ⅜" | 90-100 | 100 |
| #4 | 75-100 | 95-100 |
| #8 | 60-95 | 80-100 |
| #16 | 35-80 | 50-85 |
| #30 | 15-65 | 25-60 |
| #50 | 5-50 | 13-37 |
| #100 | 0-20 | 2-10 |
| #200 | 0-5 | 2-5 |

6 > CU > 2




NOTE:
STAINLESS STEEL RODENT SCREEN OVER 6" SEEPAGE PIPE OUTFALL SHALL BE ANCHORED INTO THREADED ANCHORS IN CONCRETE W/ REMOVABLE BOLTS W/ TAMPER PROOF HEADS.

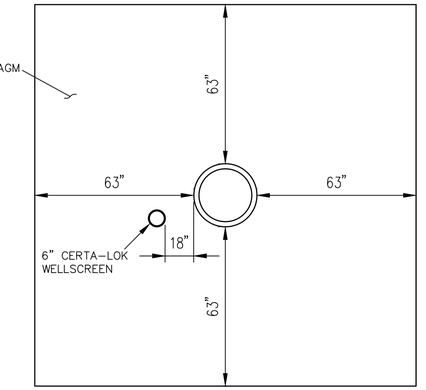
SECTION A-A ELEVATION VIEW




B/13 FILTER DIAPHRAGM PLAN VIEW

REFERENCE DRAWINGS

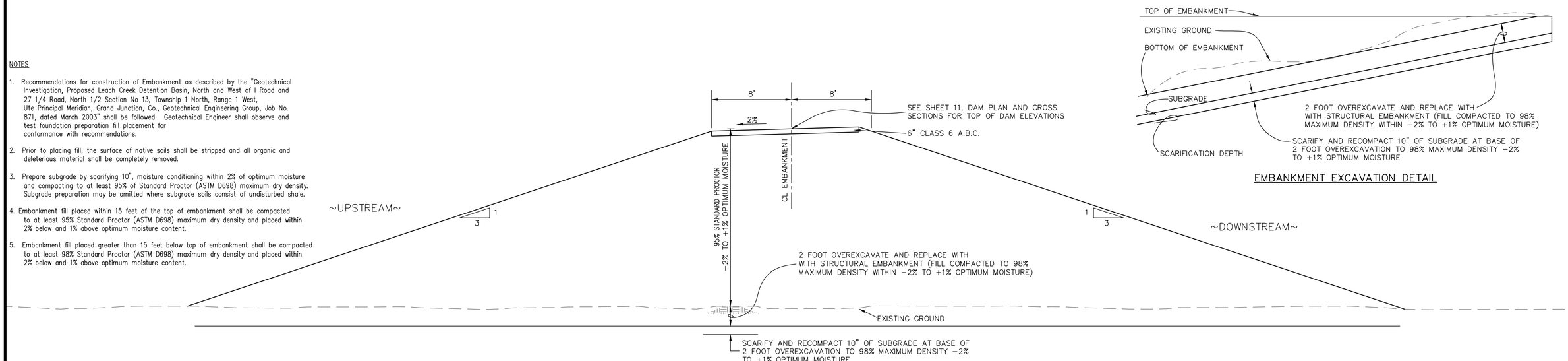





SECTION B-B SECTION VIEW

NOTES

1. Recommendations for construction of Embankment as described by the "Geotechnical Investigation, Proposed Leach Creek Detention Basin, North and West of I Road and 27 1/4 Road, North 1/2 Section No 13, Township 1 North, Range 1 West, Ute Principal Meridian, Grand Junction, Co., Geotechnical Engineering Group, Job No. 871, dated March 2003" shall be followed. Geotechnical Engineer shall observe and test foundation preparation fill placement for conformance with recommendations.
2. Prior to placing fill, the surface of native soils shall be stripped and all organic and deleterious material shall be completely removed.
3. Prepare subgrade by scarifying 10", moisture conditioning within 2% of optimum moisture and compacting to at least 95% of Standard Proctor (ASTM D698) maximum dry density. Subgrade preparation may be omitted where subgrade soils consist of undisturbed shale.
4. Embankment fill placed within 15 feet of the top of embankment shall be compacted to at least 95% Standard Proctor (ASTM D698) maximum dry density and placed within 2% below and 1% above optimum moisture content.
5. Embankment fill placed greater than 15 feet below top of embankment shall be compacted to at least 98% Standard Proctor (ASTM D698) maximum dry density and placed within 2% below and 1% above optimum moisture content.




TYPICAL EMBANKMENT SECTION - LEACH CREEK
STA 0+00 TO STA 14+38.71




EMBANKMENT EXCAVATION DETAIL

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2003
DESIGNED BY JLS DATE 2003
CHECKED BY JLS DATE 2003
APPROVED BY DATE

SCALE FEET 0 1.25 2.5 5

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
TYPICAL DAM CROSS SECTION AND FILTER DIAPHRAGM DETAILS

STATE ENGINEERS FILE NO: C-2010

9 OF 16

PROJECT NO. 202-F35500

## GENERAL NOTES

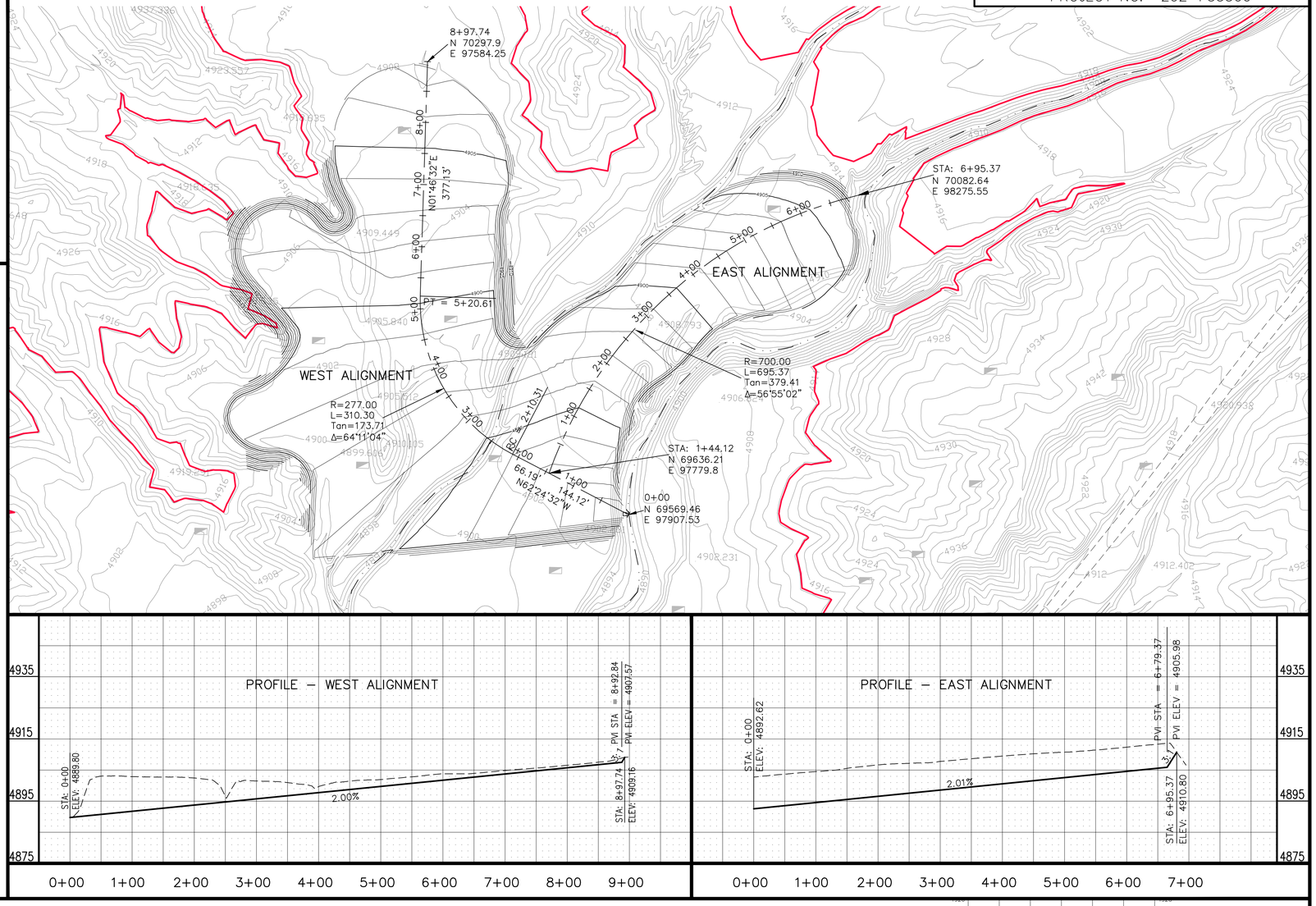
TOPOGRAPHY TAKEN FROM MESA COUNTY/CITY OF GRAND JUNCTION CIRCA 2001
2' INTERVAL CONTOURS (DATUM: NAD 83)

COORDINATES SHOWN ARE CITY OF GRAND JUNCTION LOCAL COORDINATE DEFINITION.

FOR THE LOCATION OF TESTHOLES SEE SHEET 6

## REFERENCE DRAWINGS

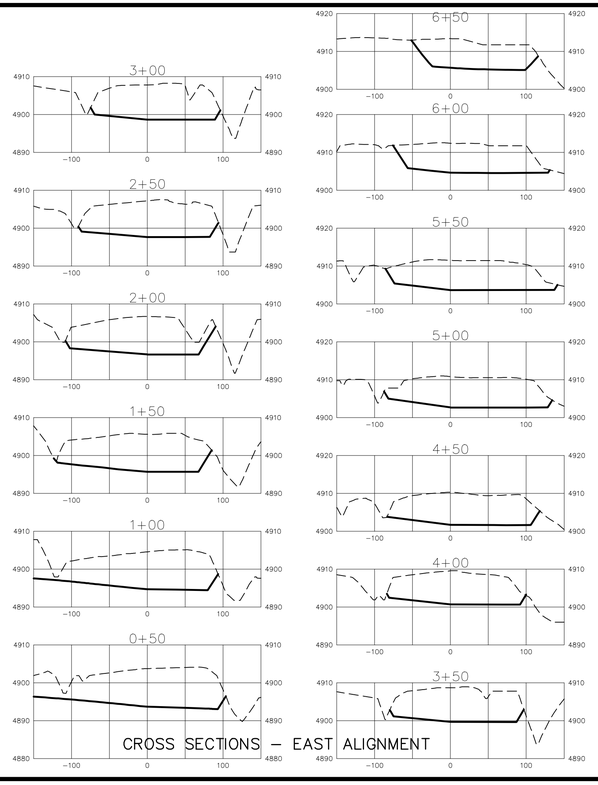


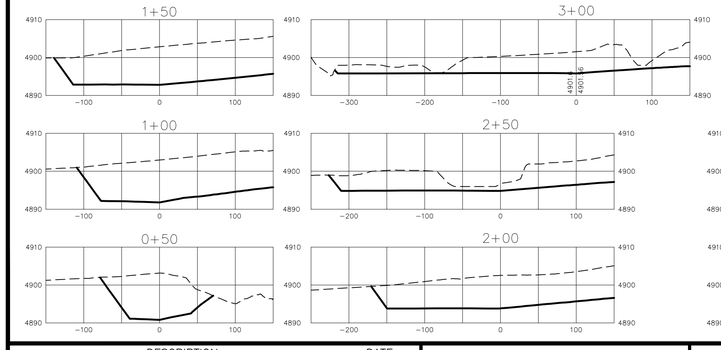


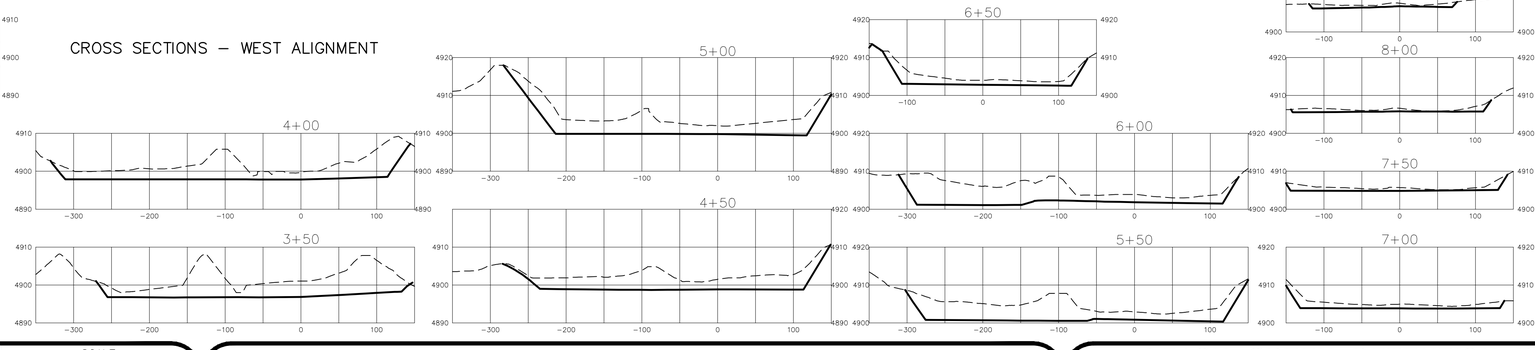







| DESCRIPTION | DATE |
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| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2003
DESIGNED BY JLS DATE 2003
CHECKED BY JLS DATE 2003
APPROVED BY DATE

SCALE FEET
HORIZ. 0 25 50 100
VERT. 0 5 10 20

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
BORROW AREA PLAN, PROFILE, AND CROSS SECTIONS

STATE ENGINEERS FILE NO: C-2010

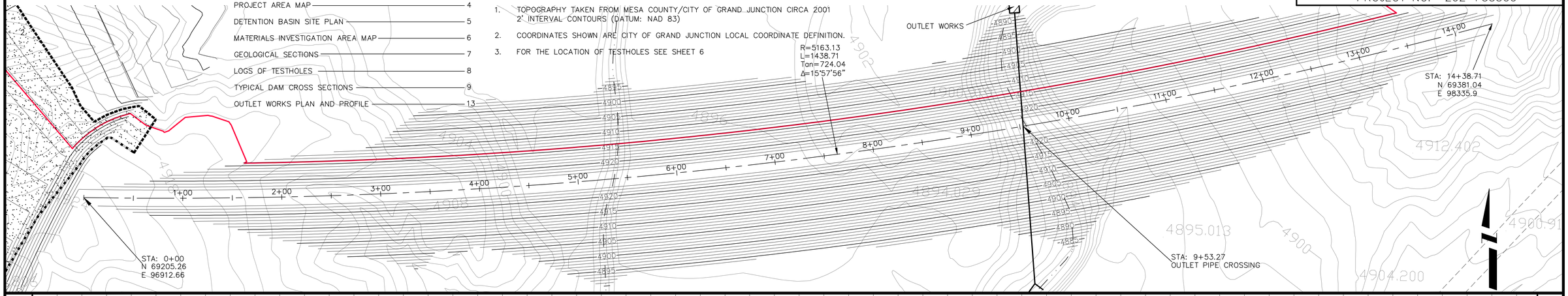
PROJECT NO. 202-F35500

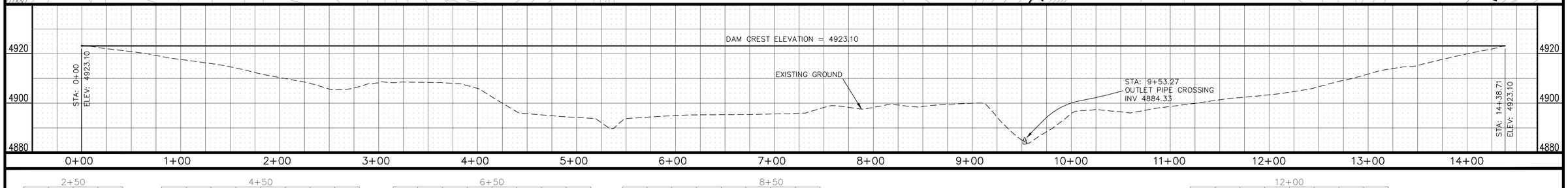
## REFERENCE DRAWINGS

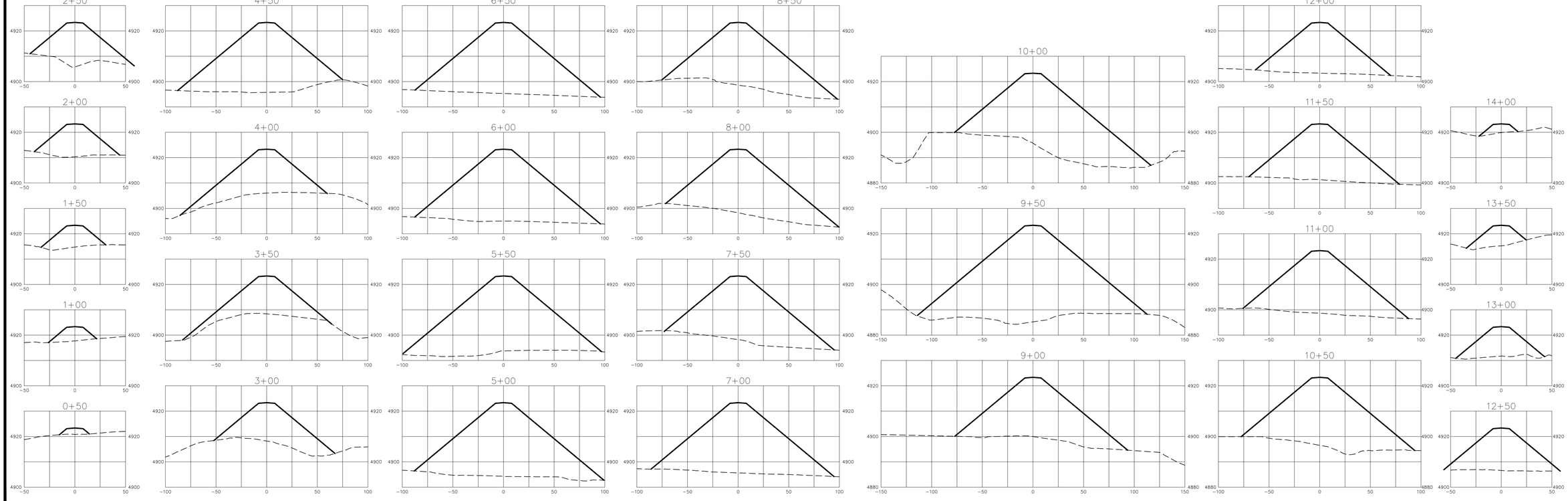


## GENERAL NOTES

1. TOPOGRAPHY TAKEN FROM MESA COUNTY/CITY OF GRAND JUNCTION CIRCA 2001 2' INTERVAL CONTOURS (DATUM: NAD 83)
2. COORDINATES SHOWN ARE CITY OF GRAND JUNCTION LOCAL COORDINATE DEFINITION.
3. FOR THE LOCATION OF TESTHOLES SEE SHEET 6




| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

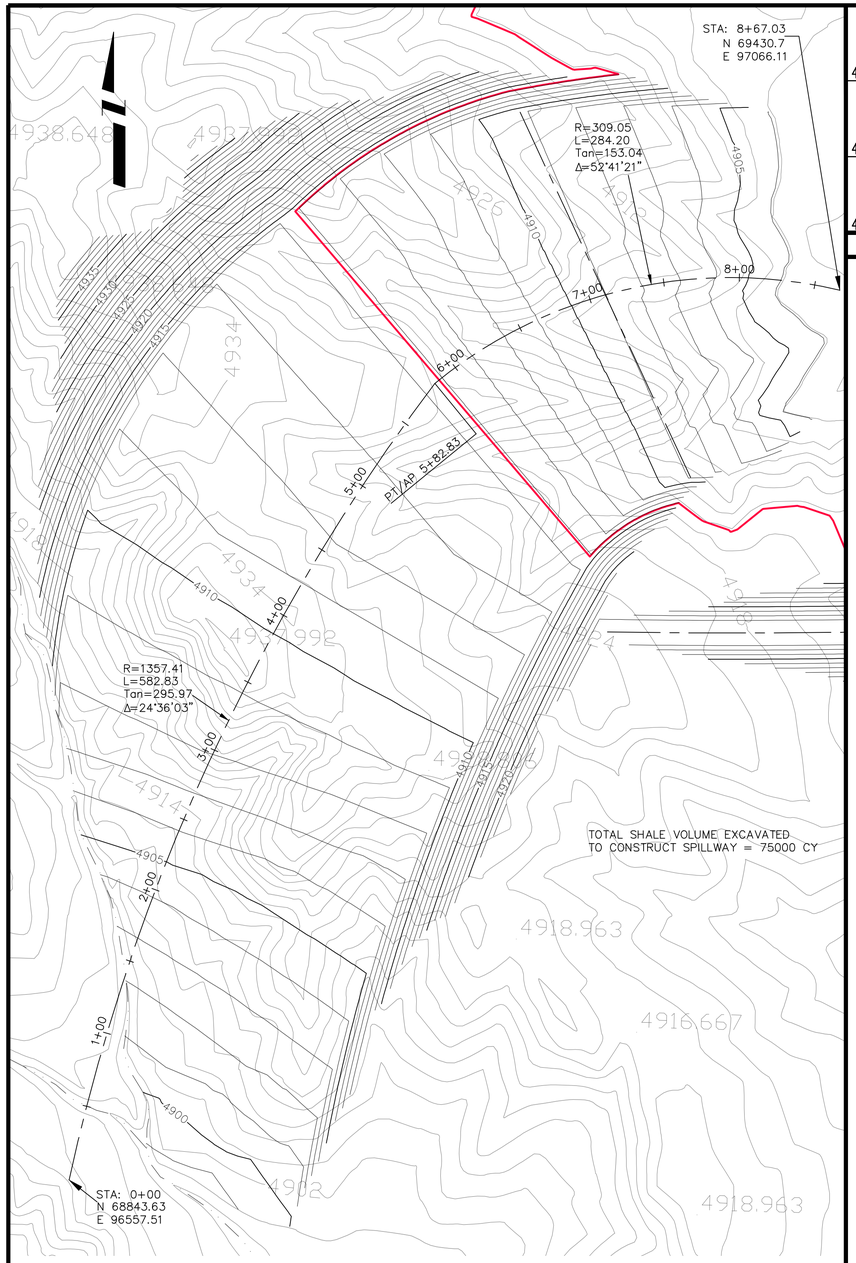
DRAWN BY JCS DATE 2003
DESIGNED BY JLS DATE 2003
CHECKED BY JLS DATE 2003
APPROVED BY DATE

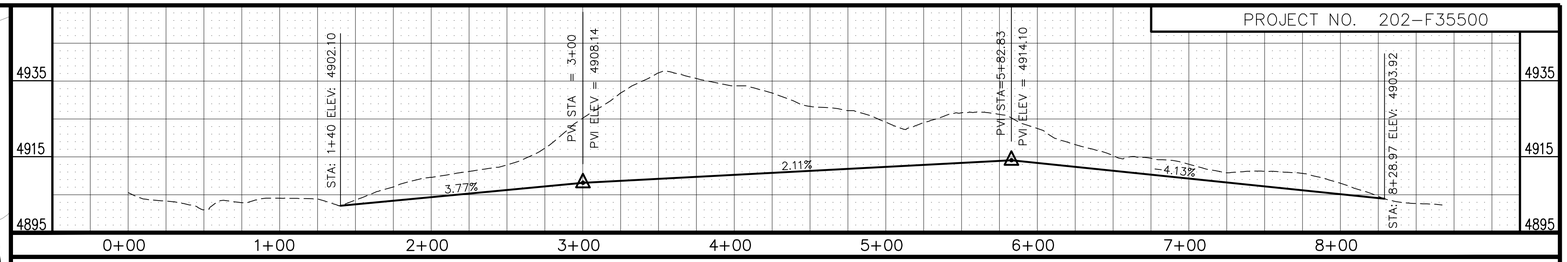
SCALE FEET
HORIZ. 0 12.5 25 50
VERT. 0 5 10 20

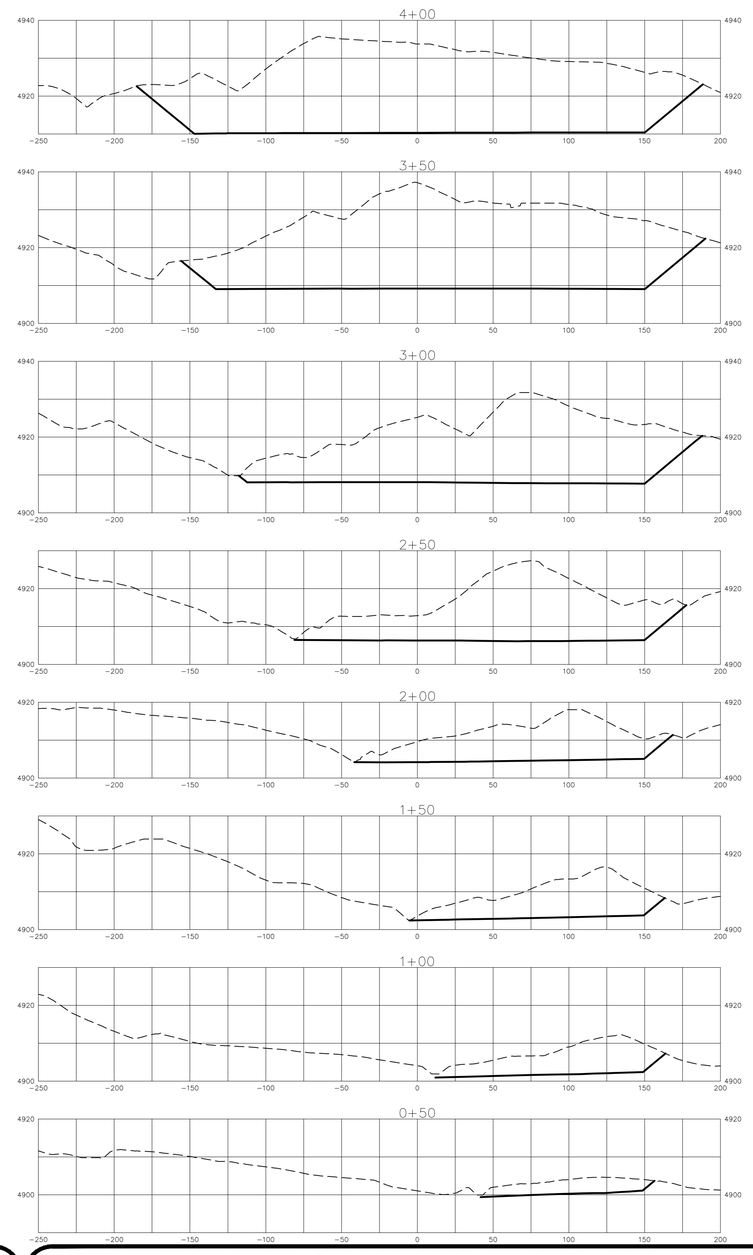
DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

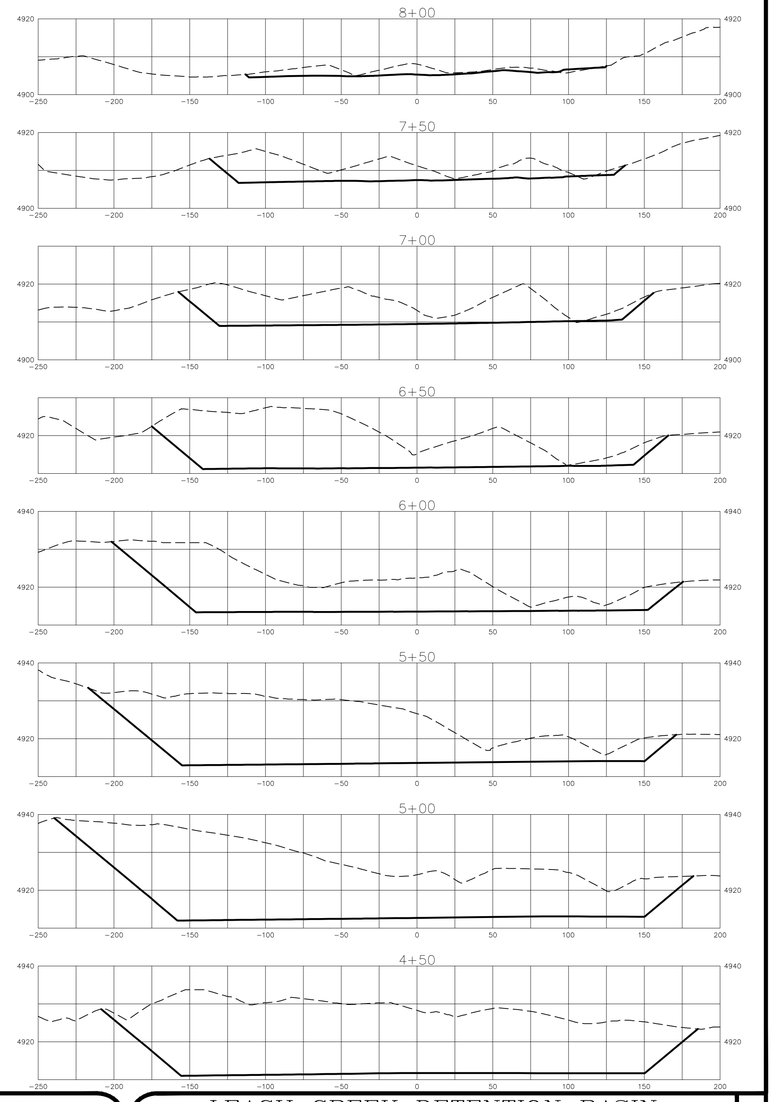
LEACH CREEK DETENTION BASIN
DAM PLAN, PROFILE, AND CROSS SECTIONS

STATE ENGINEERS FILE NO: C-2010




## GENERAL NOTES

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2. COORDINATES SHOWN ARE CITY OF GRAND JUNCTION LOCAL COORDINATE DEFINITION.
3. FOR THE LOCATION OF TESTHOLES SEE SHEET 6

## REFERENCE DRAWINGS



| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2003
DESIGNED BY JLS DATE 2003
CHECKED BY JLS DATE 2003
APPROVED BY ____ DATE ____

SCALE FEET
HORIZ. 0 12.5 25 50
VERT. 0 5 10 20

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
SPILLWAY PLAN, PROFILE, AND CROSS SECTIONS

STATE ENGINEERS FILE NO: C-2010

PROJECT NO. 202-F35500


## REFERENCE DRAWINGS



## GENERAL NOTES

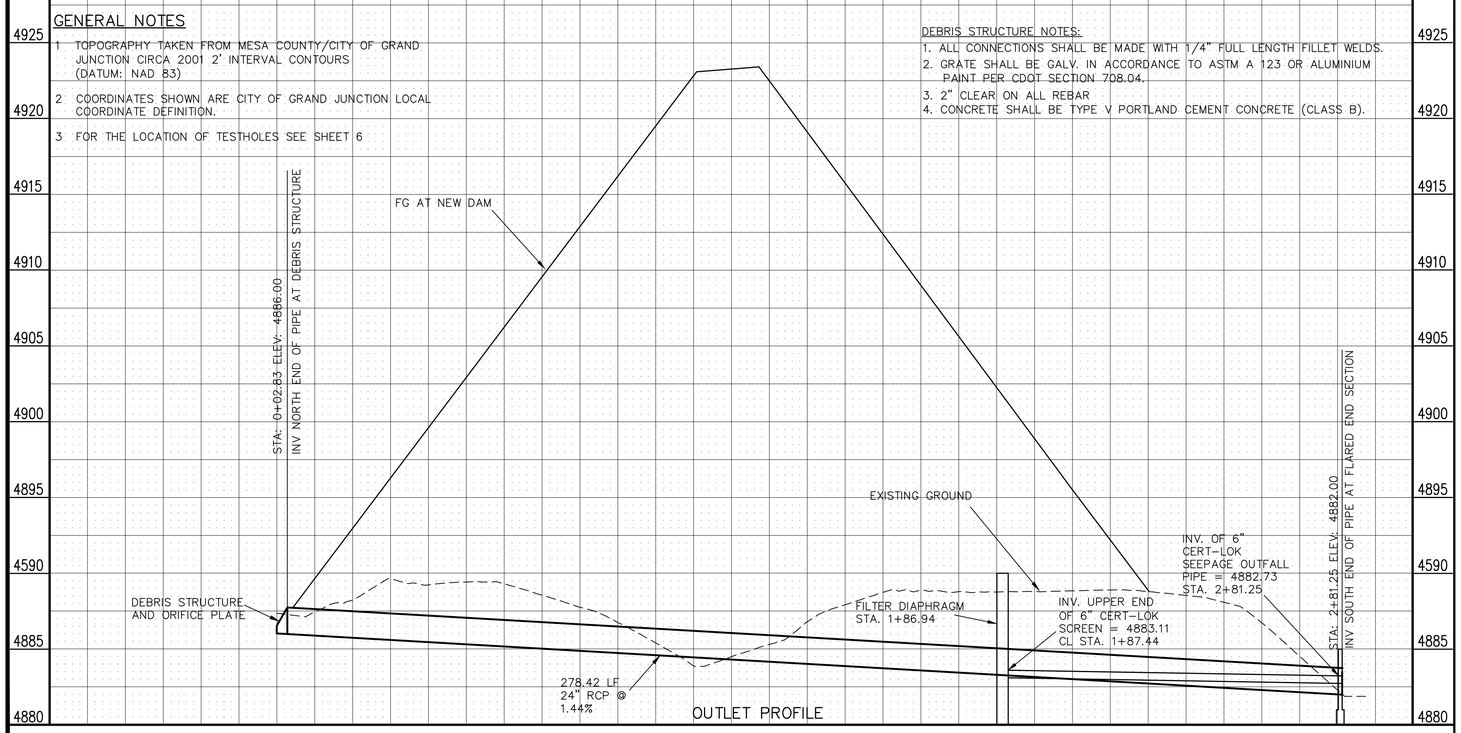
1 TOPOGRAPHY TAKEN FROM MESA COUNTY/CITY OF GRAND JUNCTION CIRCA 2001 2' INTERVAL CONTOURS (DATUM: NAD 83)

2 COORDINATES SHOWN ARE CITY OF GRAND JUNCTION LOCAL COORDINATE DEFINITION.

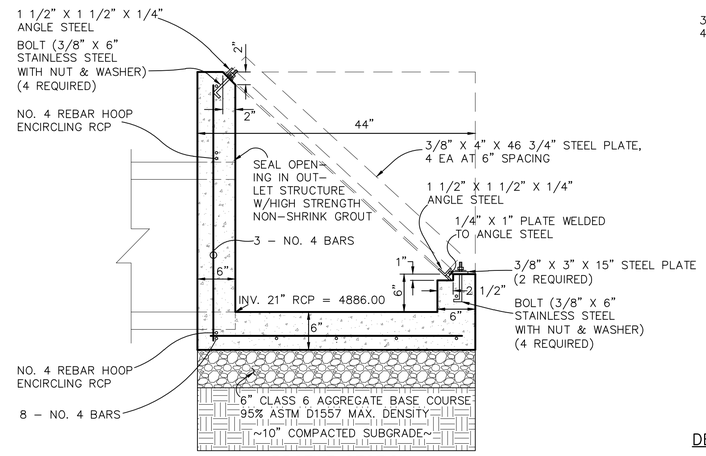
3 FOR THE LOCATION OF TESTHOLES SEE SHEET 6

DEBRIS STRUCTURE NOTES:

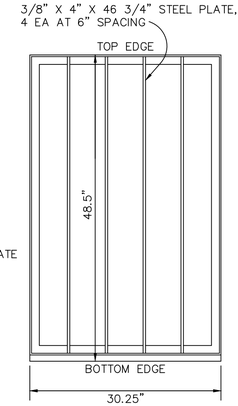
1. ALL CONNECTIONS SHALL BE MADE WITH 1/4" FULL LENGTH FILLET WELDS.
2. GRATE SHALL BE GALV. IN ACCORDANCE TO ASTM A 123 OR ALUMINIUM PAINT PER CDOT SECTION 708.04.
3. 2" CLEAR ON ALL REBAR
4. CONCRETE SHALL BE TYPE V PORTLAND CEMENT CONCRETE (CLASS B).



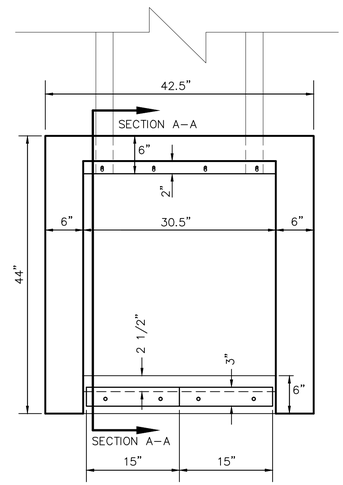

OUTLET PROFILE



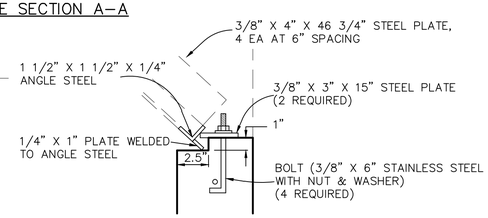

PROFILE SECTION A–A



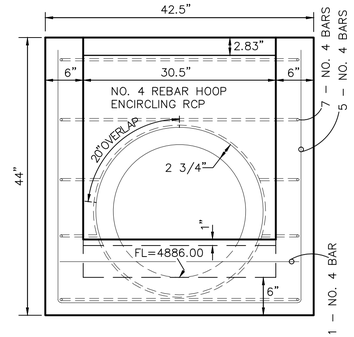

DEBRIS SCREEN PLAN VIEW



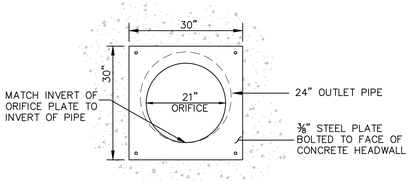

STA. 0+00 – PLAN VIEW
OUTLET CONTROL/
DEBRIS STRUCTURE




LOWER GRATE HOLD DOWN




STA. 0+00 – END VIEW (DEBRIS SCREEN NOT SHOWN)




STA. 0+00 – INLET ORIFICE PLATE

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

| | | | |
|---|---|---|---|
| DRAWN BY | JCS | DATE | 2003 |
| DESIGNED BY | JLS | DATE | 2003 |
| CHECKED BY | JLS | DATE | 2003 |
| APPROVED BY | | DATE | |

SCALE
FEET
HORIZ. 0 5 10 20
VERT. 0 1.25 2.5 5

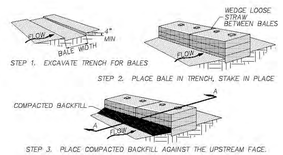
DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
OUTLET WORKS PLAN AND PROFILE

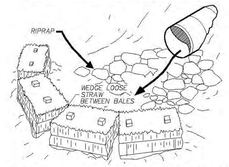
STATE ENGINEERS FILE NO: C-2010

13 OF 16

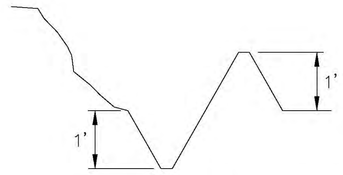
PROJECT NO. 202-F35500


**SECTION A-A**
**BALE INSTALLATION PROCEDURE**




**DETAIL C - CULVERT OUTLET TRAP**
N.T.S.
**ANCHORED STRAW BALE (A.S.B.)**




**WINDROW AROUND PERIMETER OF DISTURBANCE AREA**

## LEGEND

AREAS OF DISTURBANCE (31.80 acres)

AREAS OF DISTURBANCE BOUNDARY
SF SILT FENCE
A.S.B. ANCHORED STRAW BALE
DIRECTION OF FLOW

HYDROLOGIC SOIL TYPES
SCS SOIL TYPE C - SANDY CLAY LOAM

## GENERAL NOTES

1. TOPOGRAPHY TAKEN FROM MESA COUNTY/CITY OF GRAND JUNCTION CIRCA 2001 2' INTERVAL CONTOURS (DATUM: NAD 83)
2. COORDINATES SHOWN ARE CITY OF GRAND JUNCTION LOCAL COORDINATE DEFINITION.
3. FOR THE LOCATION OF TESTHOLES SEE SHEET 6

## REFERENCE DRAWINGS



EROSION CONTROL MEASURES

Performance Standards

The general requirements for erosion control work shall be as follows:

1. Any grading shall be conducted in such a manner so as to effectively reduce accelerated soil erosion and resulting sedimentation.
2. All grading shall be designed, constructed and completed in such a manner so that exposed area of any disturbed land shall be limited to the shortest time period.
3. Sediment caused by accelerated soil erosion shall be removed from runoff water before leaving the site.
4. Any temporary or permanent facility designed and constructed for the conveyance of water around, through, or from the graded area shall be designed to limit the water flow to a non-erosive velocity.

During Construction (Temporary Measures)

1. Anchored Straw Bales (ASB): The use of hay bales is proposed at the storm sewer outlets into channel and at all inlet locations (see Details C). Other locations are shown on the plan. Installation shall be in accordance with the detail as shown on the plans (see Detail C).
2. Silt Fence (SF) The use of silt fences is proposed at the toes of fill slopes and other areas where sediment from upstream flows may spill to existing drainage ways. Other locations are shown on the plan. Installation shall be in accordance with the detail as shown on the plans (see Detail B).

After Construction (Permanent Measures)

1. Rip-Rap: The use of rip-rap per construction drawings is proposed for the storm sewer outlets. It shall function to take the impact of the release water, thereby reducing velocities to a non-erosive rate (See plan for storm sewer outfall location).

Maintenance

1. The contractor or his designated representative shall make routine checks on all erosion control measures to determine if repairs or sediment removal is necessary.
2. After each rainfall or moderate snow melt, erosion control measures are to be checked. If repairs are needed, they shall be completed immediately.
3. Silt and sediment shall be removed when they reach a height of one-half of the barrier (silt fence or anchored straw bale).
4. When temporary measures are to be removed, any silt and sediment deposits shall be removed and spread evenly in fill areas.

General Notes

1. At all times during construction, erosion and sediment control shall be maintained by the contractor or his designated representative.
2. Erosion control system shall be installed as grading progresses.
3. Erosion bales shall be straw or hay, depending on availability.
4. Details shown are schematic only. Adjust as necessary to fit field conditions.
5. Erosion bales shall be placed to avoid runoff flowing between, around or under bales. Bales shall be anchored with 2" x 2" x 4' wooden stakes or #4 reinforcing bars, two per bale (see details for further instructions).
6. Negative impacts to downstream areas (or receiving waters) caused by the slope grading to be monitored and corrected by the contractor.
7. Construction traffic entrances shall be cleaned on a continual basis during slope grading.

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2003
DESIGNED BY JLS DATE 2003
CHECKED BY JLS DATE 2003
APPROVED BY DATE

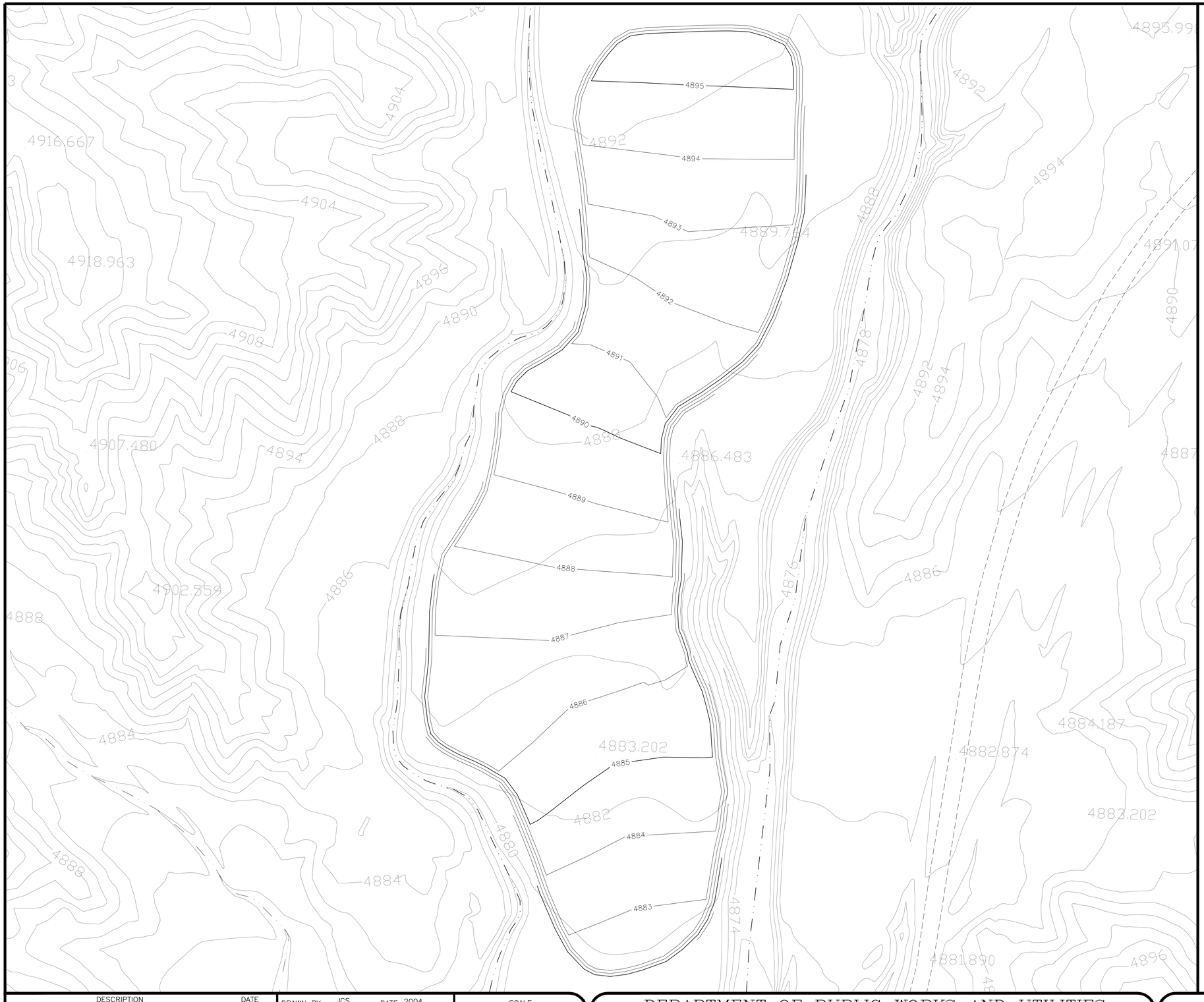
SCALE
FEET
0 62.5 125 250

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
STORM WATER MANAGEMENT PLAN

STATE ENGINEERS FILE NO: C-2010

PROJECT NO. 202-F35500




## GENERAL NOTES

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2. COORDINATES SHOWN ARE CITY OF GRAND JUNCTION LOCAL COORDINATE DEFINITION.

## REFERENCE DRAWINGS

DETENTION BASIN SITE PLAN ——— 5

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2004
DESIGNED BY DD DATE 2004
CHECKED BY DATE
APPROVED BY DATE

SCALE FEET
0 12.5 25 50

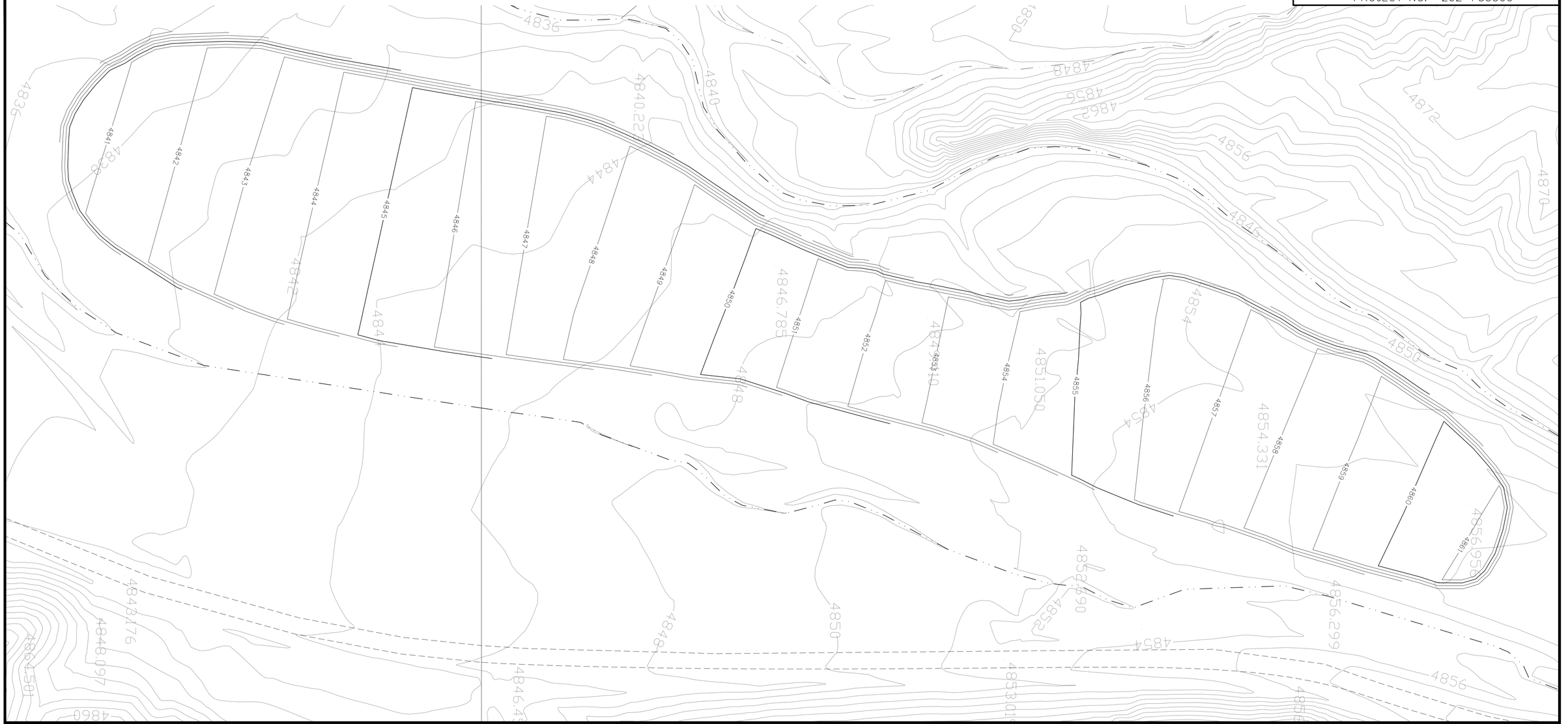
DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
HAUL AREA 1 GRADING PLAN

STATE ENGINEERS FILE NO: C-2010

15 OF 16

PROJECT NO. 202-F35500




## GENERAL NOTES

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2. COORDINATES SHOWN ARE CITY OF GRAND JUNCTION LOCAL COORDINATE DEFINITION.

## REFERENCE DRAWINGS

DETENTION BASIN SITE PLAN ——— 5

| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | |
| REVISION 2 | |
| REVISION 3 | |

DRAWN BY JCS DATE 2004
DESIGNED BY DD DATE 2004
CHECKED BY ____ DATE ____
APPROVED BY ____ DATE ____

SCALE
FEET
0 12.5 25 50

DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING AND TECHNICAL SERVICES DIVISIONS
CITY OF GRAND JUNCTION, COLORADO

LEACH CREEK DETENTION BASIN
HAUL AREA 2 GRADING PLAN

STATE ENGINEERS FILE NO: C-2010

16 OF 16

*City of Grand Junction*

Department of Public Works and Planning Division

Construction Specifications

# Leach Creek - Flood Control Dam
(North ½ Sec13, T 1 N, R 1 W, Ute Meridian, Mesa County )
Dam ID 720422

## Owner: City of Grand Junction, Colorado

***ENGINEER CERTIFICATION***

I, S. Bret Guillory, PE, certify that these specifications were prepared by me or under my direct supervision, and were based upon the criteria laid out in the Department of Natural Resources, Division of Water Resources Office of the State Engineer, Rules and Regulations for Dam Safety and Dam Construction 2 CCR 402-1.

Signature — CO 31675 License Number — 7/24/12 Date

COLORADO LICENSED STEVEN BRET GUILLORY 31675 PROFESSIONAL ENGINEER

Approved on the 3RD day of AUGUST, 20 12.

DICK WOLFE
State Engineer

By: WILLIAM T. McCormick III
For: Deputy
CHIEF, DAM SAFETY BRANCH
CO PE 29127

STATE ENGINEER OF COLORADO

July 2012

**C-2010**

CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION

**Leach Creek Flood Control Dam**

# SPECIAL CONDITIONS

The performance of the Work for this Project shall conform to the General Contract conditions presented in the City of Grand Junction's *Standard Contract Documents for Capital Improvements Construction,* revised July 2010, except as specifically modified or supplemented herein or on the Construction Drawings.

SC-1 Project Description: The project generally consists of construction of a 1,400 foot long, 39 foot high, storm water detention facility on the main stem of the Leach Creek Drainage. This will include excavation of approximately 166,000 CY, Placement of 92,000 CY Dam embankment, placement of 56,000 CY spoil material, 280 feet of 21" Class 5 RCP outlet pipe, installation of sand filter diaphragm, inlet structure, surface grading and restoration of disturbed areas including; spoil piles, dam, and access road.

SC-2 Project Engineer: The Project Engineer for the Project is Bret Guillory, PE, who can be reached at (970) 244-1590. All notices, letters, submittals, and other communications directed to the City shall be addressed and mailed or delivered to:

City of Grand Junction
Department of Public Works and Planning
Attn: Bret Guillory, PE, Utility Engineer
250 North Fifth Street
Grand Junction, CO 81501

SC-3 Pre-Construction Meeting:

A pre-construction meeting will be held at 10:00 a.m. on August 3, 2012, on site. Further discussion will take place in the Public Works Executive Conference Room at 1:30 p.m. on the same day, (City Hall, 250 North 5th Street).

SC-4 Affirmative Action: The Contractor is not required to submit a written Affirmative Action Program for the Project.

SC-5 Estimated Time of Completion: The scheduled time of Completion for the Project is **60 Calendar Days**. These days will not be consecutive.

Final completion is achieved when site clean up and all punch list items (resulting from the final inspection) have been completed. Final completion shall have the meaning set forth in Article I, Section 3 (Definitions and Terms) of the General Contract Conditions.

The anticipated schedule for the Project is as follows:

| | |
|---|---|
| Preconstruction meeting: | August 3, 2012 |
| Begin work: | August 16, 2012 |
| Substantial Completion: | September 18, 2012 |
| Final Completion: | November 18, 2012 |

SC-6 Liquidated Damages:

The US Army National Guard, 947th Engineer Company (Horizontal), (Contractor) will be providing equipment and personnel for the construction of this dam. The Contractor will provide full time work crews for this project starting August 16, 2012 through September 12, 2012. Work remaining to be completed will then be completed by crews working weekends starting September 15, 2012 through final completion. Liquidated damages will not be charged against this Contractor.

SC-7 Working Days and Hours: The working days and hours shall be 6:00a.m through 10:00 p.m., seven days per week from the starting date through September 12 as stated in SC-6. Daily start and finish times may vary based on the Contractors ability to mobilize work force.

SC-8 Permits: The following permits/approvals are required for the Project and will be obtained by the City at no cost to the Contractor:

State Engineers Office, Division of Water Resources - Dam Safety Branch Approval
Bureau of Land Management ROW Permit
US Army Corps of Engineers Nationwide 43 Permit
Storm Water Discharge Permit

SC-9 Insurance Limits: The minimum insurance limits for the Project are as stated in the General Contract Conditions.

SC-10 City Furnished Materials/ Services: The City will furnish the following materials/services for the Project:

Construction surveying
Installation of Pipe and Appurtenances

SC-11 Project Newsletters: Project newsletters will not be required for this project.

SC-12 Project Sign: Project signs, if any, will be furnished and installed by the City.

SC-13 Authorized Representatives of the City: Those authorized to represent the City shall include engineers and inspectors employed by the City, only.

SC-14 Uranium Mill Tailings: It is anticipated that no radioactive mill tailings will be encountered on this Project.

SC-15 Fugitive Petroleum or Other Contamination: It is anticipated that soil contamination from fugitive petroleum or other contaminants will not be encountered with the Project.

SC-16 Existing Permanent Easements: The existing permanent easement areas shall be restored as noted on the approved construction plans.

SC-17 Temporary Construction Easements: All construction activity shall be limited to the areas of disturbance indicated as embankment, borrow, or spoil as indicated on the approved plans.

SC-18 Existing Alley Right-of-Ways: The existing sanitary sewer line is within an existing alley right-of-way that varies in width from 18 to 20 feet wide. All sanitary sewer replacement alley construction will be done within the existing right-of-way.

SC-19 Traffic Control: The Contractor shall be aware that 27 ¼ Road is a public ROW and shall be regarded as such. The City will provide traffic control signage for this project.

1. The Contractor shall adhere to all traffic control requirements when working within City right-of-way.

SC-20 Excess Material: All excess materials shall be disposed at the two spoil areas designated on the approved plan set.

SC-21 Existing Property Pins and Survey Monuments: There are no property pins or survey monuments within the disturbance area associated with this project. The Contractor will be held responsible for replacement of damaged survey monuments or property pins that are located outside the construction area as shown on the approved construction drawings.

SC-22 Interruption of Utilities and Services: There are no existing utilities within the work zone.

CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND PLANNING
ENGINEERING DIVISION

**Leach Creek Flood Control Dam**

# SPECIAL PROVISIONS

## GENERAL:

There are no listed pay items or Bid Schedule for this Project. The project scope includes site preparation and placement of embankment for an earthen flood control dam. Work performed, as required in the Contract Documents, will be in accordance with the items and units included on the approved construction plan set and these specifications.

All construction and oversight will be accomplished in accordance with current rules and regulations for construction of earth embankment dams as defined by the Colorado Division of Water Resources Dam Safety Branch Rule 5 as follows:

The construction plans and specifications cannot be materially changed without the written approval of the State Engineer (Rule 5.3.4)

Construction will not be considered complete until accepted in writing by the State Engineer (Rule 5.3.5)

The owner's engineer will monitor the quality of construction (Rule 5.3.6)

## STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION:

The ***City of Grand Junction Standard Specifications for Road and Bridge Construction*** are hereby modified or supplemented for this Project by the following modifications to ***The Standard Specifications for Road and Bridge Construction***, State Department of Highways, Division of Highways, State of Colorado:

SP-1 Section 201 – Clearing and Grubbing

The contractor shall remove all vegetative mater from the dam footprint prior to preparing the area for cutoff wall and initial placement of embankment materials. All work shall be completed in accordance with the recommendations identified in the Geotechnical Investigation found in Appendix C of the Design Report for this project.

SP-2 Section 208 – Erosion Control

The Contractor shall be responsible for protecting all erosion control measures installed by the City of Grand Junction. The City will be responsible for maintenance of the Storm Water BMP's upon completion of the project.

SP-3 Section 203 – Excavation and Embankment

Section 203 shall be amended as follows:

The Contractor shall be responsible for materials preparation and placement per recommendations in the Geotechnical Investigation included in Appendix C of the Design Report.

Sub-grade preparation, embankment material preparation and placement shall be accomplished as described in Item 2, Page 23, of the Geotechnical Investigation – Proposed Leach Creek Detention Basin – Alternate Location 1A (dated August 23, 2003 – Job No. 1,276) and completed by Geotechnical Engineering Group, Inc. (GEG) included in Appendix C of the Design Report.

SP-4 Construction Observation Plan

The City will have full time geotechnical observation for this project. We anticipate placement of approximately 92,000 cubic yards of embankment material for this structure. Moisture/density compliance testing will be accomplished by Ground Engineering for this project. Moisture/density tests will be taken for each 200 cubic yards of material placed (roughly one test / one foot lift of material / 100 lineal feet of embankment placed). This testing schedule may be more frequent during the initial processing and placement of material in order to establish a viable procedure to process material to a point that it will meet the required moisture/density specification.

Sand cone confirmation of the in place moisture/density tests will be prepared for each ten (10) moisture/density tests taken during the few days of construction in order to confirm that the compaction specification is being met. Sand cone tests will be conducted for each 50 moisture/density tests upon confirmation of the specification.

The geotechnical Engineer will also be responsible for providing laboratory verification of test results that will include a minimum of samples taken to confirm / adjust the testing criteria for this project:

| Sample Number | Laboratory Test |
|---|---|
| 6 | Soil Classification |
| 3 | Hydrometer |
| 6 | Standard Proctor |
| 20 | Oven Dried Moisture |
| 20 | In-Place Moisture/ Density (sand cone confirmation per ASTM D1556-07) |

SP-5 Section 209 – Watering and Dust Pallatives

The City of Grand Junction will provide water trucks for preparation of embankment and dust control related to this project.

SP-6 Site Access

Site access shall be limited to areas shown on the Approved Construction Drawings.

Temporary construction staging areas are also limited to the locations shown on the construction drawings or to areas within the borrow and spoil limits.

## STANDARD SPECIFICATIONS FOR CONSTRUCTION OF WATER LINES, SANITARY SEWERS, STORM DRAINS, UNDERDRAINS AND IRRIGATION SYSTEMS

The City of Grand Junction ***Standard Specifications for Construction of Water Lines, Sanitary Sewers, Storm Drains, Underdrains and Irrigation Systems*** are hereby modified for this Project as follows:

SP-7 Coordination for Installation of Outlet Piping and Appurtenances

The City of Grand Junction will hire another contractor to install the 21" Class 5 RCP outlet pipe, concrete outlet head wall, sand diaphragm and drain line, and concrete inlet structure for this project. The City will coordinate with the National Guard crews constructing this dam.

SP-8 Bedding and Haunching for Outlet Piping

The bedding and haunch material for the outlet pipe will be non-diggable flowable fill. This material will be batched to produce a minimum compressive strength of 350 psi. Three cylinders will be collected for every three loads of this material delivered to the site. Cylinders shall be prepared in accordance with ASTM D4832-10. Compressive strength meeting this specification shall be attained at 28 days. The area of the sand filter diaphragm will be protected with temporary bulkheads that will be removed when the flowable fill material has set to a point that will not collapse upon removal of the bulkhead.

**Geotechnical Engineering Group, Inc.**

# GEOTECHNICAL INVESTIGATION
## Proposed Leach Creek Detention Basin – Alternate Location 1A
## North and West of H Road and 27 ¼ Road
## North ½ Section No. 13, Township 1 North, Range 1 West, Ute Principal Meridian
## Grand Junction, Colorado

**Prepared For:**

**City of Grand Junction**
**Department of Public Works, Engineering Division**
**250 North 5th Street**
**Grand Junction, CO 81501**

**Attention: Mr. Jim Shanks, PE, PLS**

**Job No. 1,276**

**August 28, 2003**

Geotechnical, Environmental and Materials Testing Consultants

(970) 245-4078 • fax (970) 245-7115 • geotechnicalgroup.com
2308 Interstate Avenue, Grand Junction, Colorado 81505

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## SCOPE

This report presents the results of a Geotechnical Investigation for the proposed Leach Creek Detention Basin located north and west of H Road and 27 ¼ Road in Grand Junction, Colorado. Our investigation was conducted to provide information on the local geology of the area, explore subsurface conditions in proposed foundation and borrow areas, test site borrow areas soils for suitability as embankment fill and to provide recommendations for embankment design and construction. This report includes descriptions of subsoil and groundwater conditions found in thirty-seven exploratory borings, results of field and laboratory testing, results of analysis and design and construction recommendations for the proposed construction. This investigation was performed in general conformance with our Proposal No. 02-336 dated December 11, 2002.

This report was prepared from data developed during our field exploration, laboratory testing, engineering analysis, experience with similar conditions and review of the City of Grand Junction, "Request For Proposal For Geotechnical Engineering Testing and Design Services" dated July 24, 2001, the "Rules and Regulations for Dam Safety and Construction" dated September 30, 1988 by State of Colorado, Office of the State Engineer and the "Design of Small Dams" dated 1987 by the United States Bureau of Reclamation. A brief summary of our

conclusions and recommendations follows. Detailed criteria are presented within the report.

## SUMMARY OF CONCLUSIONS

1. Subsoils found in the 37 exploratory borings consisted of variable depths (0 to 28 feet) of silty, sandy clay underlain by shale to the maximum depth explored of 55 feet below the ground surface. Ground water was not encountered the day of drilling or when checked 6 days later.

2. Relatively moderate bearing capacity soils were encountered in the proposed embankment foundation. Due to the proposed use as a detention basin (flood control) embankment we believe a simple homogenous-type embankment dam can perform satisfactorily.

3. Slope stability and soil bearing capacity analysis of the existing soil conditions indicated factors of safety against slope movement of greater than 1.7. In our opinion, the calculated factor of safety against movement should be adequate for the proposed embankment.

4. Laboratory and field testing indicated the proposed borrow area materials will be suitable for use as embankment soils. Recommendations are included in the text of the report for foundation preparation, placement of embankment soils and upstream and down stream slope protection.

## SITE CONDITIONS

The subject site is located north and west of H Road and 27 ¼ Road in Grand Junction, Colorado. A vicinity map is included as Fig. 1. The subject site was vacant and mostly barren land. The vicinity has been designated for general off highway vehicle (OHV) use. We noted scattered OHV roads / trails across the site. Contours, showing elevation of the existing ground surface are shown on Fig. 2. Slopes reported herein were measured from this data unless otherwise noted.

### Embankment Dam Area

The west portion of the proposed embankment dam consisted of rolling terrain. Sparse grasses and typical desert vegetation were noted. The terrain generally sloped down towards the east and southeast (toward the smaller drainage channel located in the west portion of the site) at 5 to 12 percent.

The central portion of the subject site consisted of a basically flat and nearly level area between the smaller drainage channel noted in the west portion and a larger drainage channel in the east portion. We noted a slight rise near the east drainage channel. The rise was approximately 4 to 6 feet higher than the surrounding grade. The western drainage channel was north/south oriented,

approximately 30 to 40 feet across, approximately 6 feet in depth and bank slopes of 24 degrees to 36 degrees down towards the bottom (measurements estimated by pacing and hand level). Scattered gravel and cobbles were noted in the bottom of the drainage. We noted typical top down erosion in the drainage banks. The eastern drainage was north/south oriented, approximately 45 to 105 feet across, 6 to 10 feet in depth and banks sloped down towards the bottom at 33 degrees to areas of near vertical. We noted scattered gravel, cobble and boulder in the drainage bottom. Silty, sandy clays were noted in the creek banks. Various scattered debris, such as abandoned household appliances and trash, were also noted.

The east portion of the embankment dam was variable rolling terrain. The ground surface was barren with scattered typical desert vegetation. We noted slopes of 6 to 15 percent.

**Borrow Area**

The area north of the proposed embankment dam (proposed borrow area) was basically flat and nearly level with scattered small dry washes that sloped down into the two Leach Creek channels. The ground surface was barren with scattered typical desert vegetation. Rolling terrain was noted north of the

proposed borrow area. The terrain sloped down towards the south and southwest at 2 percent or less.

**Spillway**

The area west of the proposed embankment dam (proposed spillway area) was rolling terrain and sloped down towards the north, south and east. The ground surface was barren with scattered typical desert vegetation. We noted the remnants of an abandoned car in the vicinity of the spillway. We noted several relatively small drainages in the rolling terrain. These drainages appeared to have water flow related erosion. We noted relatively established scattered vegetation in the drainages. The terrain sloped down towards the north, south and east at slopes ranging from 5 percent to 24 percent.

The vicinity generally sloped down towards the south and east at slopes of 1 to 3 percent (USGS Corcoran Point and Grand Junction, Colorado topographic map dated 1962, photoinspected 1973).

## PROPOSED CONSTRUCTION

We understand proposed construction will consist of a storm water detention basin impounded behind a soil embankment (flood control dam) with an approximate 249.5 acre–foot storage capacity. There will be approximately 1,450 lineal feet of embankment with a maximum height of 37 feet. The embankment will be a "small Class II Jurisdictional Dam" as defined by the "Rules and Regulations for Dam Safety and Dam Construction", published by the Office of the State Engineer dated September 30, 1988. The location of the proposed embankment is shown on Figs. 1 and 2. No water will be permanently retained in the basin. The basin will be used solely to detain storm water for a relatively short duration. The maximum design detention period will be 60 hours. If proposed construction changes or is different from what is described by this report, we should be contacted to review actual construction and our recommendations.

## GEOLOGIC CONDITIONS

In order to investigate geological conditions, we visited the site, sampled and tested soils from exploratory borings as described in the text and reviewed documents from our library. We reviewed the "USGS Grand Junction, Colorado"

topographic quadrangle dated 1962, photo revised 1973, the "Geologic Map of Colorado" by Tweto, 1979 and an aerial photograph of the site un-dated (recent) provided by the City of Grand Junction.

The mapped geology of the site identified Mancos Shale formation. In our opinion, site observations and soils we found during this investigation confirm the mapped conditions. The Mancos Shale generally underlies the north portion of the Colorado River basin in this area. The Mancos Formation is surficial toward the north (and Bookcliffs) and has alluvial and flood plain type overburden soils toward the south (and Colorado River).

We also identified mapped alluvium from current and ancient drainages, overlying the formational Mancos shale. Review of topographical maps (USGS Corcoran Point, Colorado and Grand Junction, Colorado, 1962, photorevised 1973) suggest the alluvium was generated from weathering of the Bookcliff area, north of the site. In our opinion, site observations and soils we found during this investigation confirm the mapped conditions. The alluvium identified generally included sandy clays and clayey sands.

The Mancos shale is an overconsolidated material composed primarily of silts and clays. The shale, in our experience, exhibits relatively high bearing

capacities and variable, low to high expansion potential. The shale material exhibits relatively low permeability, however, water has been observed to flow horizontally and vertically through fractures. Water soluble sulfate concentrations in the shales are generally considered to have a severe to very severe effect on concrete. In our experience, the overlying sands and clays exhibit relatively low to moderate bearing capacities and relatively low to moderate permeability. The nearest fault we identified was approximately 6 miles north and east of the site.

## INVESTIGATION

The field portion of our investigation consisted of drilling and sampling thirty-seven (37) exploratory borings in the location of the proposed embankment, spillway and borrow areas. The field drilling program was conducted using a truck mounted, CME-75 drill rig and a track mounted, CME-55 drill rig. A Geotechnical Engineering Group, Inc. Staff Geologist supervised drilling operations and collected samples during drilling. Locations of exploratory borings are shown on Fig. 3. Graphic logs of the soils found in the exploratory borings and field penetration resistance tests are presented in Appendix A, Figs. A-1 through A-11.

## SUBSURFACE CONDITIONS

Subsurface conditions encountered in the exploratory borings consisted of variable depths (0 to 28 feet) of silty, sandy clay underlain by shale to the maximum depth explored of 55 feet below the ground surface. Subsurface conditions are described in more detail in the following paragraphs.

### Silty, Sandy Clays

Silty, sandy clays were generally encountered at the surface to depths of up to 28 feet below the ground surface. The silty, sandy clay was soft to very stiff, dry, tan and brown. Variable sandy clay, clayey gravelly sand and silty to clayey, sandy gravel lenses were identified within the silty, sandy clay. Twelve clay samples were tested. These samples had moisture contents of 5.3 percent to 12.2 percent and dry densities of 91 pcf to 113 pcf. Six samples were tested for Atterberg limits. These samples exhibited liquid limits of 23 to 30, plasticity indices of 5 to 16 and 54 to 81 percent passing the No. 200 sieve (silt and clay sized particles). Another clay sample had 51 percent passing the No. 200 sieve. Selected clay samples were tested for one-dimensional swell / consolidation characteristics. These samples ranged from consolidating 5.7 percent to swelling 1.2 percent when wetted under a confining pressures of 500 psf to

1,000 psf. A standard Proctor (ASTM D698) was performed on two silty, sandy clay samples. These samples exhibited a maximum dry density of 119 pcf and 109.5 pcf at optimum moistures of 11.0 and 17.0 percent, respectively. Due to relatively large particle sizes in the samples triaxial shear tests were performed on relatively undisturbed and remolded samples. Two relatively undisturbed samples were tested under consolidated-drained conditions. These samples exhibited a cohesion value of 0 psf and 37 psf and angle of internal friction values of 34 and 29.9 degrees, respectively. Two remolded samples were tested under consolidated-drained conditions. These samples exhibited cohesion values of 599 psf and 550 psf and angle of internal friction values of 32.9 and 28.7 degrees, resepectively. Silty, sandy clay samples were also tested for permeability, moisture-density relationship and presence of dispersive clays characteristics. Further discussion of these tests are included later in the text.

Eleven samples of the sand lenses that were identified within the silty, sandy clays were also tested. The sand lenses identified by this investigation were generally limited and not widespread. Sand samples tested had moisture contents of 3.8 percent to 9.6 percent. Five sand samples tested had dry densities of 106 pcf to 116 pcf. Four sand samples tested exhibited liquid limits

of 20 to 24, plasticity indices of 3 to 6 and 19 to 39 percent passing the No. 200 sieve. Other sand samples tested had 14 to 42 percent passing the No. 200 sieve. One sand sample was tested for one-dimensional swell / consolidation characteristics. This sample exhibited no movement when wetted under a confining pressure of 1,000 psf. One gravelly, clayey, sand sample was tested for standard Proctor (ASTM D698). This sample exhibited a maximum dry density of 119.5 pcf at an optimum moisture content of 11.0 percent. Laboratory test results are presented in Appendix B, Figs. B-1 through B-30 and summarized in Tables B-I and B-II.

**Shale**

Formational shale was encountered at less than 10 feet from the ground surface in exploratory borings TH-1 through TH-4, TH-16 through TH-19, TH-22, TH-28 through TH-34. The shale was found below clay at depths greater than 10 feet at borings TH-5 through TH-15, TH-20, TH-21 and TH-23 through TH-27. The shale was clayey, medium hard to very hard, dry, brown and tan, layered and slightly fractured with sulfates noted.

Thirteen shale samples were tested. These samples had moisture contents of 5.5 percent to 11.4 percent and dry densities of 111 pcf to 132 pcf.

Eleven samples were tested for Atterberg limits. These samples exhibited liquid limits of 31 to 36, plasticity indices of 12 to 18 and 72 to 90 percent passing the No. 200 sieve. Two samples were tested for one-dimensional swell / consolidation characteristics. These samples compressed 0.2 and 0.3 percent when wetted under a confining pressure of 1,000 psf. Laboratory test results are presented in Appendix B, Figs. B-1 through B-30 and summarized in Tables B-I and B-II.

## Groundwater

Ground water was not encountered the day of drilling. Temporary monitoring piezometers where installed in TH-2, TH-7, TH-10, TH-14, TH-17, TH-20 and TH-22. We did not find water in these piezometers when checked 6 days after drilling and installation.

## BORROW AREA SOILS

The proposed borrow area material was investigated by drilling 6 exploratory borings (TH-24 through TH-26 and TH-35 through 37), as shown on Fig. 3. The proposed borrow areas were located north of the proposed

embankment in the proposed inundation area. These materials were tested in our laboratory for soils classification (Atterberg limits, gradation and hydrometer), standard Proctor, compressibility, shear strength, permeability, remolded permeability and presence of dispersive clays.

Two bulk samples were tested from across the proposed borrow area. The sample from exploratory borings TH-25 and 26, bulk combined, classified as a gravelly, clayey sand. The sample from exploratory borings TH-35 and TH-36, bulk combined, classified as a silty, sandy, clay. Two standard Proctor (ASTM D698) tests were performed on these combined samples. The TH-25 and TH-26 bulk combined sample exhibited a liquid limit of 20, plasticity index of 3 with 14 percent retained on the No. 4 sieve (gravel sized particles) and 34 percent passing the No. 200 sieve. This sample exhibited a maximum dry density of 119.5 pcf and an optimum moisture content of 11.0 percent. The TH-35 and TH-36 bulk combined sample exhibited a liquid limit of 30, plasticity index of 5 with 3 percent retained on the No. 4 sieve (gravel sized particles) and 63 percent passing the No. 200 sieve. This sample exhibited a maximum dry density of 109.5 pcf and an optimum moisture content of 17.0 percent. Results of these tests are shown on Figs. B-20 and B-21.

Consolidated-drained triaxial shear tests were conducted on two remolded samples using the back pressure saturation method. These samples were prepared at approximately 95 percent maximum dry density standard Proctor (ASTM D698) and at approximately optimum moisture content. These samples exhibited cohesion values of 599 psf and 550 psf and angle of internal friction values of 32.9 and 28.7 degrees, Figs. B-29 and B-30.

In situ density test results were compared to standard Proctor (ASTM D698) density results to calculate a theoretical grading loss. Using this method, we calculated a grading loss of approximately 8 to 13 percent (by volume) due to compaction to 95 percent of maximum dry density.

A double hydrometer analysis (ASTM D 422) and crumb test (ASTM D6572-00) were performed on samples taken from the proposed borrow area and embankment area to investigate for the presence of dispersive clays. These test results indicate soils with low dispersion potential were encountered. Hydrometer analysis did indicate 10 percent to 17 percent particles smaller than 0.005 millimeters. Generally soils with 12 percent or less particles smaller than 0.005 millimeters have low resistance to erosion regardless of dispersive characteristics. Due to the proposed use and relatively short detention times we do not believe soils encountered will impact the proposed construction. We

believe less steep slope, quality control during construction and proper embankment slope protection can help mitigate surficial erosion concerns. We recommend slopes no greater than 3 to 1 ratio (horizontal to vertical), quality control during construction be performed by this firm and proper embankment slope protection.

## LIQUIFACTION POTENTIAL

Review of gradation tests performed on soils encountered in the foundation (Figs. B-13 through B-18) area indicate variable sandy clay and clayey sand overburden soils underlain by shale exist below the proposed embankment. Overburden soils tested had 27 to 86 percent sand sized particles and 14 to 73 percent clay sized particles (passing the No. 200 sieve). We understand fine, uniform graded and loose sand deposits that are susceptible to sudden but temporary increases in pore pressure are most susceptible to liquefaction. Typically, saturated cohesionless soils are more likely to experience liquefaction. We did not identify clean sand deposits at this site. The sand fractions of gradation tests exhibited poorly graded characteristics and not uniform grades. Groundwater was not identified during this investigation. Due to limited detention times we do not anticipate complete saturation of soils below

the proposed embankment dam. Based on the data presented, we believe the proposed embankment foundation area exhibits low liquefaction potential.

## SEEPAGE

Three relatively undisturbed samples and two remolded samples were tested for hydraulic conductivity properties using a flexible wall permeameter (ASTM 5084) test procedure. The three relatively undisturbed samples sampled from the embankment area exhibited hydraulic conductivities of $7.9x10^{-9}$ m/sec ($3.11x10^{-7}$ in/sec), $1.7x10^{-6}$ m/sec ($6.69x10^{-5}$ in/sec) and $2.3x10^{-9}$ m/sec ($9.06x10^{-8}$ in/sec). Two samples from the proposed borrow areas (TH-25 and 26 bulk combined and TH-35 and 36 bulk combined), were remolded to approximately optimum moisture content and 95 percent maximum dry density standard Proctor (ASTM D698). These samples exhibited hydraulic conductivities of $2.0x10^{-6}$ m/s ($7.87x10^{-6}$ in/sec) to $1.38x10^{-6}$ m/s ($1.38x10^{-6}$ in/sec).

Proposed use does not include water to be impounded for greater than 60 hours. Based on the maximum detention time and highest hydraulic conductivity test results, we calculated a maximum infiltration of up to 15 inches. We do not

anticipate seepage through the embankment or foundation to occur due to the design detention time and proposed use. Based on the proposed construction, test results and calculations presented, we do not consider this level of infiltration to be a significant design factor. Laboratory testing results are summarized on Table B-II.

## SLOPE STABILITY

Slope stability analysis was performed using topographic data obtained from site plans provided by The City of Grand Junction. Subsurface conditions were modeled based on results of this field investigation and laboratory testing. We used the computer program SLIDE, version 2.0, using the Bishop simplified method of slices to generate trial failure surfaces and calculate factor of safety against movement. We made several analysis iterations for each condition modeled. The models considered were derived from results of field and laboratory investigations.

We began by considering several cross sections of the embankment as shown in Appendix C, Figs. C-1 through C-5. We considered the critical section of the embankment to be cross section E-E' (Fig. C-5). We used a slope of 3

horizontal to 1 vertical with a 17 foot width crest and a maximum height at the crest of 35 feet. A cross section showing the model of slope and subsurface conditions used is included as Fig. C-6 through C-8.

Embankment foundation conditions were modeled using 30 feet of medium stiff to very stiff clay underlain by shale. The following assumptions are derived from laboratory testing and experience with similar materials. The embankment fill material was modeled using a cohesion value of 550 psf, an internal friction angle of 30 degrees and a wet density of 124 pcf. The foundation subgrade (medium stiff clay) was modeled using a cohesion value of 0 psf, an internal friction angle of 30 degrees and a wet density of 121 pcf. The shale was modeled using a cohesion value of 500 psf, an internal friction angle of 35 degrees and a wet density of 130 pcf. Groundwater was not considered in the static slope model but was considered in the steady state and rapid drawdown slope models. Groundwater conditions were modeled assuming water level at maximum water level of basin and time allowed for steady state conditions to occur. We do not anticipate these conditions to occur in actual use as a proposed flood control dam.

We modeled the embankment for typical state (no impoundment) and steady state conditions. Failure surfaces for the typical state had a minimum factors of safety of 2.708 and 2.572. We modeled upstream and down stream

slopes under steady state conditions. Minimum factors of safety against movement of 2.810 and 2.267 were calculated, respectively. We modeled upstream and down stream slopes for rapid draw down conditions. Minimum factors of safety against movement for rapid draw down were 1.766 for upstream and 2.192 for downstream. We understand minimum factors of safety against movement of 1.5 for steady state conditions and 1.2 for rapid draw down are required. The embankment, as defined by design detention time and proposed use, should not achieve steady state or rapid draw down conditions. Typical models including failure surfaces are presented in Figs. C-5 through C-8.

Calculated factors of safety against slope movement for the proposed embankment met or exceeded minimum requirements for the conditions modeled. In our opinion, an important aspect will be confirmation of the design assumptions during construction. A Geotechnical Engineering Group, Inc. representative should observe and document actual foundation and embankment construction to confirm these design assumptions at that time.

## BEARING CAPACITY AND SETTLEMENT

The materials encountered in the embankment subgrade were variable but predominately sandy clays and clayey sands. Laboratory testing indicated the soils as predominately cohesionless. The bearing capacity analysis we performed considered the soils to be cohesionless. We analyzed bearing capacity using Terzaghi's method and also empiracle methods based on blow count engineering. We considered the conservative case in our design. Using blow count engineering we calculated a maximum allowable bearing capacity of 5,280 psf. This is considering a corrected standard blow count (N) value of 12 for the sandy clay soils. Terzaghi's method gave a substantially higher bearing capacity. We anticipate a maximum surcharge (at maximum of 35 feet in height and a soil unit weight of 124 pcf) of 4,340 psf. This situation was encountered in the drainage areas. A typical height in the embankment dam of 25 feet was considered for the central portion of the site. We anticipate a maximum loading of 3,100 psf in this area. The shale soils encountered in the west and east portion of the embankment dam exhibited much greater bearing capacities. We calculated a maximum allowable bearing capacity in the shales as 16,000 psf. Our design considers a maximum allowable bearing capacity of 5,000 psf in the clayey sands and sandy clays and a maximum allowable bearing capacity of 10,000 psf in the shale soils.

We tested three clay samples for consolidation potential using a one dimensional oedometer apparatus. These samples were loaded beyond anticipated pressures of the proposed embankment under wetted conditions. We estimated a maximum surcharge pressure of 4,340 psf based on anticipated embankment soils and maximum height of embankment. The samples tested consolidated 1.6 percent to 8.2 percent under wetted conditions at a confining pressure of 4,340 psf. We used a consolidation of 5.0 percent in our settlement calculation. The settlement of the proposed embankment foundation is calculated to be about 1.5 feet in the area of tallest part of the embankment. While some movement and related maintenance / repair should be anticipated due to foundation related movements, embankment foundation improvement was considered during design to help mitigate potential of damages caused by this movement.

## FOUNDATION AND EMBANKMENT DESIGN

This investigation indicates medium stiff to very stiff sandy clays and hard shale at foundation levels. In our opinion, a concern for the proposed construction will be settlement potential in the sand and clay foundation subsoils. We anticipate that a portion of the settlement will occur during construction but

long term settlements will need to be considered in design and construction. We also recommend the upper 2 feet of existing soils subjected to freeze thaw and weathering should be overexcavated and replaced as a well compacted structural fill. To help improve soils immediately below the crest of the embankment we recommend incorporating a cutoff trench below the central portion of the dam. Due to variability of borrow area soils, a process to help provide a more thoroughly mixed embankment fill material will be necessary.

We understand the proposed use of the embankment is to detain water for a period of no longer than 60 hours. Our design considers detention times for steady state conditions to occur. We believe a less complex homogenous embankment design is suitable for the proposed use of the embankment.

For upstream protection we considered the use of on site materials (sandy clay soils), geotextile composite, end dumped riprap and soil cement. The use of native on site soils may result in long term monitoring of embankment and continual repairs. An end dumped riprap protection can provide a more long term solution but may not be cost effective in the short term. Due to the anticipated settlement and that soils cement procedures are relatively uncommon in this area, we did not consider soil cement as a viable option.

Riprap and geotextile composite alternatives for slope face protection are presented below.

We present design and construction recommendations for subgrade preparation, cutoff trench, embankment and slope protection below. These criteria were developed from analysis of field and laboratory data, our analysis, review of "DNR, Division of water resources, Office of the State Engineer Rules and Regulations for Dam Safety and Dam Construction, CCR 402-1, Effective September 30, 1988", "Design of Small Dams, United States Department of the Interior, Bureau of Reclamation, Third Edition, 1987" and our experience.

1. We recommend a maximum allowable soil bearing capacity of 10,000 psf for foundations bearing in the shale. We recommend a maximum soil bearing capacity of 5,000 psf for foundations bearing in silty, sandy clay soils.

2. Prior to placing embankment fill, the surface of native soils should be stripped and all organic and deleterious materials completely removed. A 2 foot depth of soils below embankment areas should be overexcavated and replaced as a well compacted structural fill. Prior to fill placement the resulting subgrade should be prepared by scarifying at least 10-inches, moisture conditioning to within 2 percent of optimum moisture and compaction to at least 95 percent of maximum standard Proctor (ASTM D698) dry density. Subgrade preparation may be omitted where subgrade soils consist of undisturbed shale. Due to variability encountered in borrow area soils, an intermediate mixing / processing area should be established to help thoroughly mix borrow area soils prior to placement in embankment. This intermediate soil processing will be required in addition to the typical cut / fill procedure if it is determined, by our representative, more mixing should be

completed to obtain more homogeneous embankment material. Embankment fill placement within 15 feet of the top of embankment should be compacted to at least 95 percent standard Proctor (ASTM D698) maximum dry density and within 2 percent below and 1 percent above optimum moisture content. Embankment fill placement greater than 15 feet below top of embankment level should be compacted to at least 98 percent standard Proctor (ASTM D698) maximum dry density and within 2 percent below and 1 percent above optimum moisture content. An embankment cross section is included in Fig. 4.

3. A cutoff trench should be provided along the center line of the embankment. The bottom of the trench should be at least 5 feet in depth and 17 feet in width. The slopes of the trench should be at least 2.5 horizontal to 1 vertical. The cutoff trench may be neglected in areas were the width of embankment bottom is less than 50 feet.

4. The upstream and downstream embankment slopes should have a minimum ratio of 3 horizontal to 1 vertical.

5. Areas where the embankment will contact existing slopes should be benched at a ratio of 5 feet horizontal to 1 foot vertical at the time of placement of fill material (see Fig. 5).

6. Placement of fill during construction should be continuous and uniform across the site to help mitigate potential of developing excessive foundation pore pressures.

7. A minimum freeboard of 5 feet should be maintained across the embankment area, not including camber. To compensate for anticipated settlement, a camber of 5 percent of embankment height should be applied.

8. The minimum crest width at the top of the embankment should be no less than 17 feet. The crest should be provided with a crown of at least three inches or sloped to drain towards the upstream slope. The latter is preferred. A minimum of 4-inches of a well compacted (90 percent maximum dry density modified Proctor (ASTM D1557) and within 2 percent of optimum moisture content) granular material such as a CDOT Class 6 road base is recommended to help mitigate potential crest damages. Proposed

materials should be provided to our office for acceptance testing prior to import.

9. Upstream areas of the embankment slope and spillway areas should be protected by a minimum 24-inch nominal thickness of a hard, dense and durable rock. Rock sizes should conform to a maximum size of 2,500 lbs with 40 percent to 50 percent > 1,250 lbs, 50 percent to 60 percent of rocks between 75 lbs and 1,250 lbs, and 0 percent to 10 percent 75 lbs or less. We understand it may be difficult to obtain a rock in this area of the above mention specifications. A semi angular to angular locally available rock may be used. If a lesser rock is used it would be prudent to inspect rip rap on regular basis to identify any damages / displacement to the rip rap.

10. Alternatives to item No. 9 above for upstream slope cover (spillway not included) include an aggregate cover with a nominal particle size of 12-inches or a geo-composite erosion control reinforced turf mat rated for low flow channels covered with at least 3 inches of on site soils. These alternatives may be less expensive but will involve a higher risk of damage and related repair / maintenance expense.

11. Downstream slope should be provided with a vegetative cover with low water requirements. Care should be taken to prevent animals from burrowing into embankment. Care should be taken to prevent trees or other large rooted plants from growing in the embankment surface.

12. Vegetation, debris and deleterious materials should be removed from at and below the design retention / inundation elevation to help mitigate potential of obstructing outlet structures. It would also be prudent to provide a barrier to prevent off highway vehicles from accessing the slope faces. Rock / concrete debris berms have been noted in use for this purpose in other dams in the area and appear to have performed satisfactorily

13. A Geotechnical Engineering Group representative should be called to observe and test subgrade and placement of embankment fill during construction to confirm subsurface conditions are as anticipated and embankment is constructed in conformance with our recommendations. Quality control measures should be

provided during construction to verify proper preparation of foundation and placement of embankment material.

## CONCRETE

Two samples were tested (TH-7 and TH-8, 0 to 5 feet, TH-25 and TH-26, 0 to 5 feet and TH-35 and TH-36, 0 feet to 5 feet, bulk combined) were tested for water soluble sulfate concentrations. These samples had water soluble sulfate concentrations of 2,800 ppm, 4,100 ppm and 700 ppm, respectively. Sulfate concentrations in this range are considered to have a moderate to severe effect on concrete which comes into contact with the soils. We recommend a Type V cement plus pozzolan (any Class F fly ash) be used for concrete that comes into contact with the subsoils. In addition, concrete should have a maximum water-cement ratio of 0.45.

## SURFACE DRAINAGE

Performance of foundations and concrete flatwork is influenced by surface moisture conditions. Risk of wetting foundation soils can be reduced by carefully planned and maintained surface drainage. Surface drainage should be designed to provide rapid runoff of surface water away from the proposed embankment. We

recommend the following precautions be observed during construction and maintained at all time after the construction is completed.

The ground surface surrounding the embankment should be sloped to drain away from the embankment in all directions. We recommend a slope of at least 12 inches in the first 10 feet around the embankment, where possible. In no case should the slope be less than 6 inches in the first 5 feet. The ground surface should be sloped so that water will not pond adjacent to the embankment.

## CONSTRUCTION MONITORING

Geotechnical Engineering Group, Inc. should be retained to provide general review of construction plans for compliance with our recommendations. Geotechnical Engineering Group, Inc. should be retained to provide construction monitoring services during all earthwork and foundation and embankment construction phases of the work. This is to observe the construction with respect to the geotechnical recommendations, to enable design changes in the event that subsurface conditions differ from those anticipated prior to start of construction and to give the owner a greater degree of confidence that the embankment is constructed in accordance with the geotechnical recommendations.

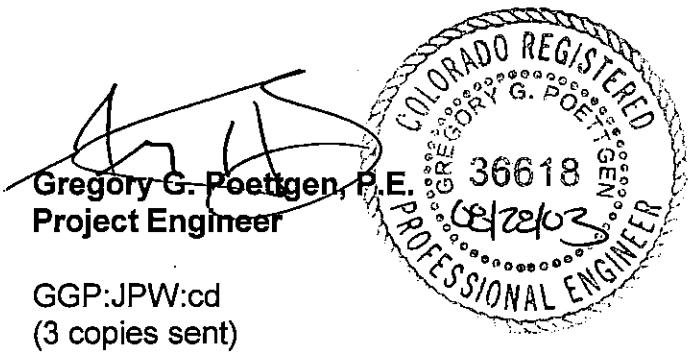
## LIMITATIONS

Thirty-seven exploratory borings were observed, spaced across the subject site. The exploratory borings are representative of conditions encountered only at the exact exploratory boring locations. Variations in the subsoil conditions not indicated by the exploratory borings are always possible.

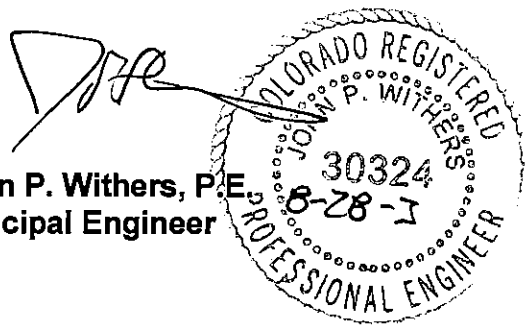
We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No other warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or the analysis of the influence of the subsurface conditions on the design or construction of the project, please call.

**Sincerely,**
**GEOTECHNICAL ENGINEERING GROUP, INC.**

**Reviewed by:**



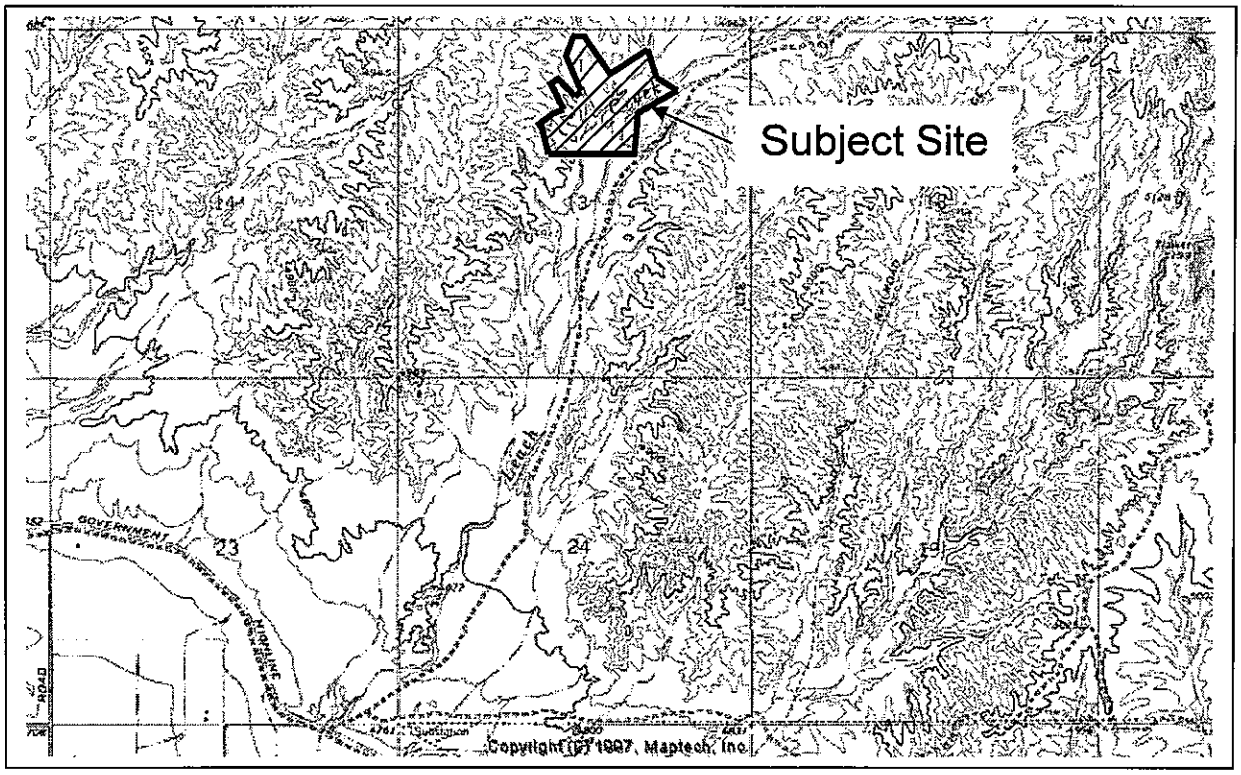

**Gregory G. Poettgen, P.E.**
**Project Engineer**




**John P. Withers, P.E.**
**Principal Engineer**

GGP:JPW:cd
(3 copies sent)

# Geotechnical Investigation and Design
# Alternate Site No. 1 A
# Leach Creek Dentention Basin
# North and West of H Road and 27 ¼ Road
# Grand Junction, Colorado




Job No. 1,276

Vicinity Map

Fig. 1

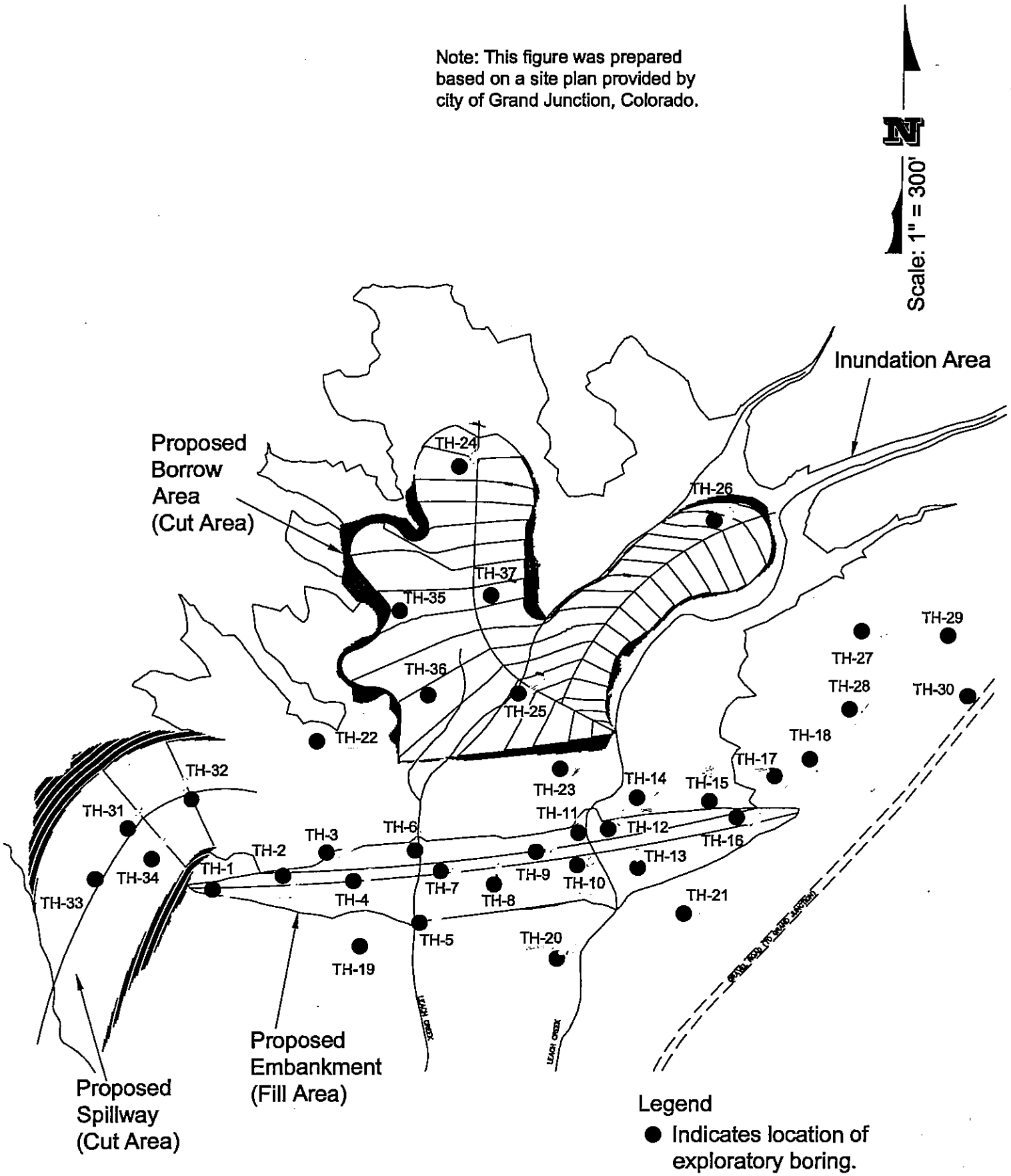
Note: This figure was prepared based on a site plan provided by city of Grand Junction, Colorado.

N

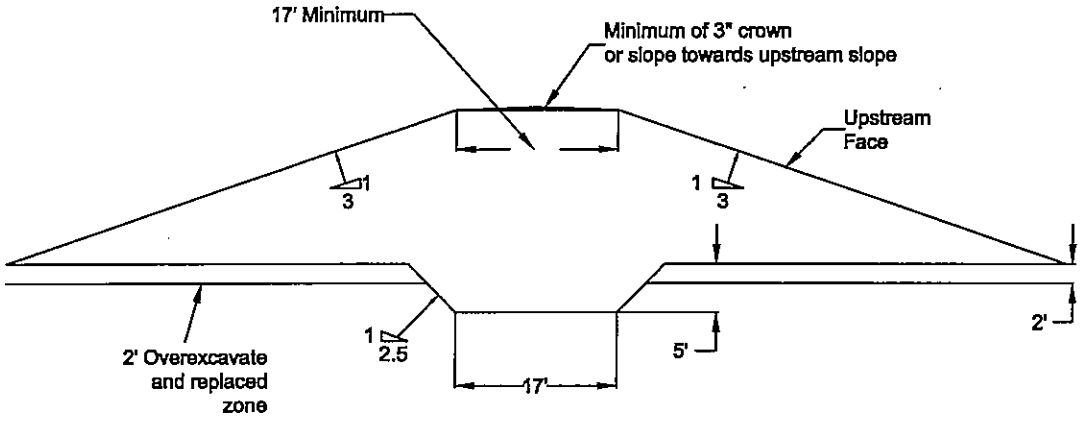
Scale: 1" = 300'


Job No. 1,276 Location of Proposed Embankment Fig. 2

Note: This figure was prepared based on a site plan provided by city of Grand Junction, Colorado.




Job No. 1,276 **Location of Exploratory Borings** Fig. 3

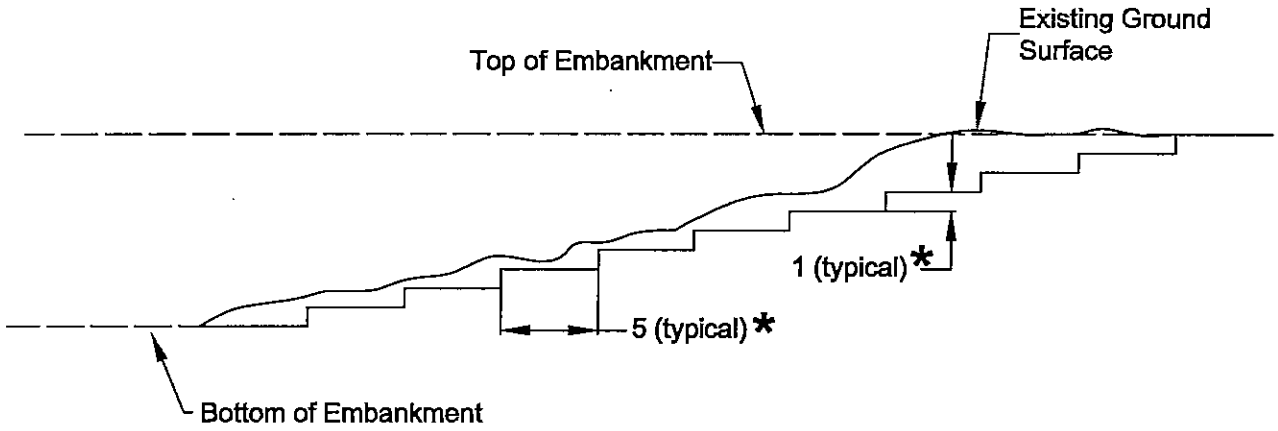



Scale: 1" = 20'

# Recommended Embankment Cross Section

Job No. 1,276

Fig. 4




*Note: 5 Horizontal to 1 Vertical Bench

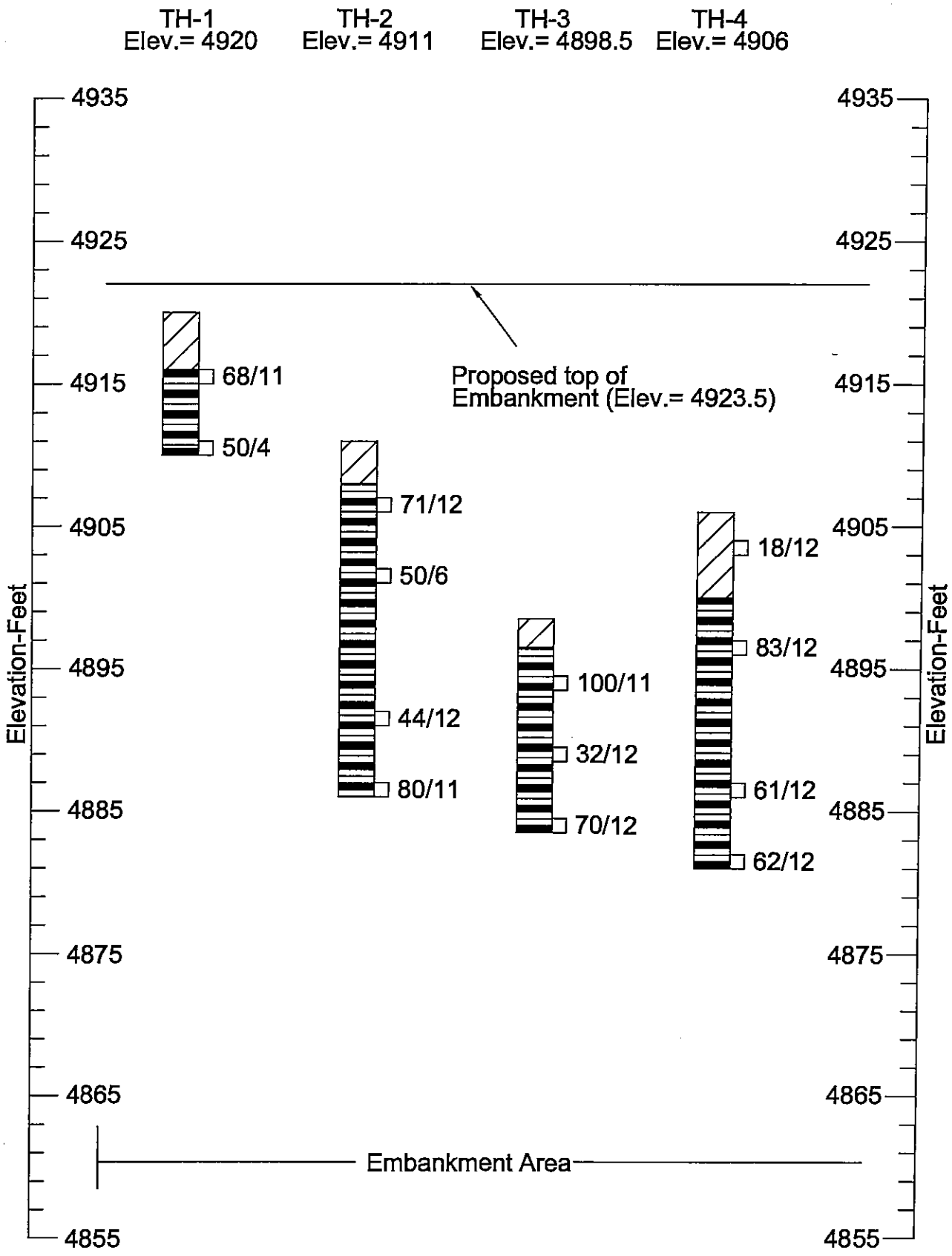
Scale: 1" = 10'

Job No. 1,276

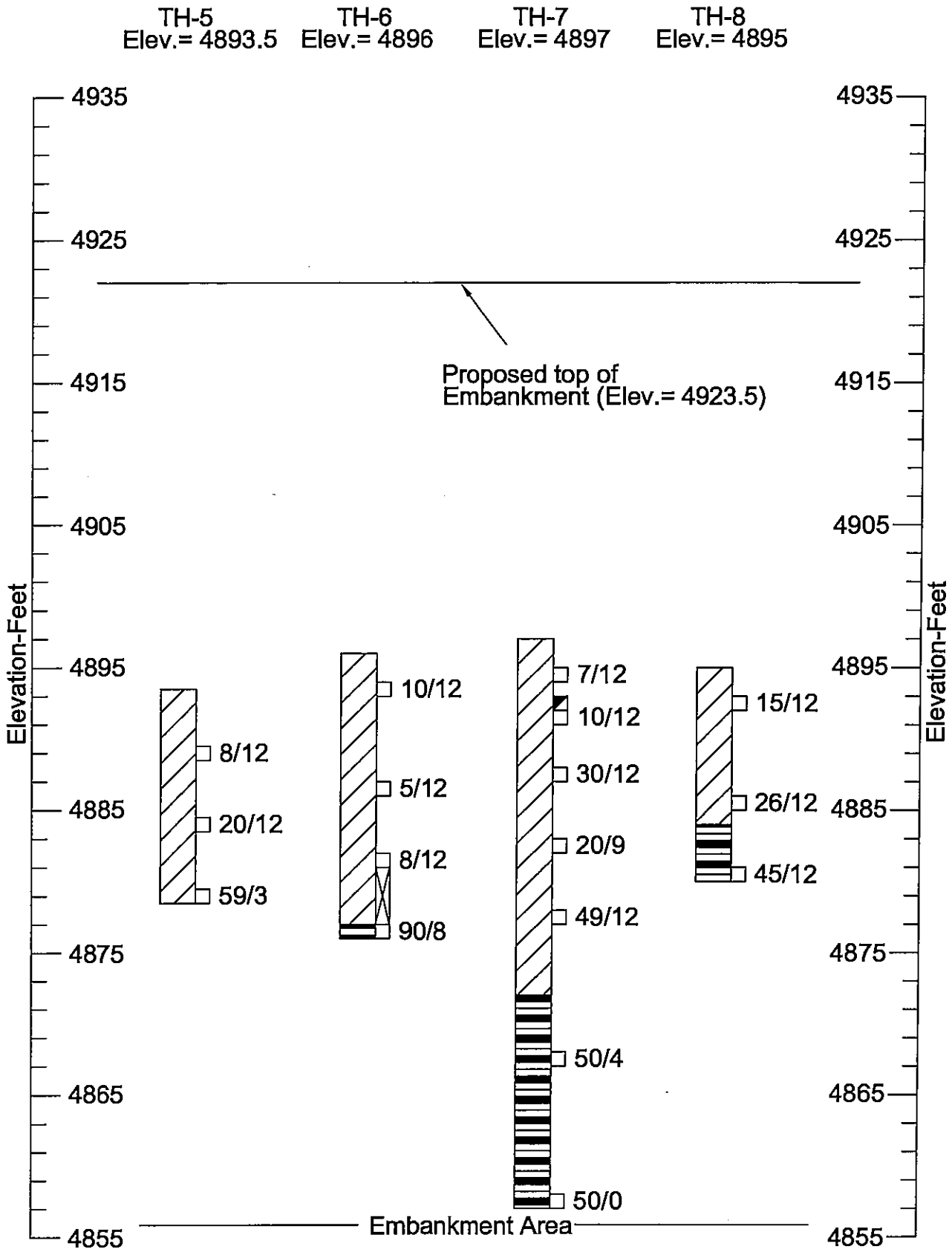
# Recommended Bench Into Existing Shale Slope Cross Section

Fig. 5

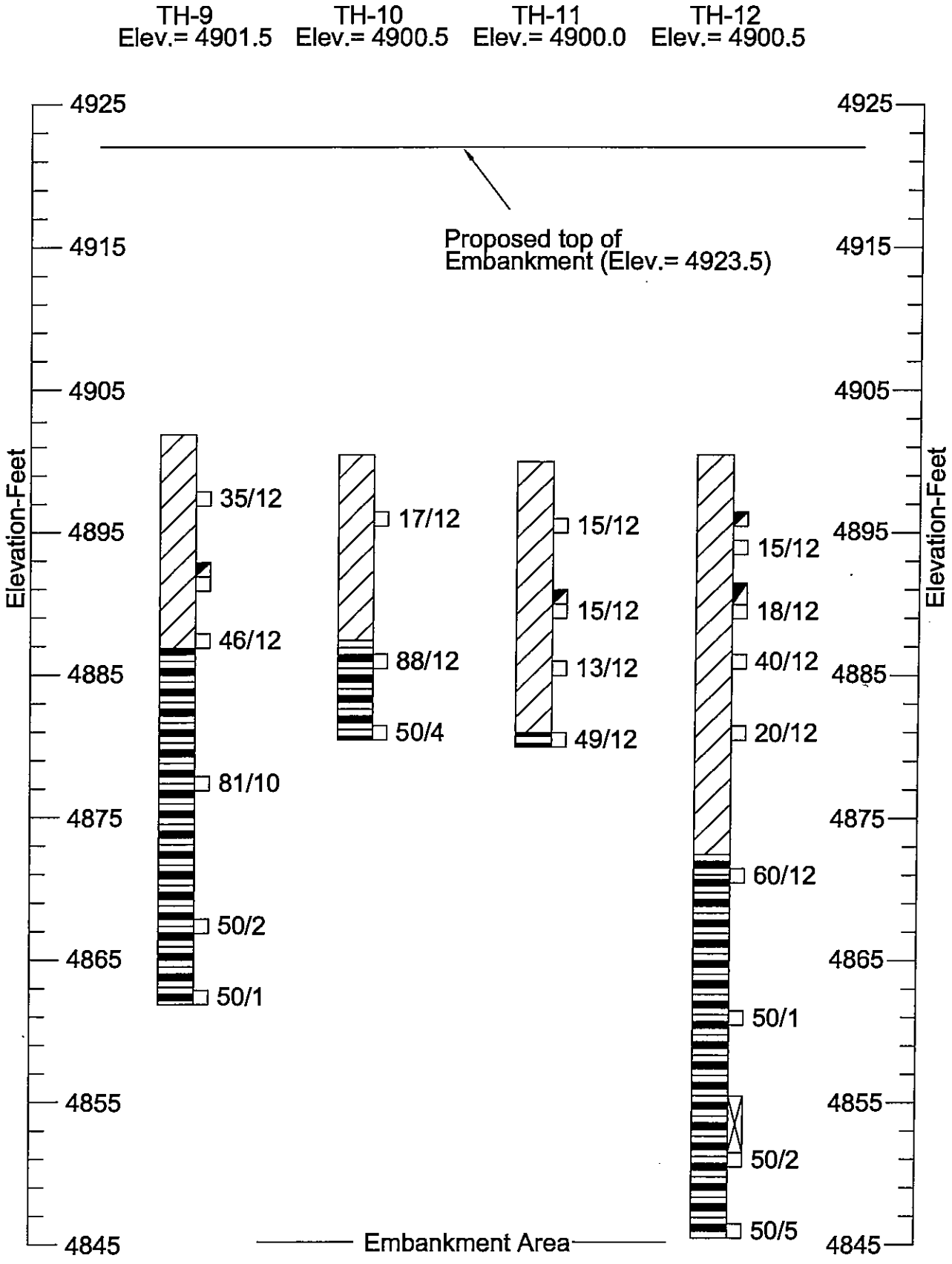
# APPENDIX A
## Logs of Exploratory Borings



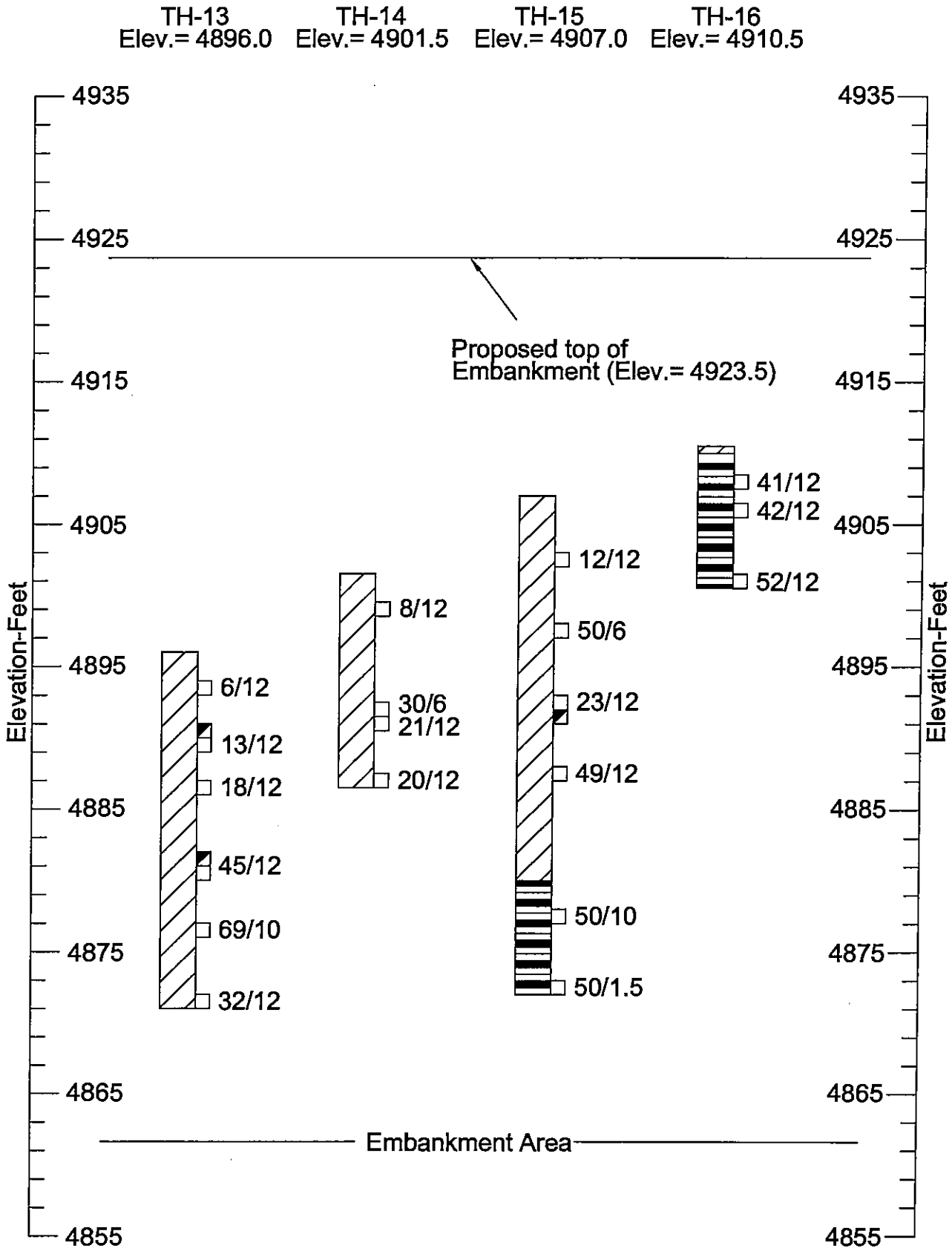

Job No. 1,276 **Logs of Exploratory Borings** Fig. A-1



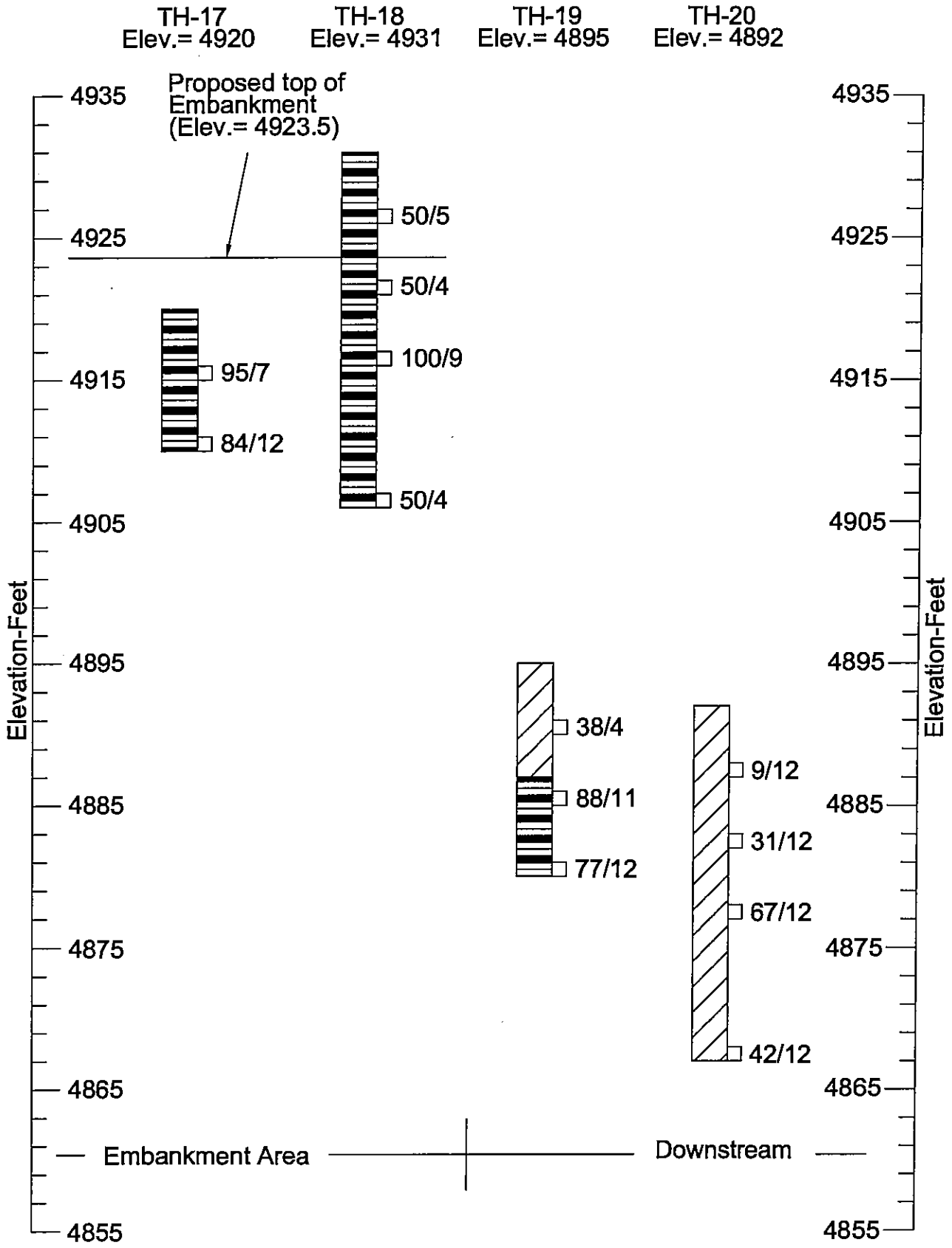

Job No. 1,276 Logs of Exploratory Borings Fig. A-2



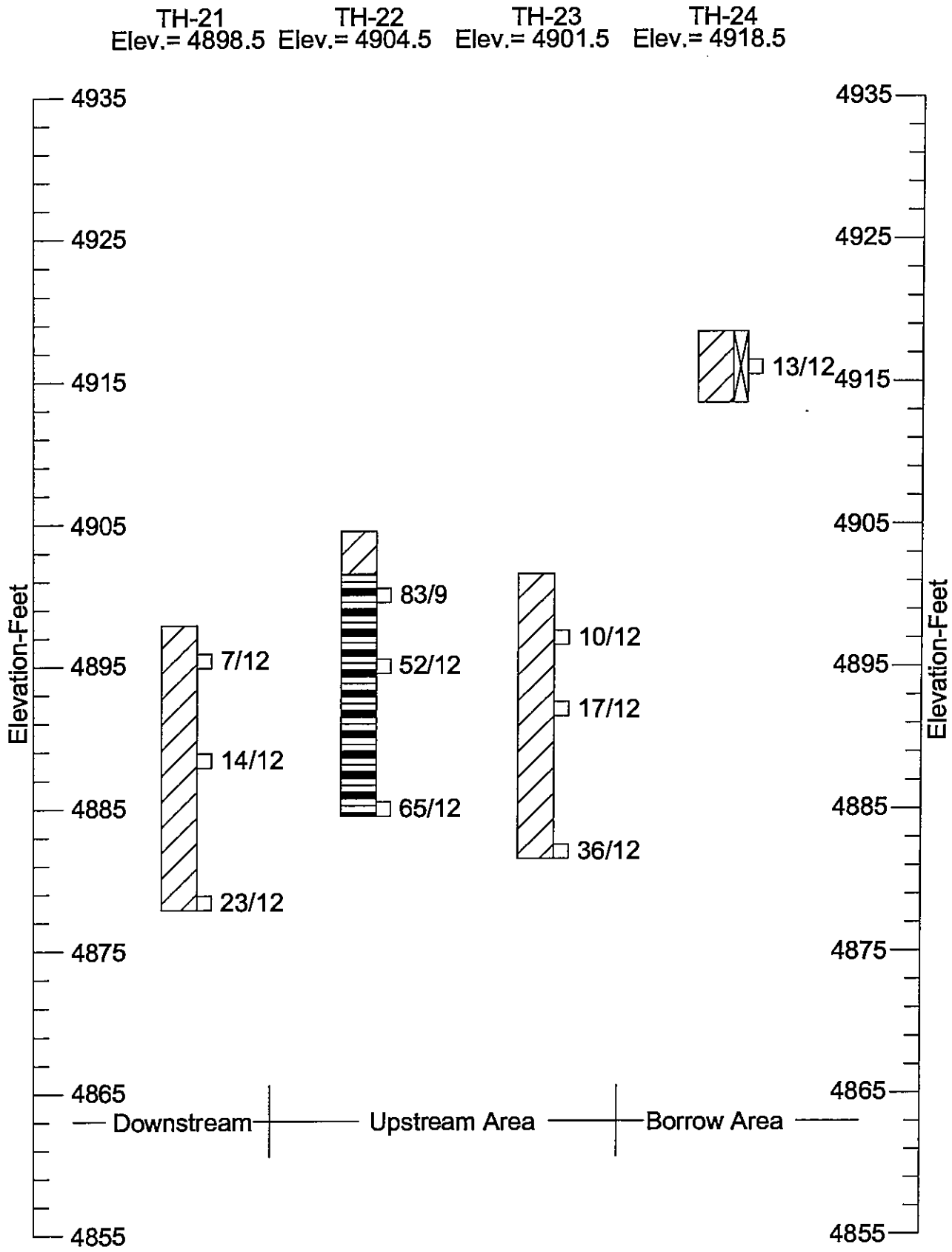

Job No. 1,276 **Logs of Exploratory Borings** Fig. A-3



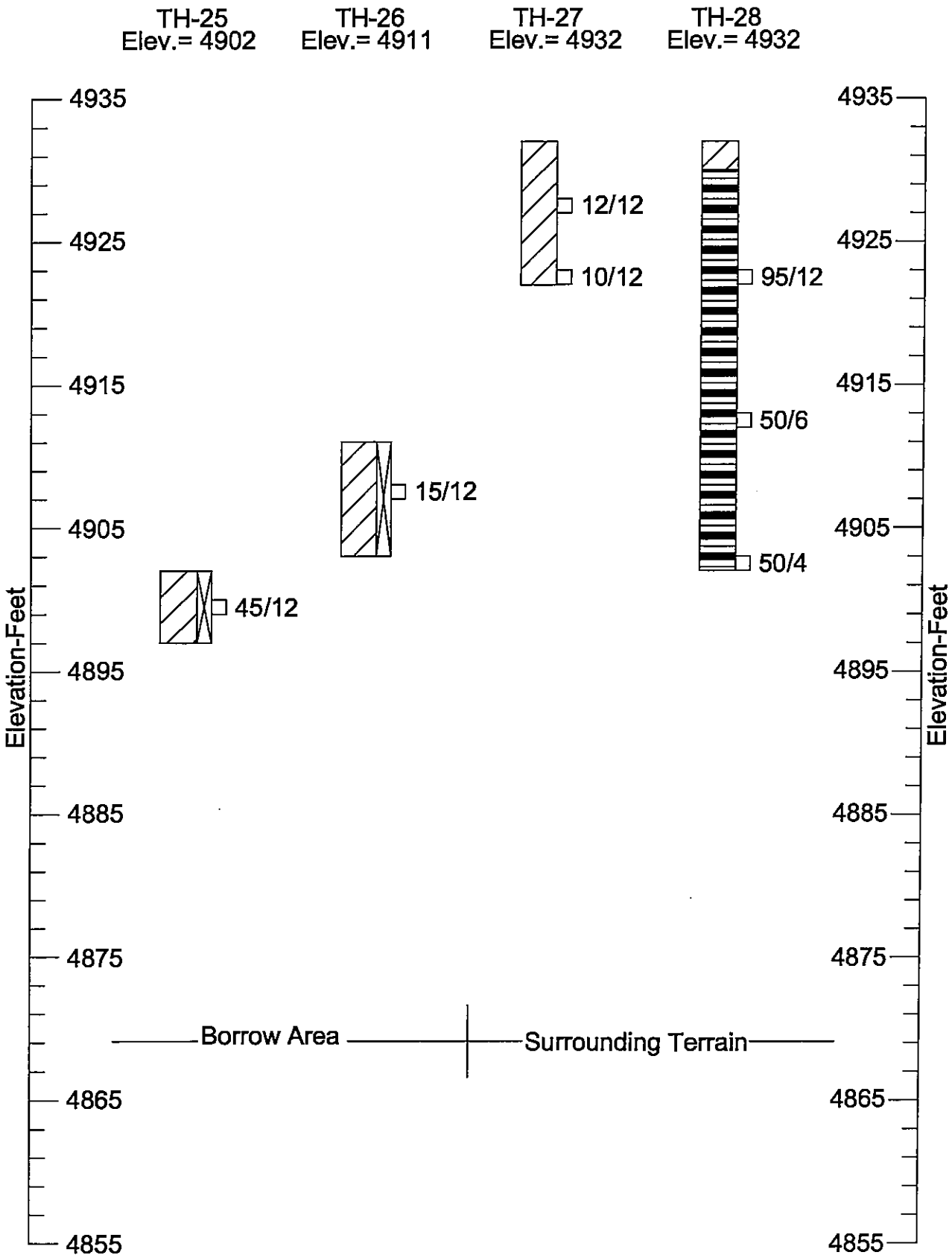

Job No. 1,276 **Logs of Exploratory Borings** Fig. A-4



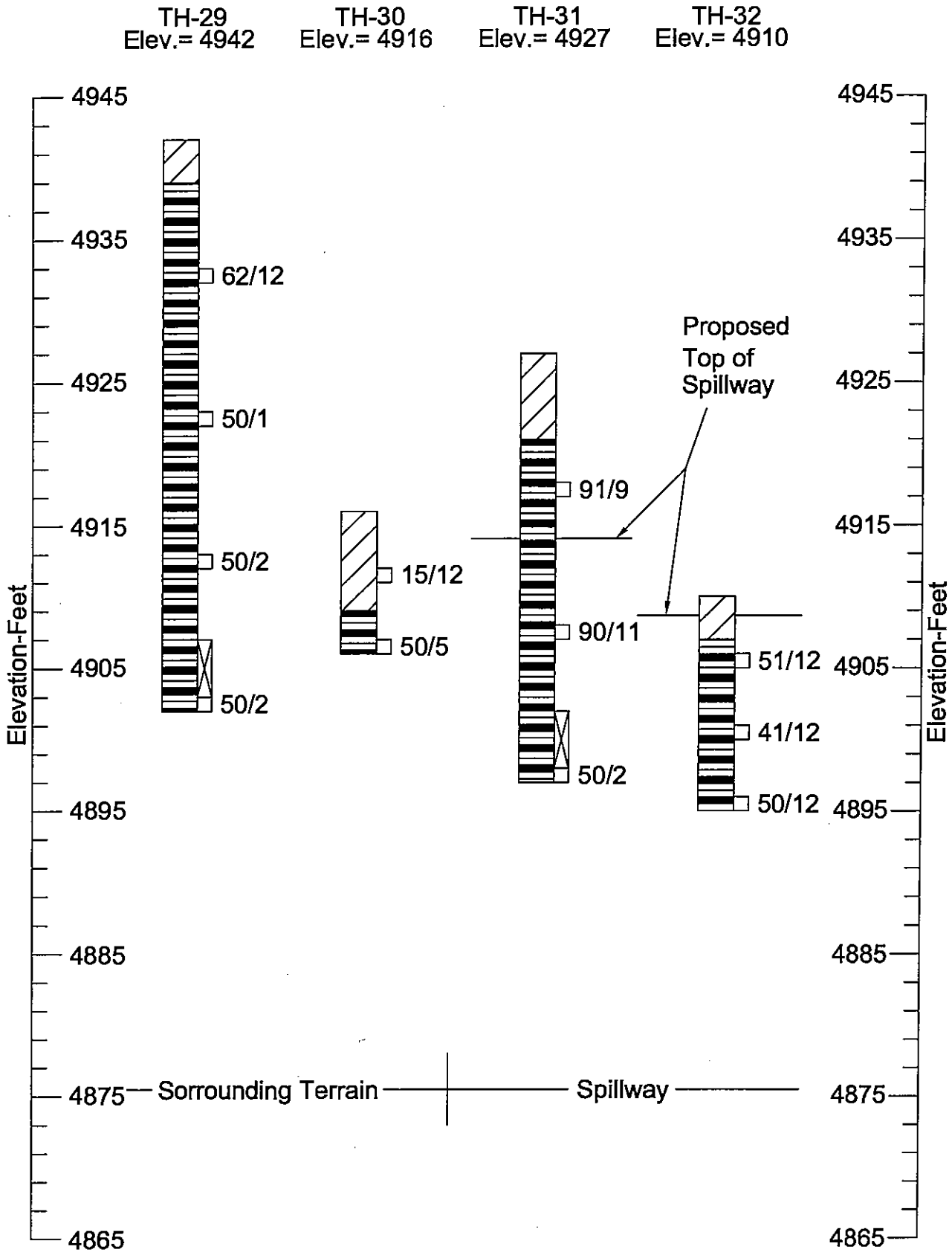

Job No. 1,276 Logs of Exploratory Borings Fig. A-5



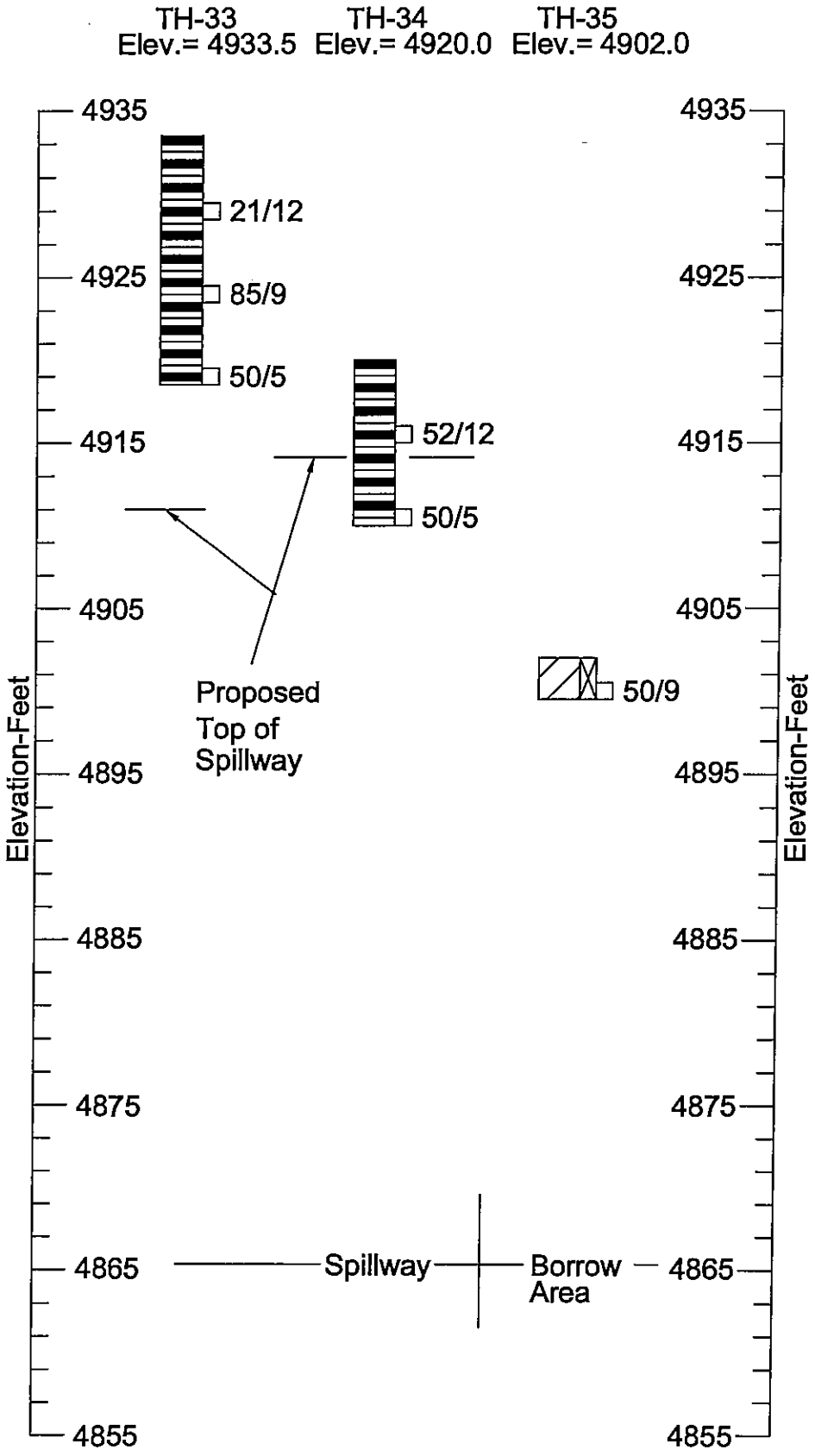

Job No. 1,276 **Logs of Exploratory Borings** Fig. A-6



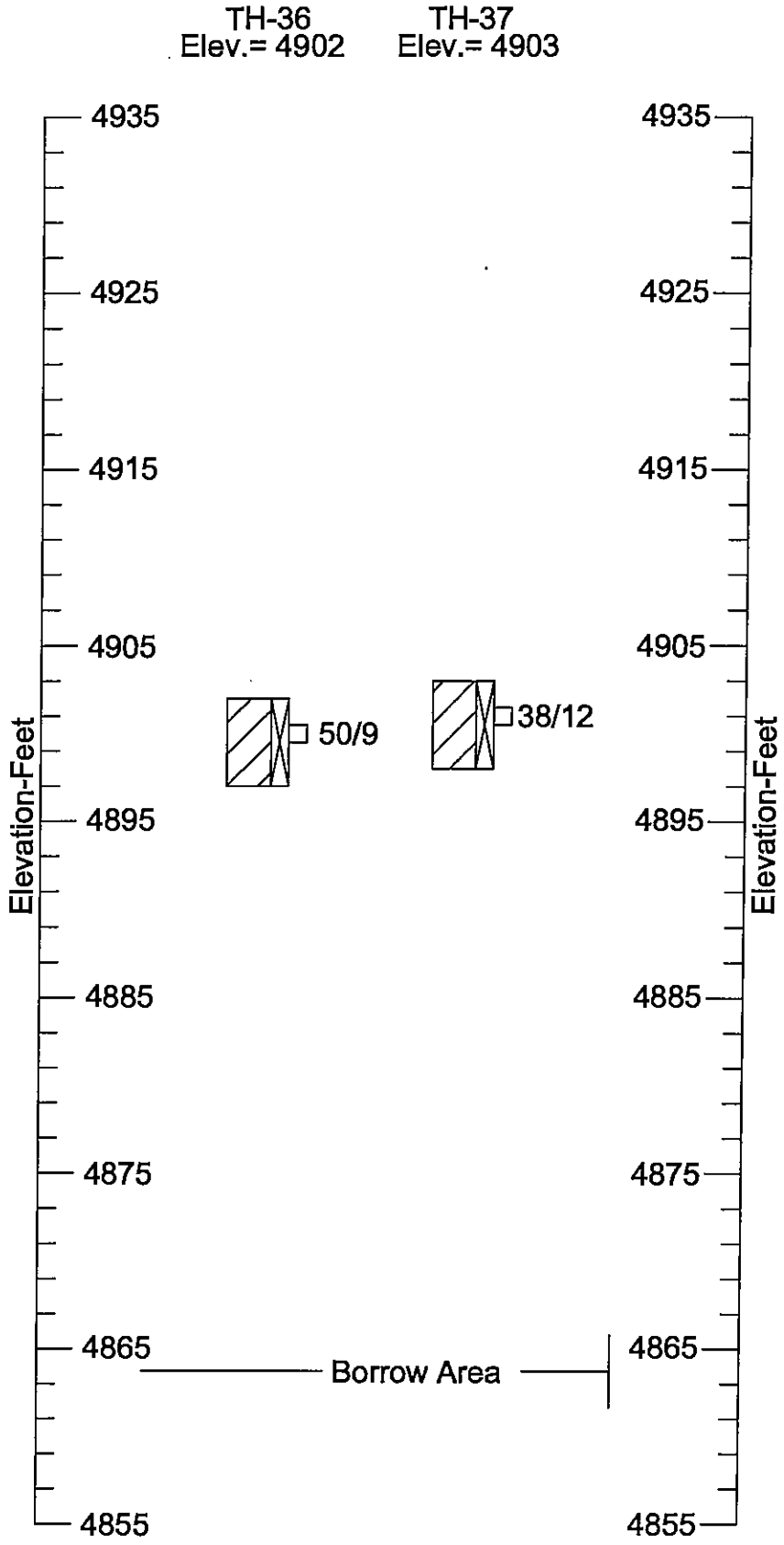

Job No. 1,276 **Logs of Exploratory Borings** Fig. A-7




Job No. 1,276 **Logs of Exploratory Borings** Fig. A-8




Job No. 1,276 Logs of Exploratory Borings Fig. A-9




Job No. 1,276 **Logs of Exploratory Borings** Fig. A-10

## Legend

Clay, silty, sandy, with variable sandy clay, silty to clayey sand and gravelly lenses noted, soft to very stiff, dry, tan, brown (CL, SC, SM)

Shale, clayey, medium hard to very hard, dry, brown, tan, layered, slightly fractured, sulfates noted

Indicates drive sample. The symbol 68/11 indicates that 68 blows of a 140 pound hammer falling 30 inches were required to drive a 2.0 inch O.D. sample barrel 12 inches.

Indicates location of bulk sample collected from auger cuttings.

Indicates location of shelby tube (3- inch, O.D.) type sample.

## Notes

1. Exploratory borings were drilled and sampled on January 14,15,16,17 and 21, 2003 using a 6-inch diameter solid stem, continuous flight auger and a truck and track mounted drill rig.
2. Elevations provided by City of Grand Junction.
3. These logs are subject to the explanations, limitations and conclusions as contained in this report.

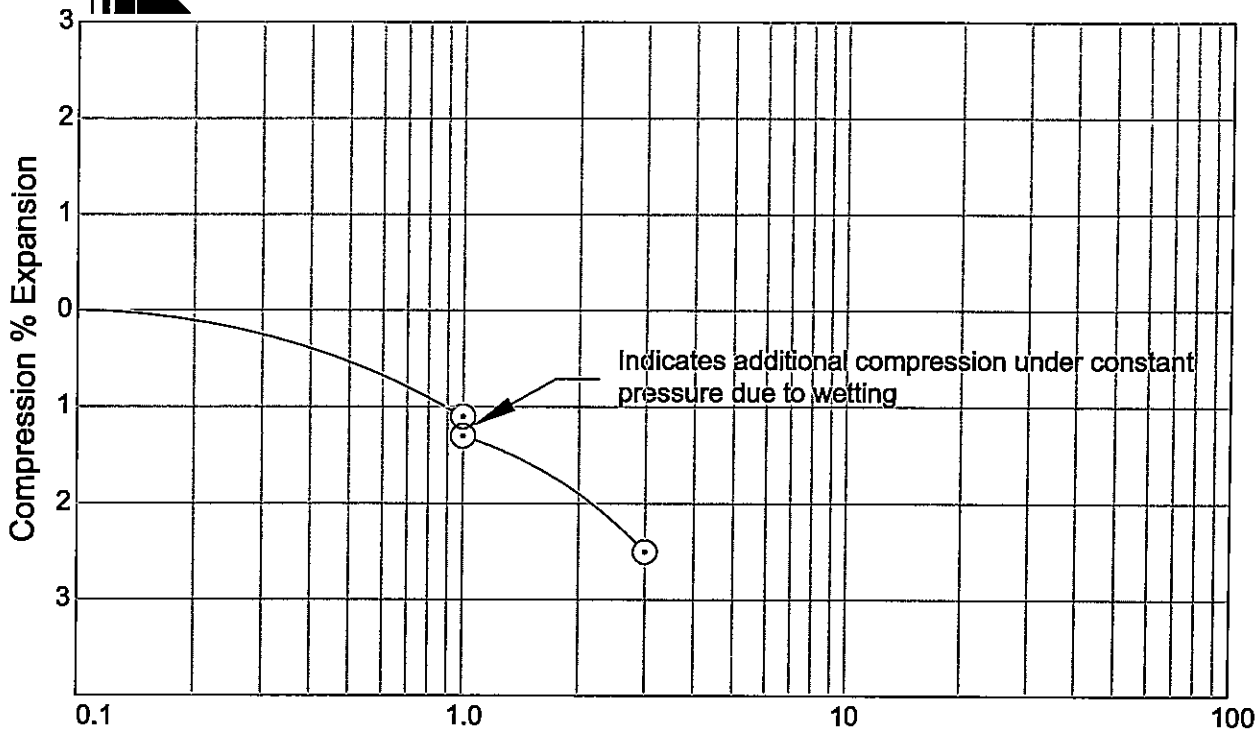
Job No. 1,276

# Legend of Logs of Exploratory Borings

Fig. A-11

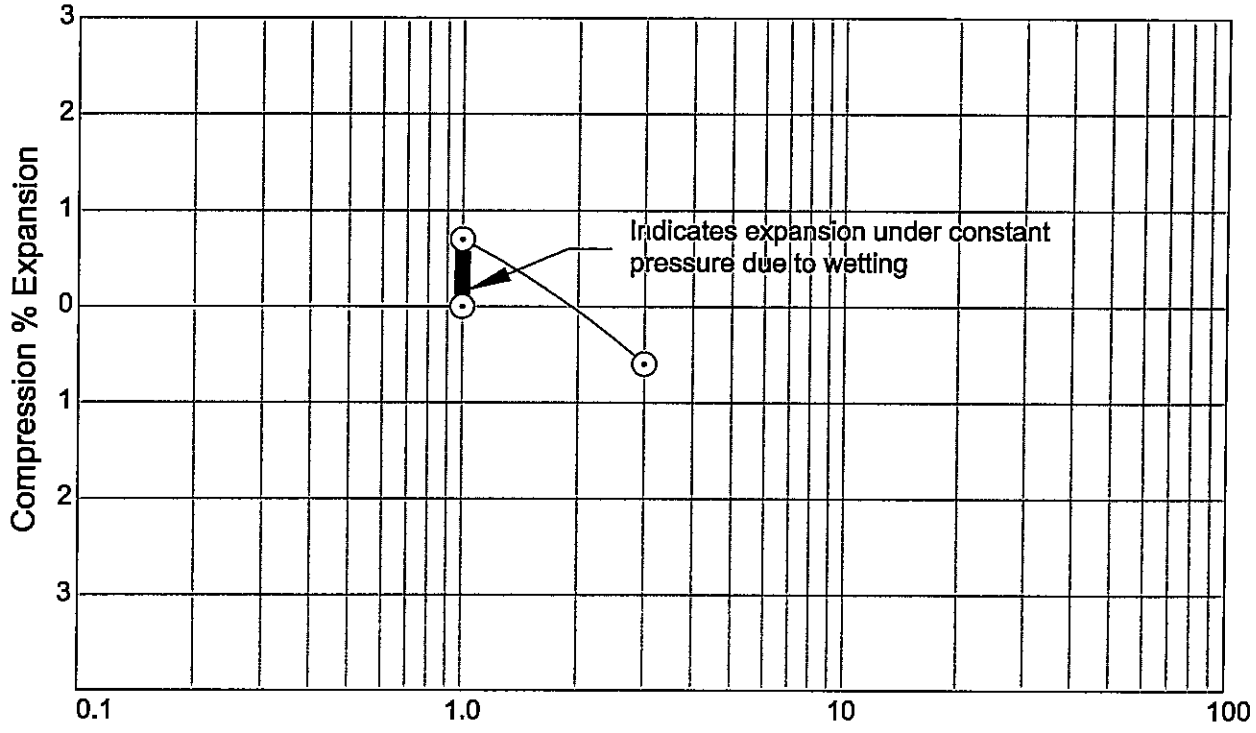
# APPENDIX B
## Results of Laboratory Testing

# Geotechnical Engineering Group, Inc.




Sample of: Shale, partial remold
From: TH-3 @ 9 foot depth

Dry Unit Weight= 118 PCF
Moisture Content= 5.5 %

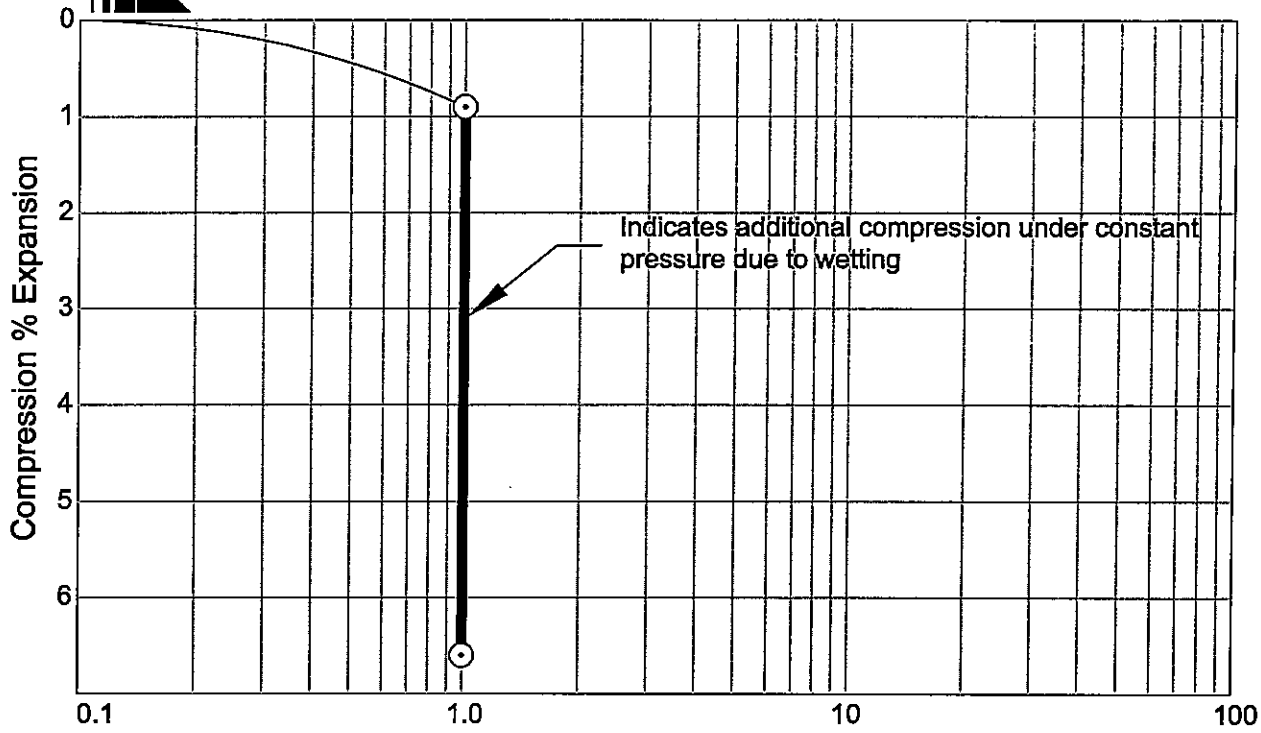



Sample of: Shale, partial remold
From: TH-4 @ 9 foot depth

Dry Unit Weight= 120 PCF
Moisture Content= 7.4 %

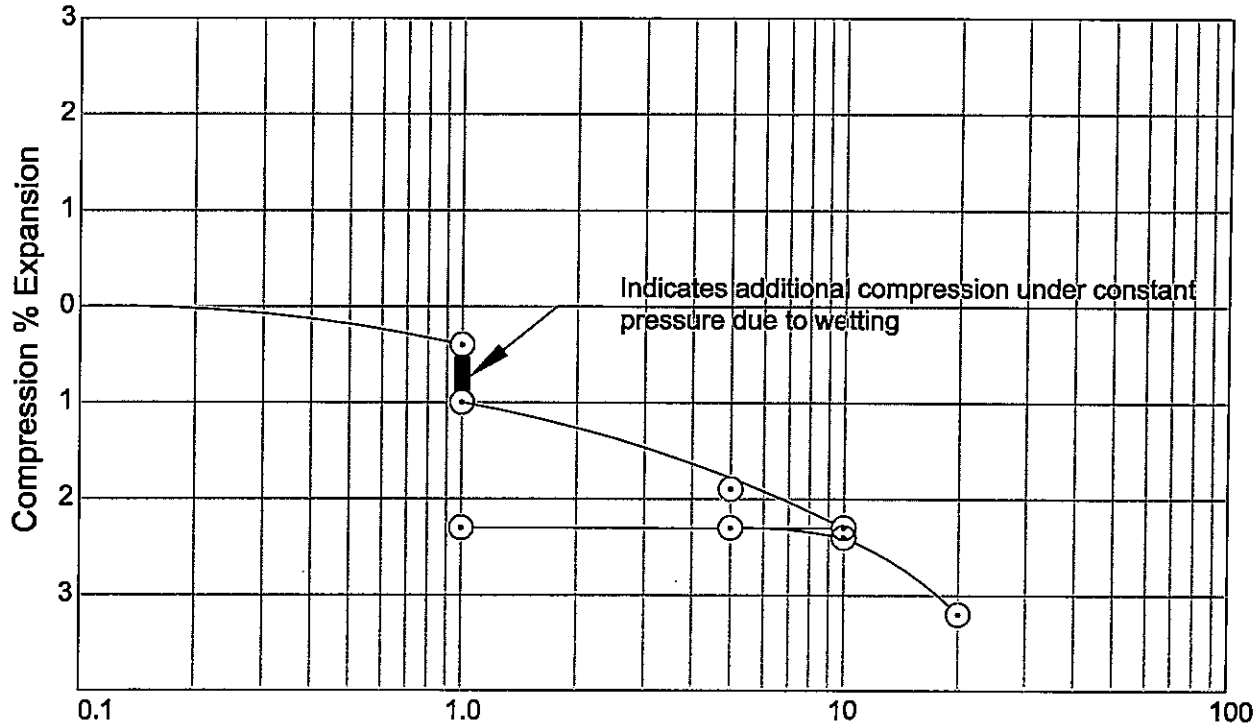
Job No. 1,276 Swell Consolidation Test Results Fig. B-1

# Geotechnical Engineering Group, Inc.




Sample of: Clay, silty, sandy (CL)
From: TH-6 @ 9 foot depth

Dry Unit Weight= 91 PCF
Moisture Content= 6.8 %

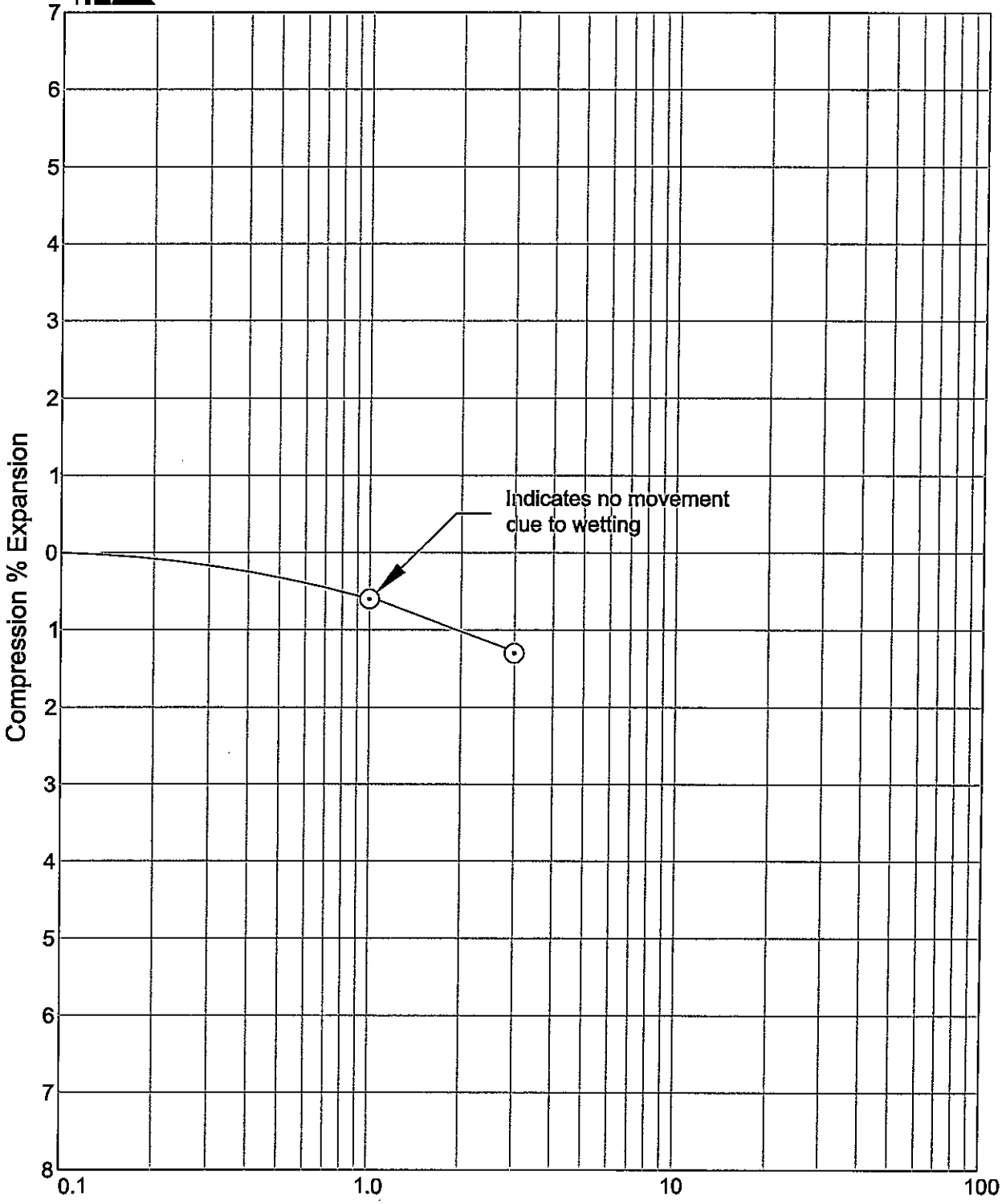



Sample of: Sand, clayey, gravelly (SC)
From: TH-8 @ 2 foot depth

Dry Unit Weight= 108 PCF
Moisture Content= 5.0 %

Job No. 1,276 Swell Consolidation Test Results Fig. B-2

**Geotechnical Engineering Group, Inc.**

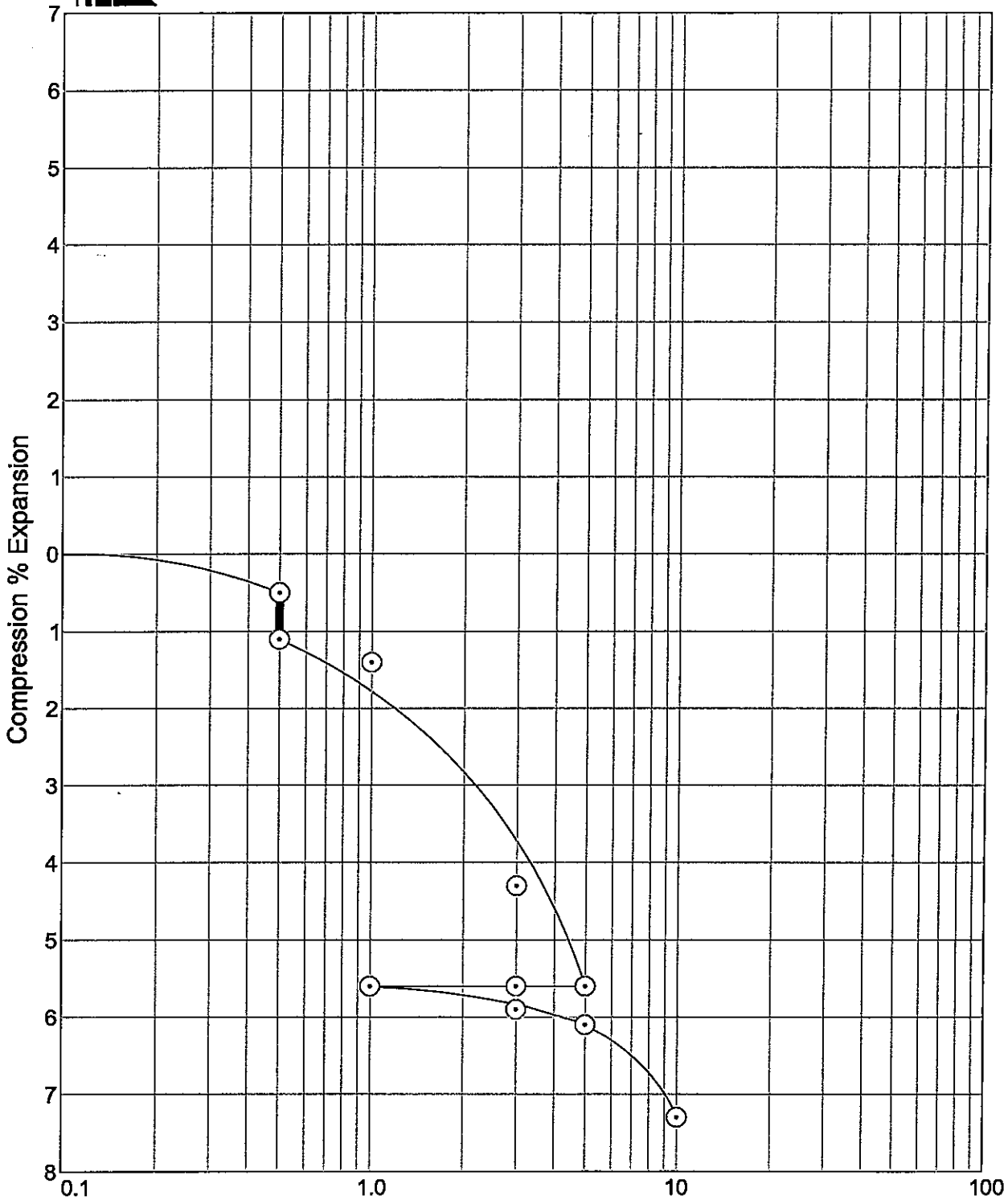



Sample of: Sandy, clayey, gravelly (SC)
From: TH-9 @ 9 foot depth

Dry Unit Weight= 116 PCF
Moisture Content= 4.6 %

Job No. 1,276 Swell Consolidation Test Results Fig. B-3

**Geotechnical Engineering Group, Inc.**

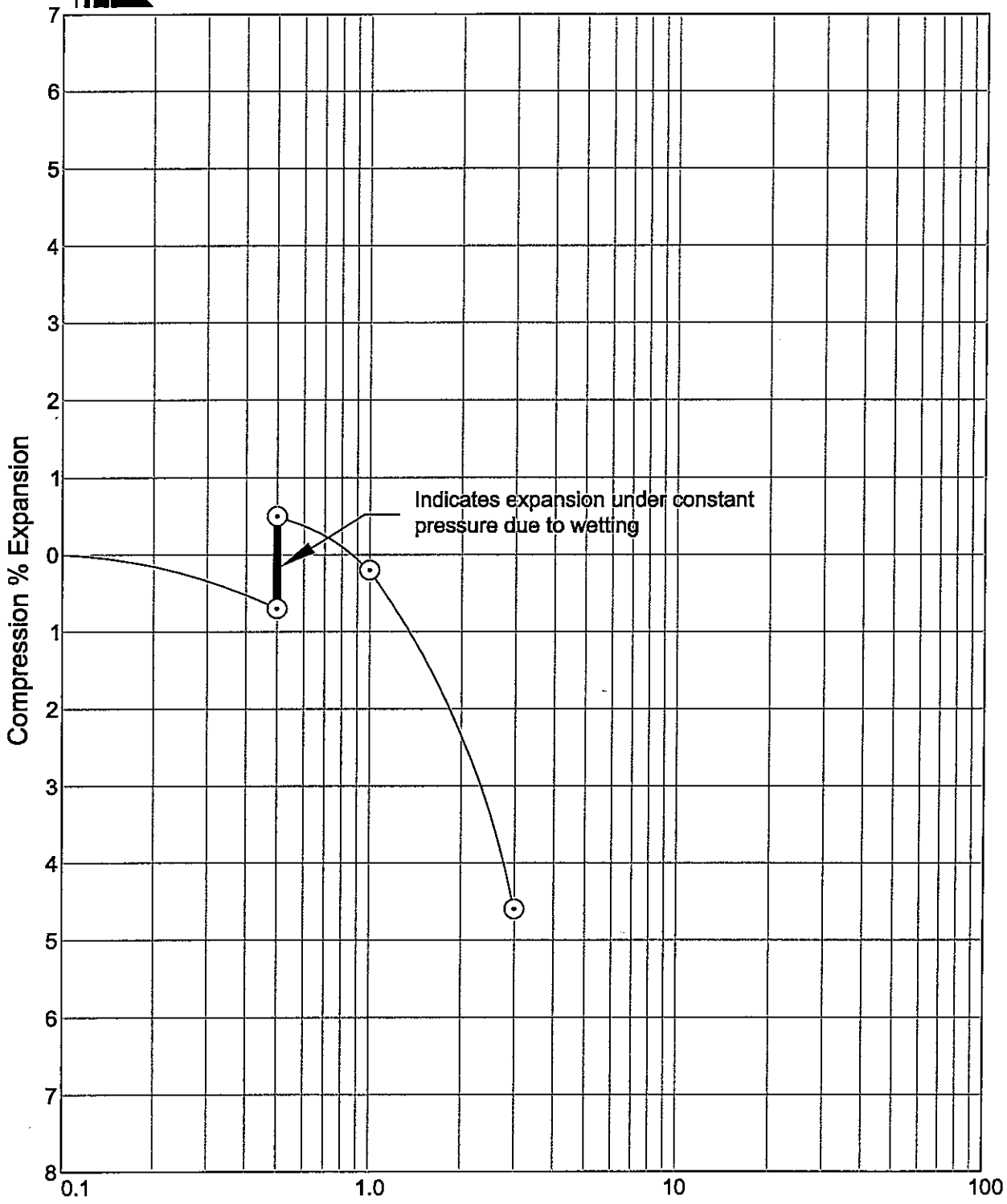



Sample of: Clay, silty, sandy (CL)
From: TH-10 @ 4 foot depth

Dry Unit Weight= 101 PCF
Moisture Content= 5.3 %

Job No. 1,276 Swell Consolidation Test Results Fig. B-4

**Geotechnical Engineering Group, Inc.**

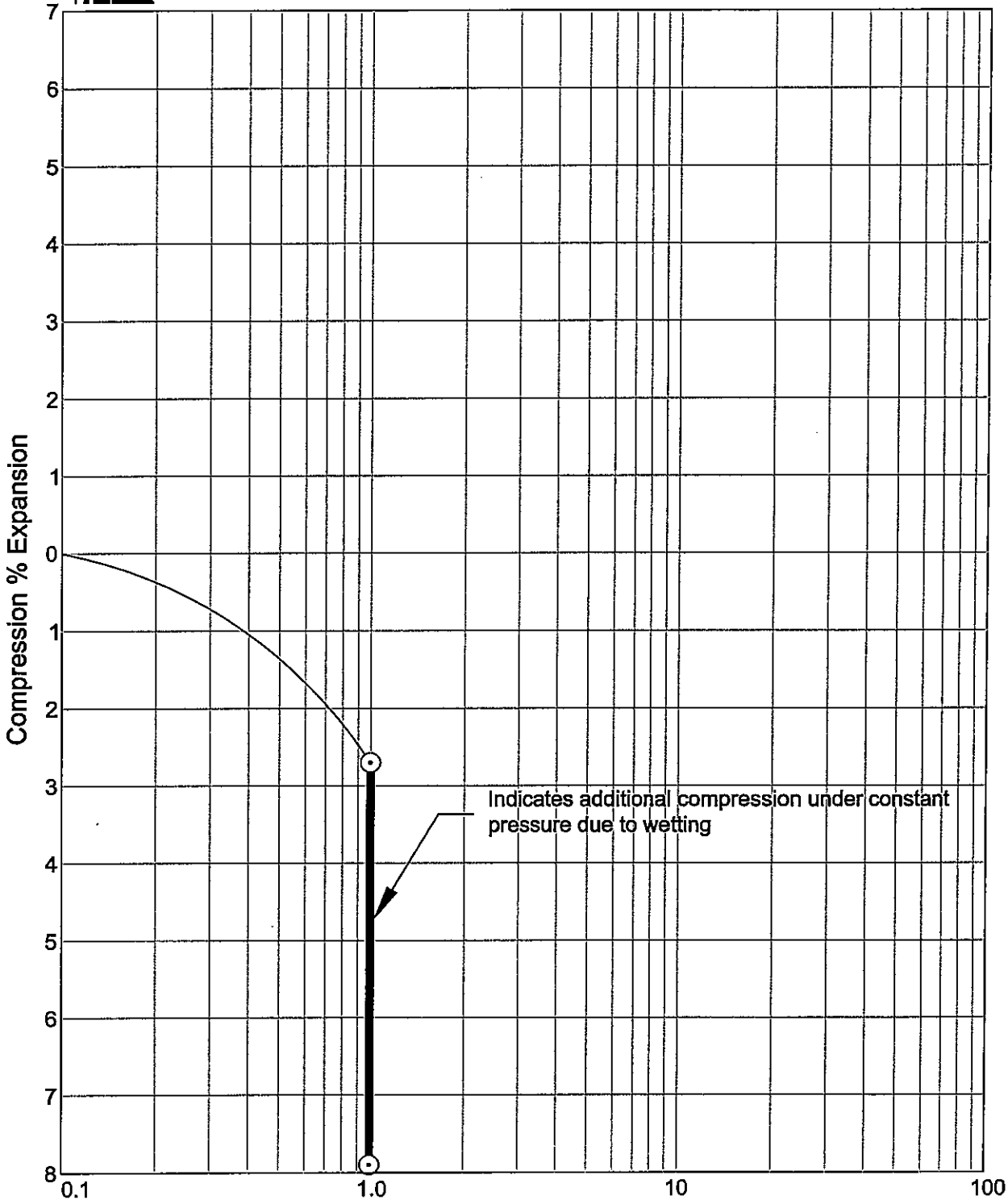



Sample of: Clay, silty, sandy (CL)
From: TH-11 @ 4 foot depth

Dry Unit Weight= 113 PCF
Moisture Content= 7.7 %

Job No. 1,276 Swell Consolidation Test Results Fig. B-5

**Geotechnical Engineering Group, Inc.**

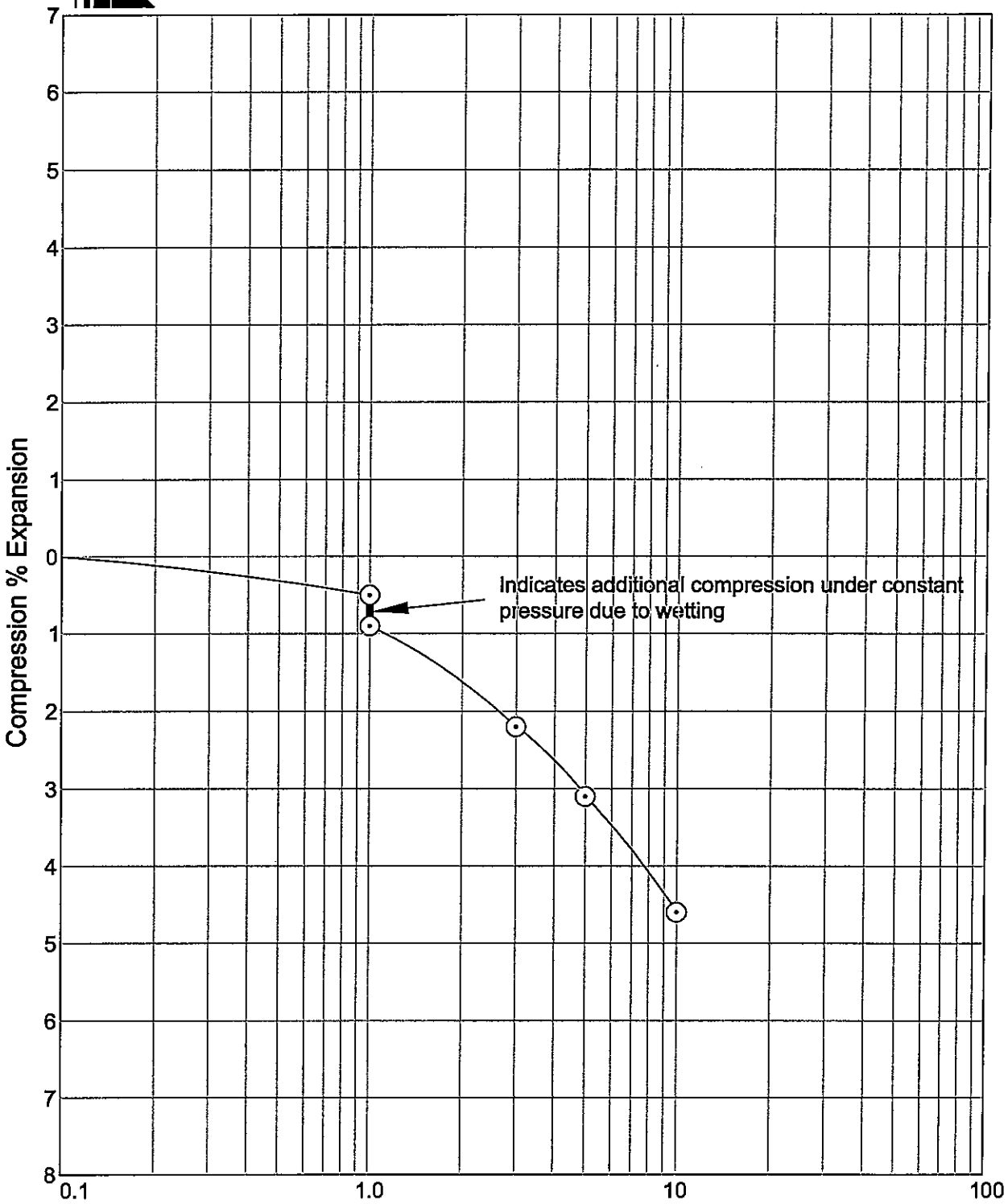



Sample of: Clay, silty, sandy (CL)
From: TH-12 @ 6 foot depth

Dry Unit Weight= 99 PCF
Moisture Content= 10.8 %

Job No. 1,276 Swell Consolidation Test Results Fig. B-6

**Geotechnical Engineering Group, Inc.**



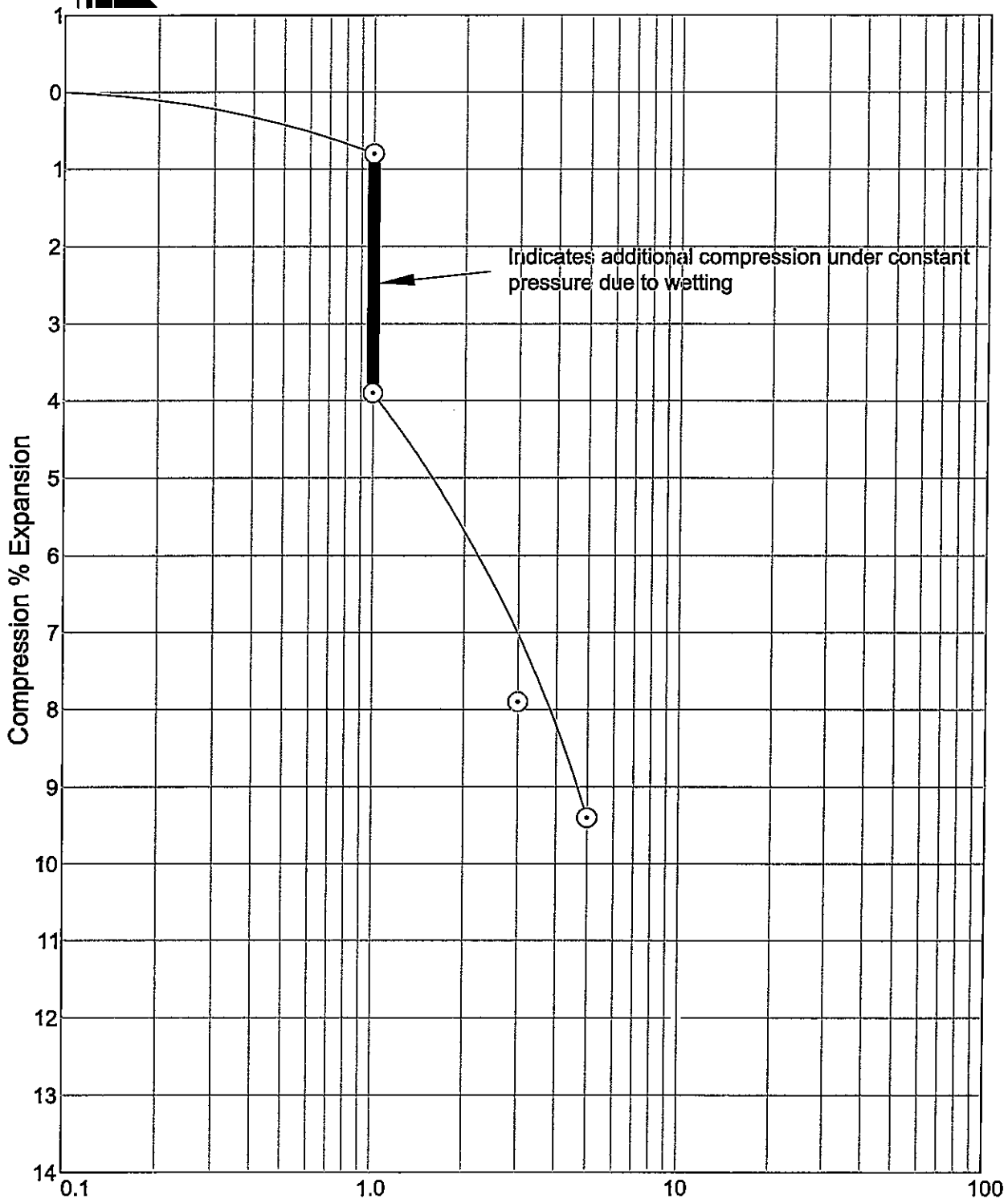

Applied Pressure - KSF

Sample of: Sand, clayey, gravelly (SC)
From: TH-12 @ 14 foot depth

Dry Unit Weight= 114 PCF
Moisture Content= 5.2 %

Job No. 1,276 Swell Consolidation Test Results Fig. B-7

**Geotechnical Engineering Group, Inc.**

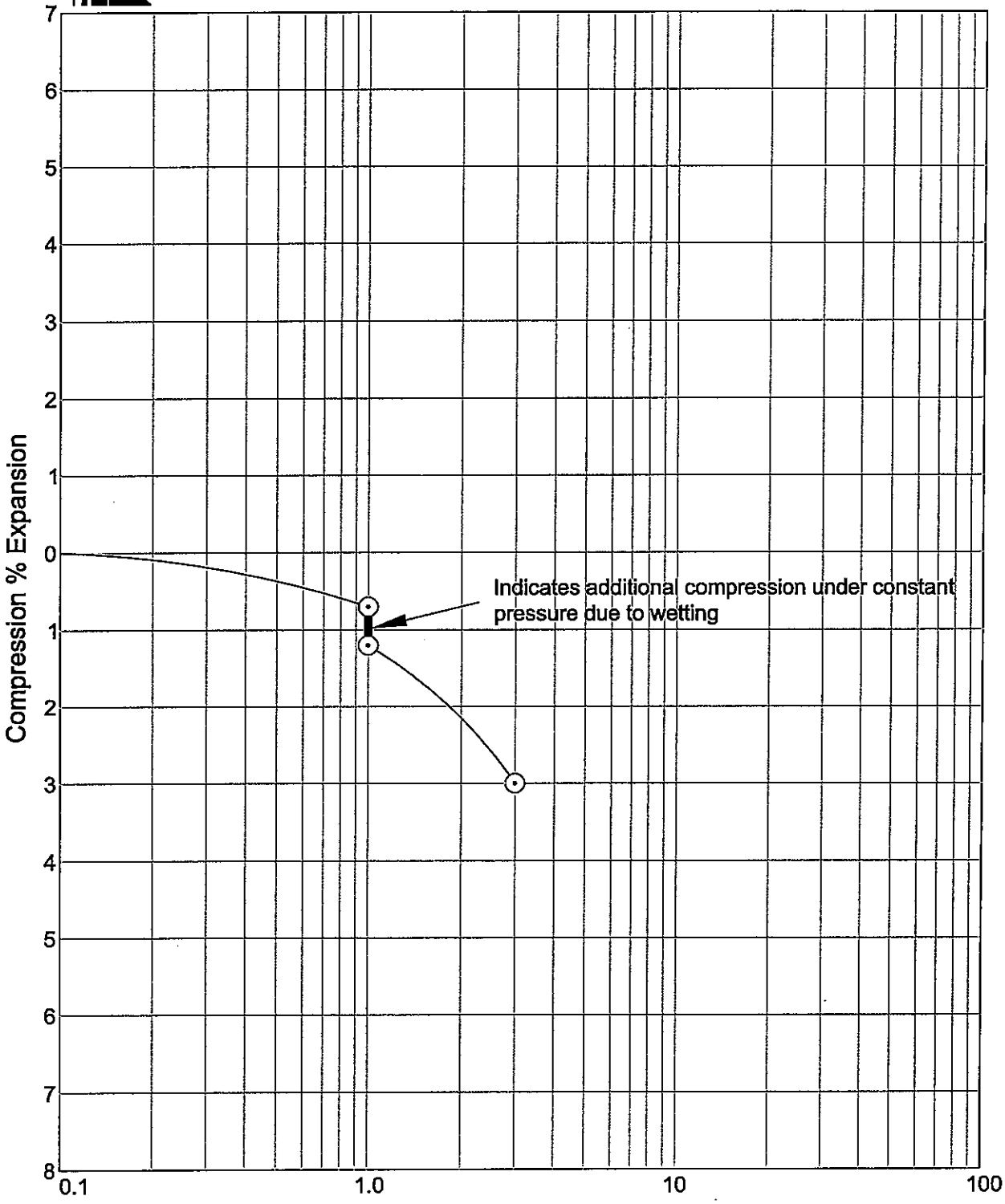



Sample of: Clay, silty, sandy (CL)
From: TH-13 @ 2 foot depth

Dry Unit Weight= 104 PCF
Moisture Content= 8.0 %

Job No. 1,276 Swell Consolidation Test Results Fig. B-8

**Geotechnical Engineering Group, Inc.**

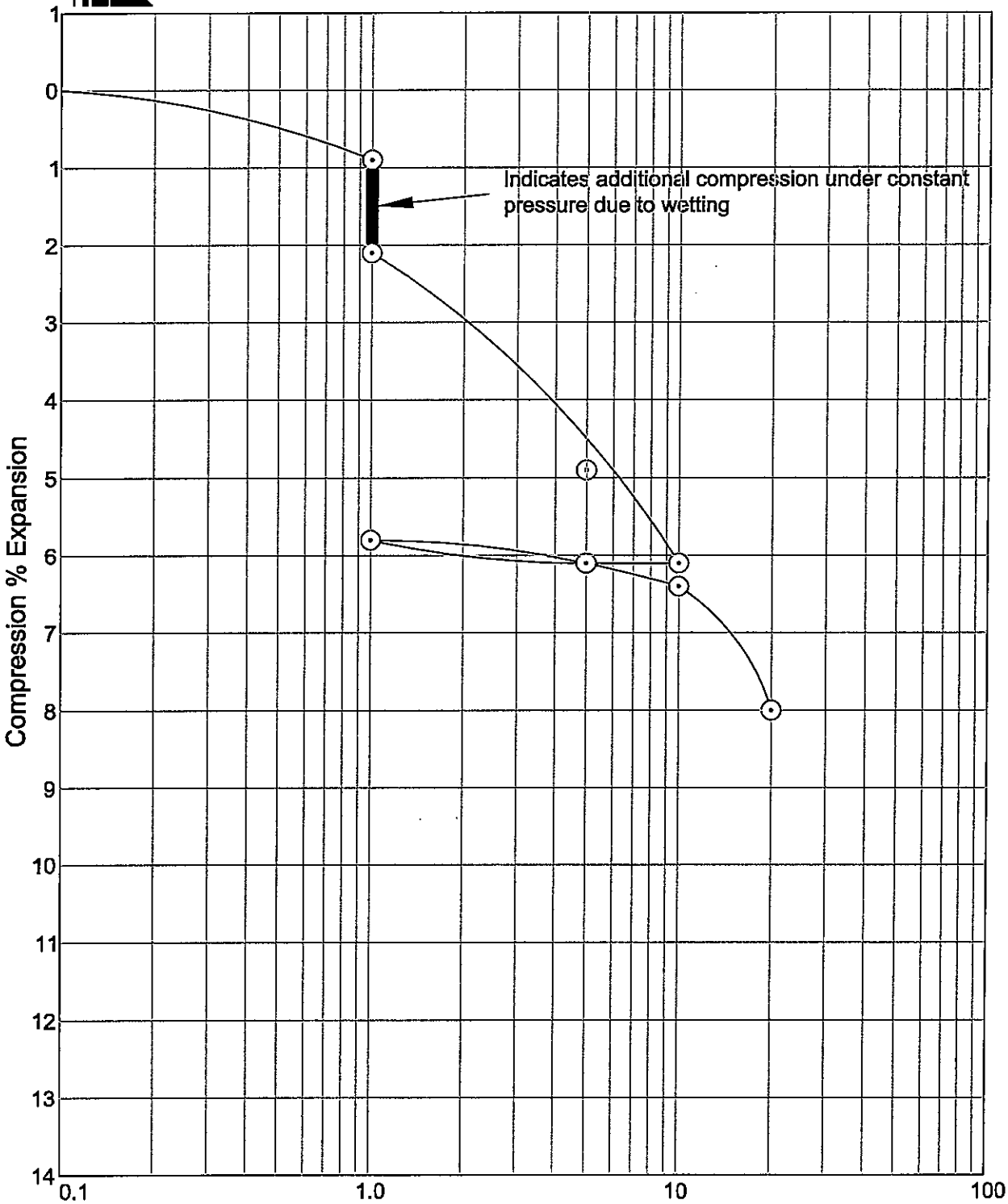



Sample of: Clay, silty, sandy (CL)
From: TH-13 @ 6 foot depth

Dry Unit Weight= 111 PCF
Moisture Content= 8.3 %

Job No. 1,276 Swell Consolidation Test Results Fig. B-9

**Geotechnical Engineering Group, Inc.**

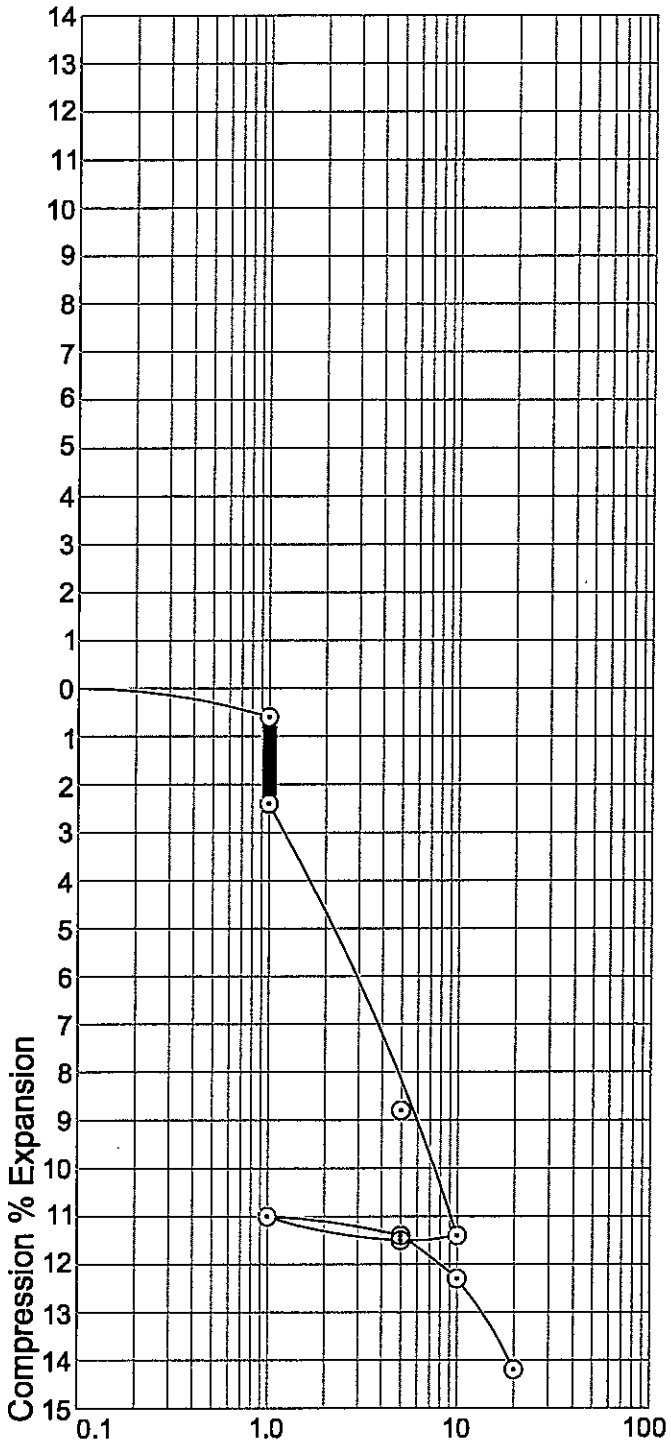



Sample of: Clay, silty, sandy (CL)
From: TH-13 @ 9 foot depth

Dry Unit Weight= 109 PCF
Moisture Content= 8.1 %

Job No. 1,276 Swell Consolidation Test Results Fig. B-10

Geotechnical Engineering Group, Inc.




Applied Pressure - KSF

Sample of: Clay, silty, sandy (CL)
From: TH-15 @ 4 foot depth

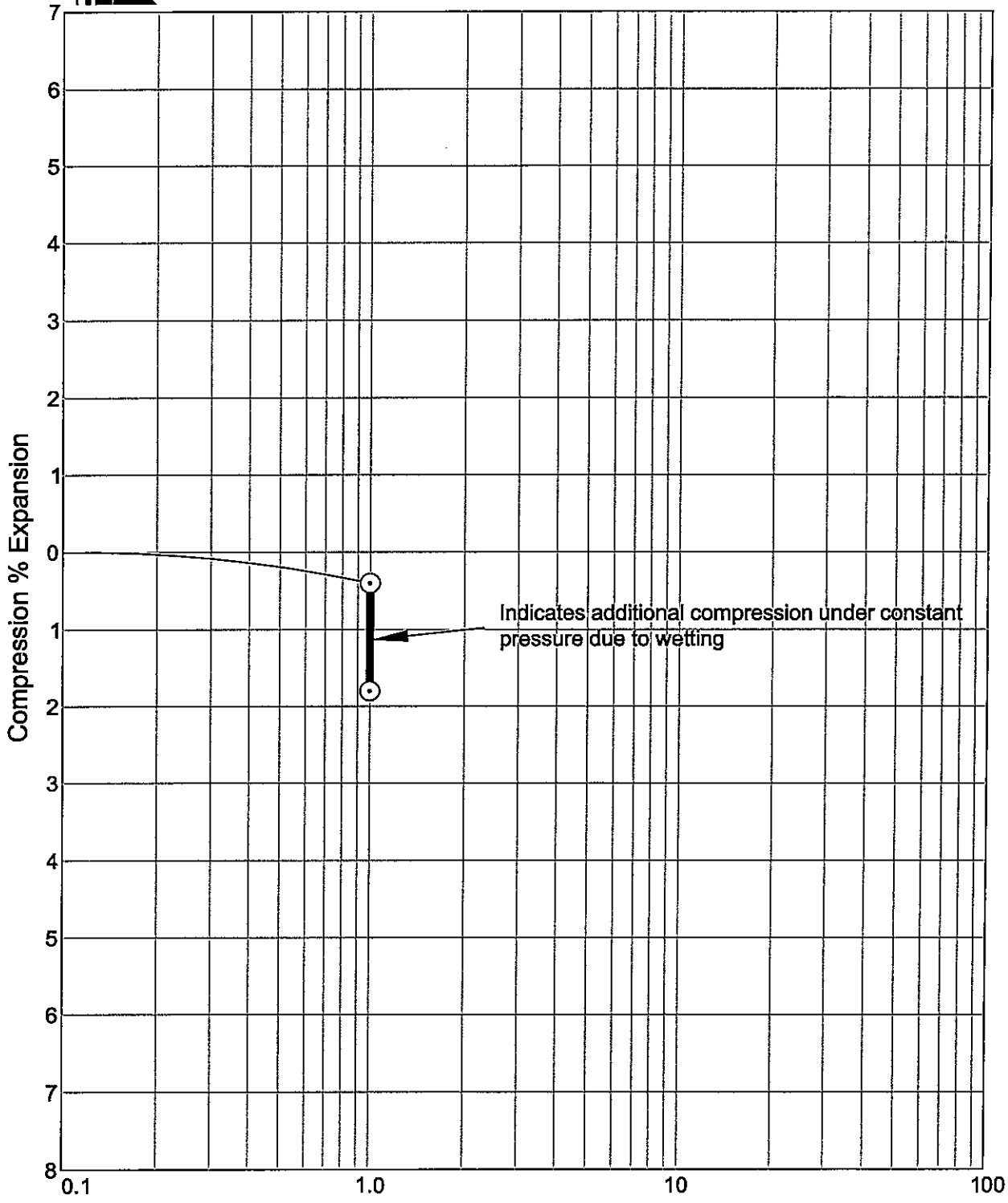
Natural Dry Unit Weight= 104 PCF
Natural Moisture Content= 6.5 %

Job No. 1,276

Fig. B-11

Swell Consolidation Test Results

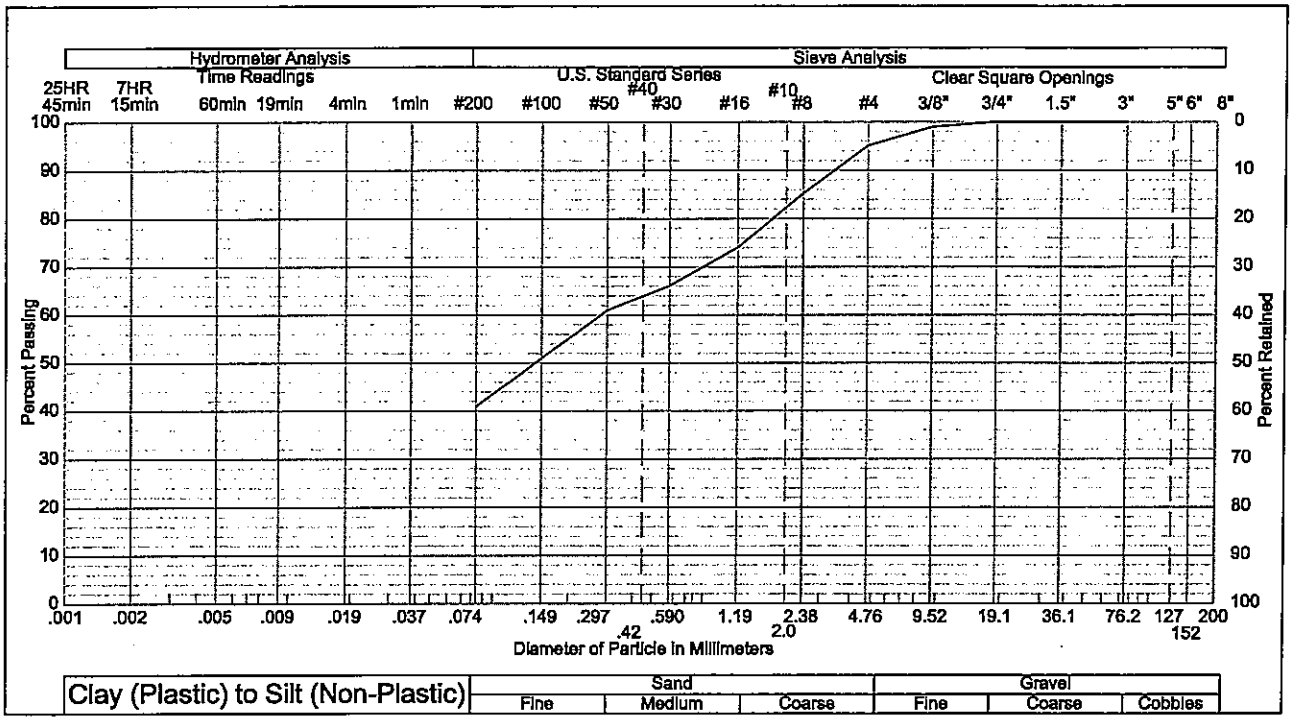
**Geotechnical Engineering Group, Inc.**




Sample of: Clay, silty, sandy (CL)
From: TH-15 @ 14 foot depth

Dry Unit Weight= 100 PCF
Moisture Content= 7.3 %

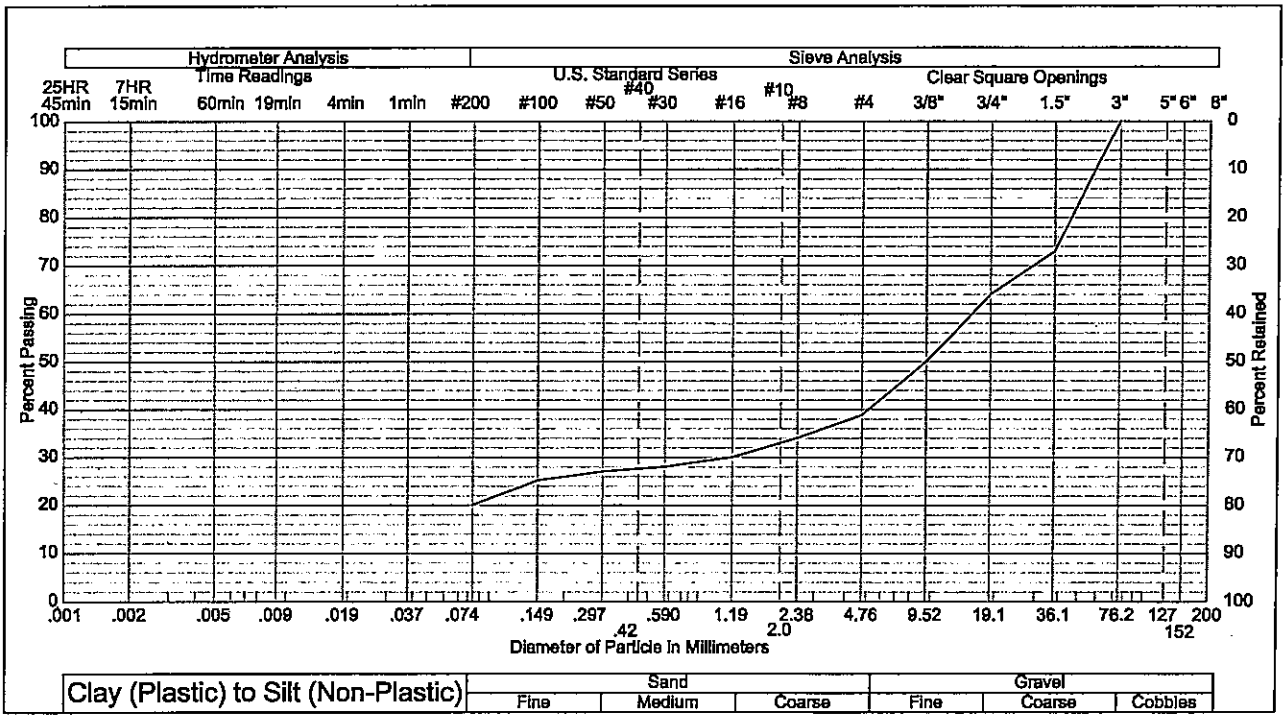
Job No. 1,276 Swell Consolidation Test Results Fig. B-12




Sample of: Sand, clayey (SC)
From: TH-5 @ 4 foot depth

Gravel: 5 %
Silt & Clay: 41 %
Plasticity Index:

Sand: 54 %
Liquid Limit:




Sample of: Gravel, clayey, sandy (GC)
From: TH-7 @ 14 foot depth

Gravel: 61 %
Silt & Clay: 20 %
Plasticity Index:

Sand: 19 %
Liquid Limit:

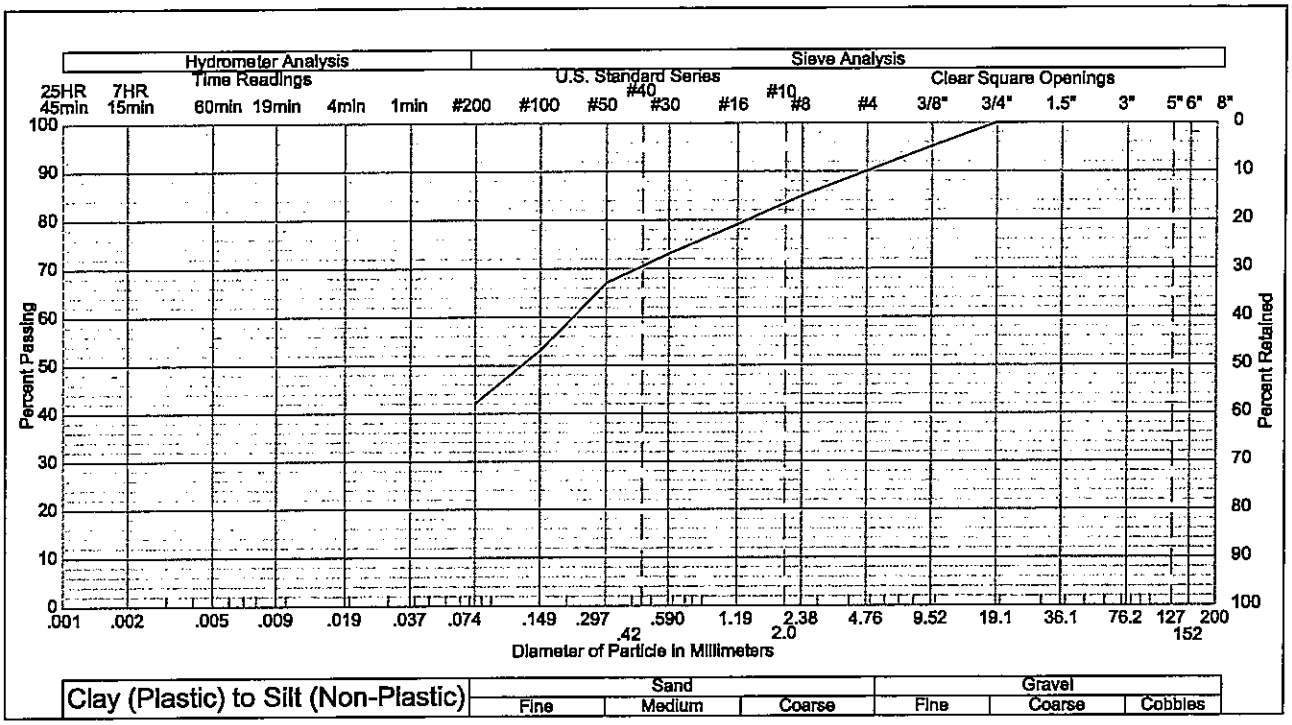
# Gradation Test Results

**Geotechnical Engineering Group, Inc.**

Job No. 1,276

Date: August, 2003

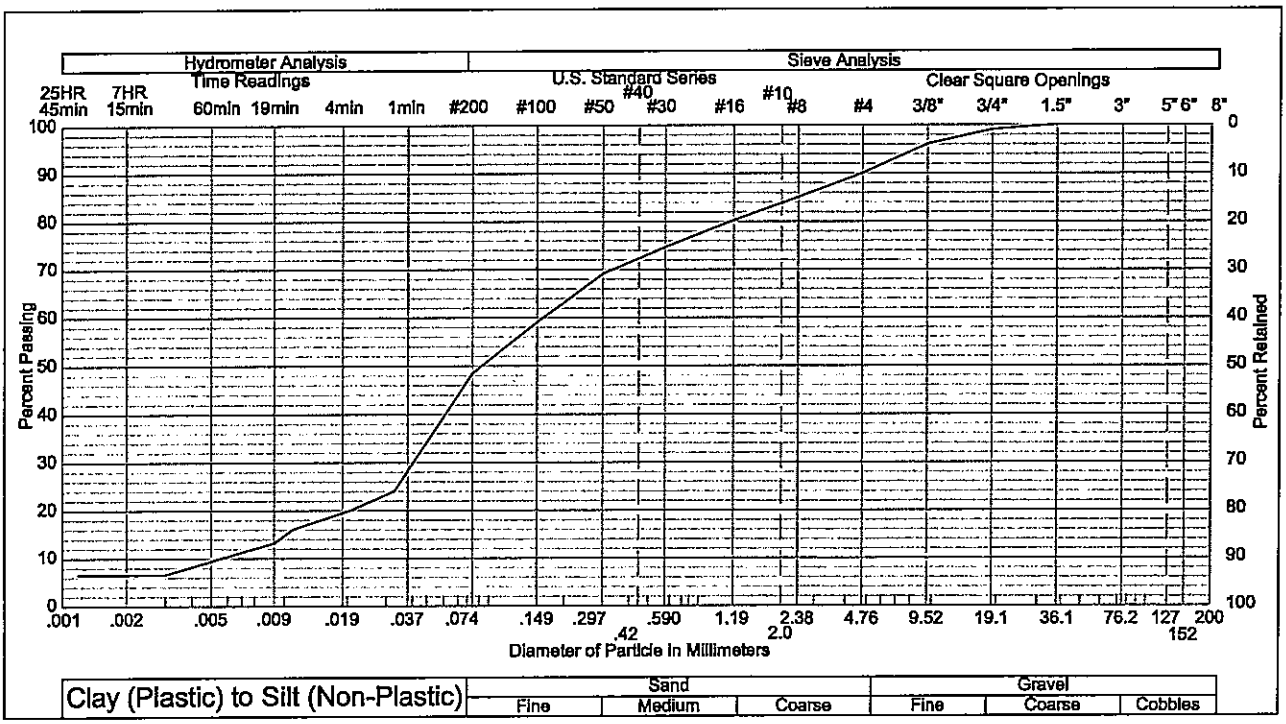
Fig. B-13




Sample of: Sand, clayey, gravelly (SC)
From: TH-8 @ 9 foot depth

Gravel: 10 %
Silt & Clay: 42 %
Plasticity Index:

Sand: 48 %
Liquid Limit:




Sample of: Clay, silty, sandy, gravelly (CL)
From: TH-7 and 8 @ 0-5 foot depth

Gravel: 10 %
Silt & Clay: 48 %
Plasticity Index: 5

Sand: 42 %
Liquid Limit: 21

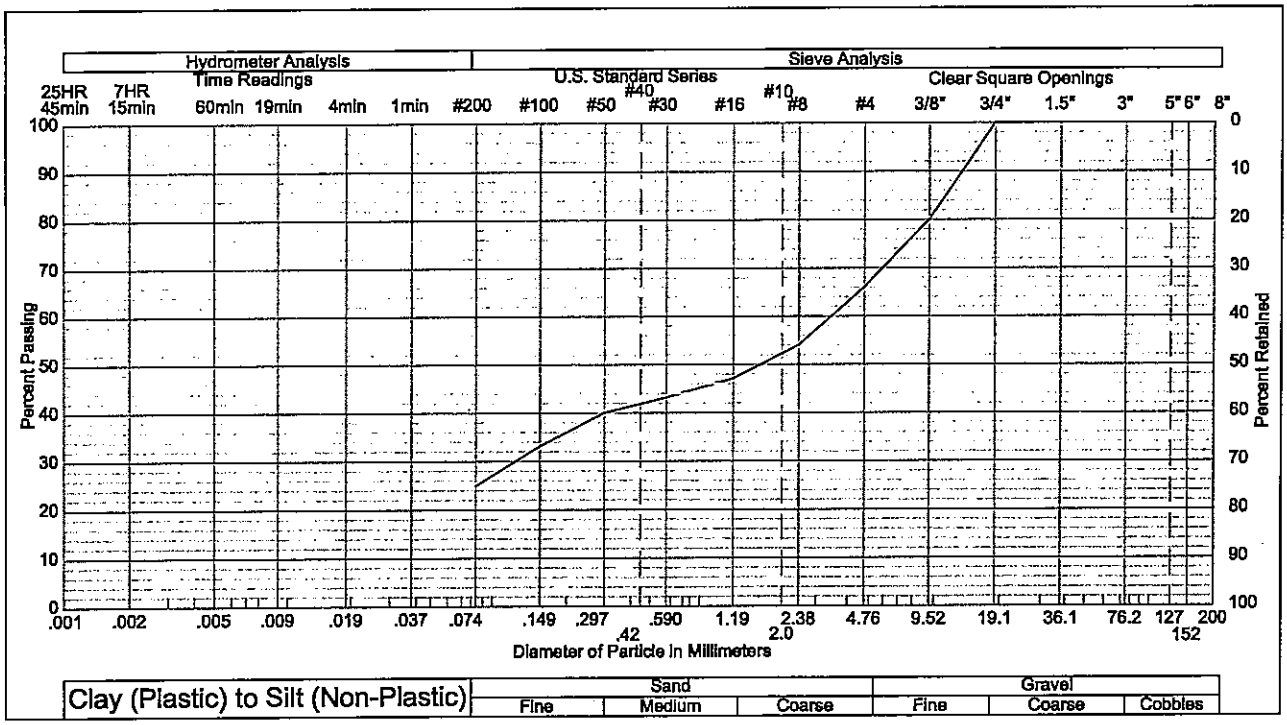
# Gradation Test Results

**Geotechnical Engineering Group, Inc.**

Job No. 1,276

Date: August, 2003

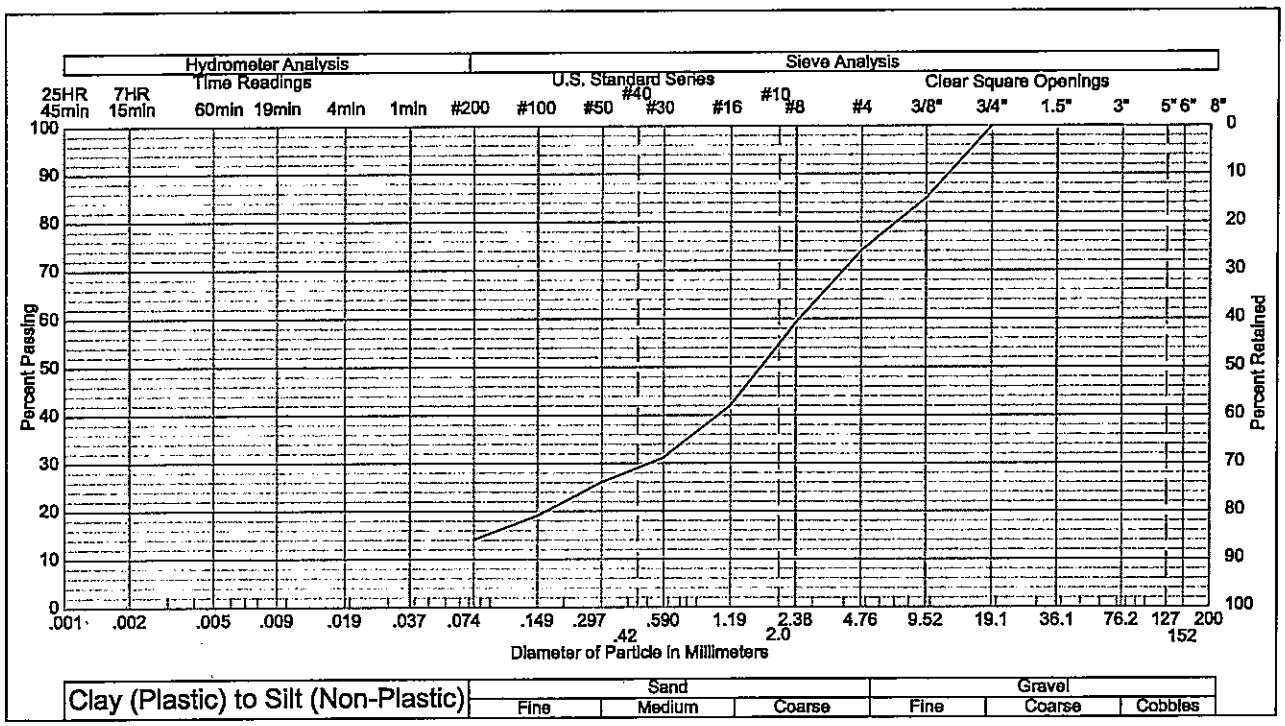
Fig. B-14




Sample of: Sand, gravelly, clayey (SC)
From: TH-9 @ 14 foot depth

Gravel: 34 %
Silt & Clay: 25 %
Plasticity Index:

Sand: 41 %
Liquid Limit:




Sample of: Sand, gravelly, clayey (SC)
From: TH-11 @ 14 foot depth

Gravel: 26 %
Silt & Clay: 14 %
Plasticity Index:

Sand: 60 %
Liquid Limit:

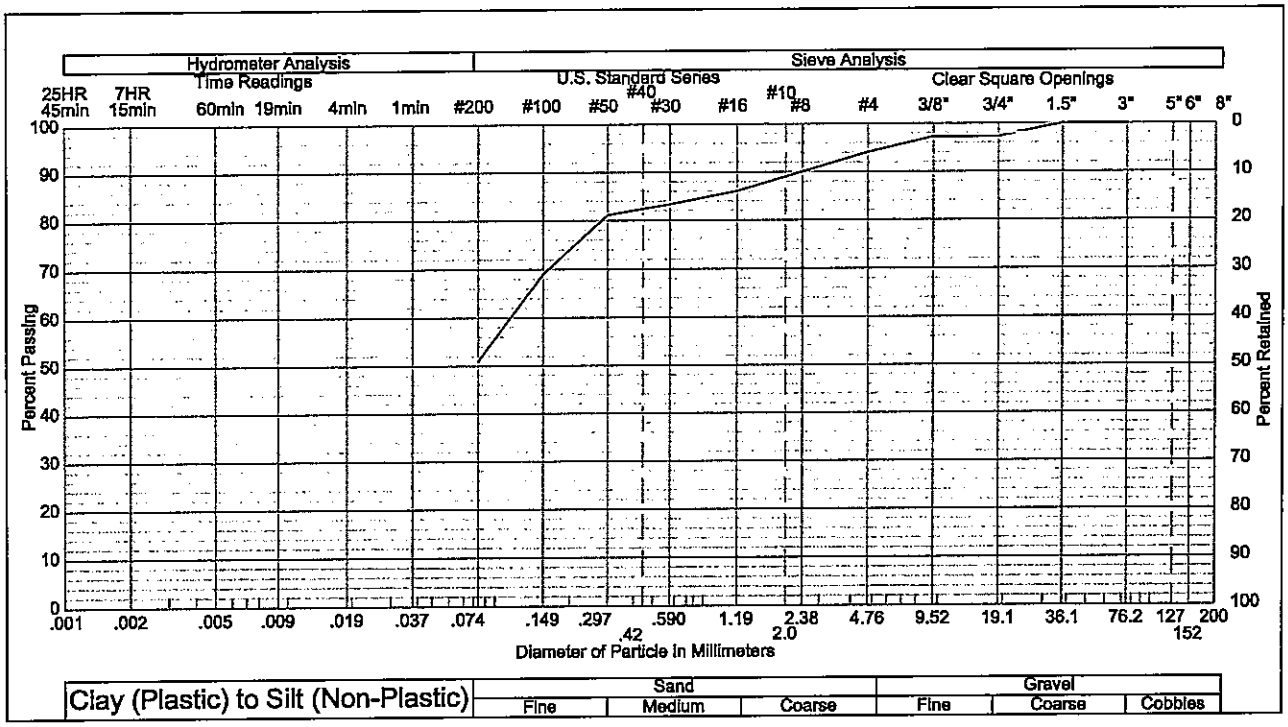
# Gradation Test Results

Job No. 1,276

Date: August, 2003

Fig. B-15

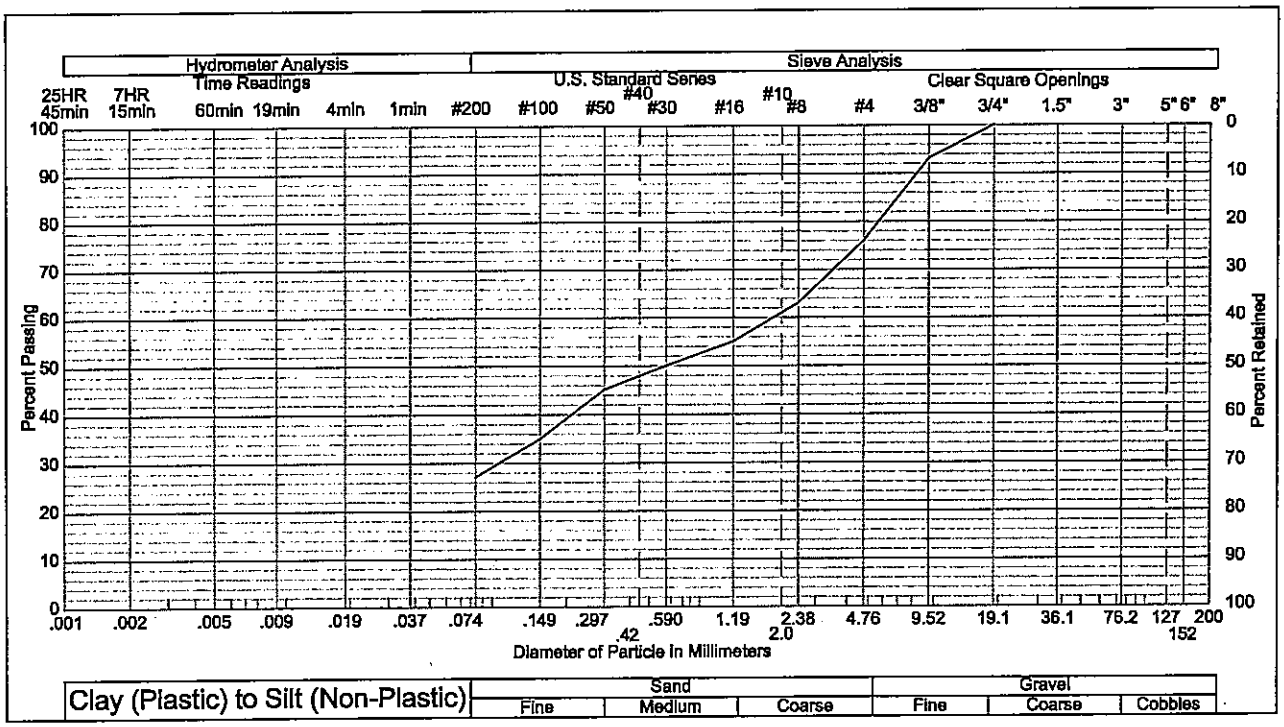
Geotechnical Engineering Group, Inc.




Sample of: Clay, silty, sandy, gravelly (CL)
From: TH-13 @ 14.5 foot depth

Gravel: 6 %
Silt & Clay: 51 %
Plasticity Index:

Sand: 43 %
Liquid Limit:




Sample of: Sand, clayey, gravelly (SC)
From: TH-14 @ 9 foot depth

Gravel: 24 %
Silt & Clay: 27 %
Plasticity Index:

Sand: 49 %
Liquid Limit:

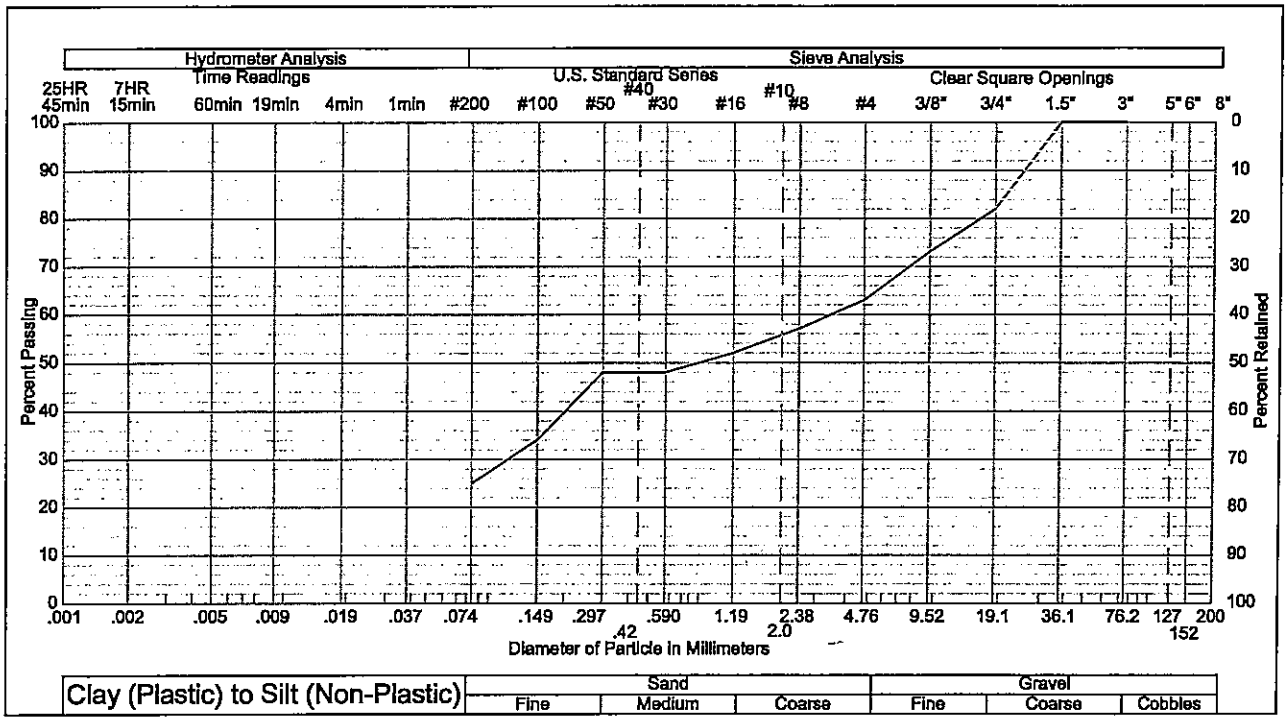
# Gradation Test Results

Job No. 1,276

Date: August, 2003

Fig. B-16

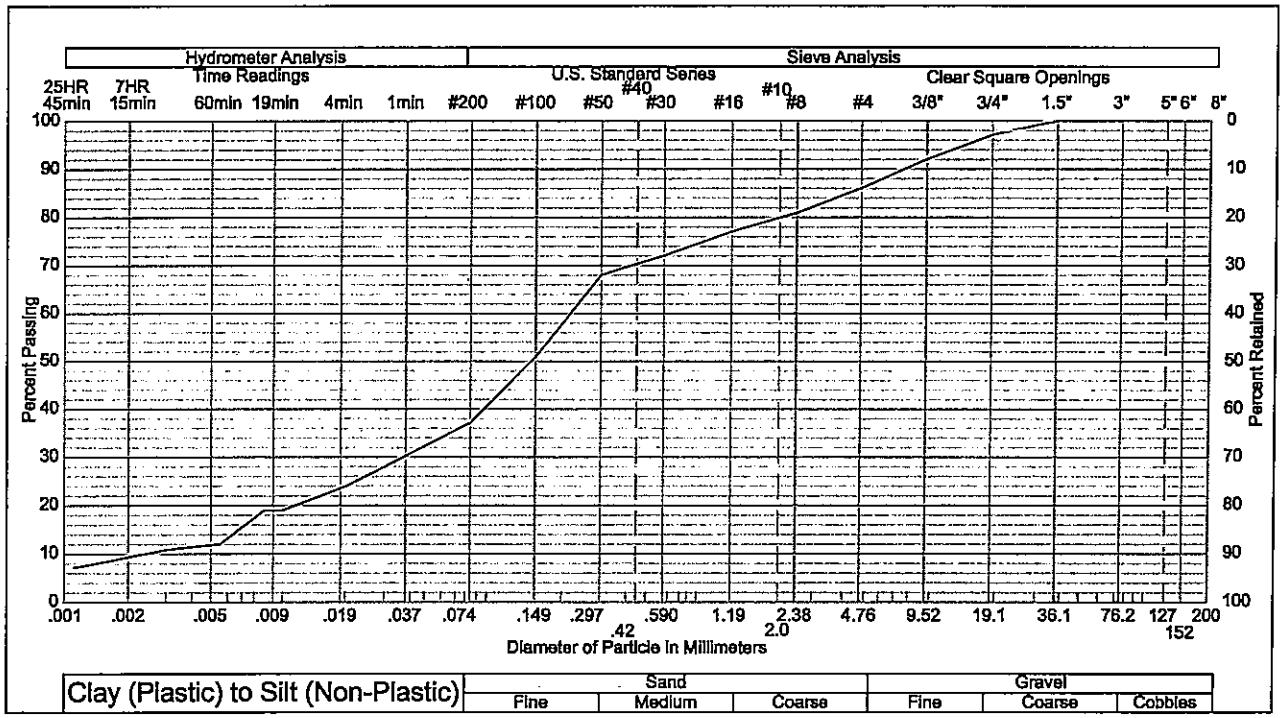
**Geotechnical Engineering Group, Inc.**




Sample of: Sand, clayey, gravelly (SC)
From: TH-20 @ 9 foot depth

Gravel: 37 %
Silt & Clay: 25 %
Plasticity Index:

Sand: 38 %
Liquid Limit:




Sample of: Sand, silty, gravelly (SM)
From: TH-25 and 26 @ 0 to 5 foot depth, bulk combined

Gravel: 14 %
Silt & Clay: 34 %
Plasticity Index: 3

Sand: 52 %
Liquid Limit: 20

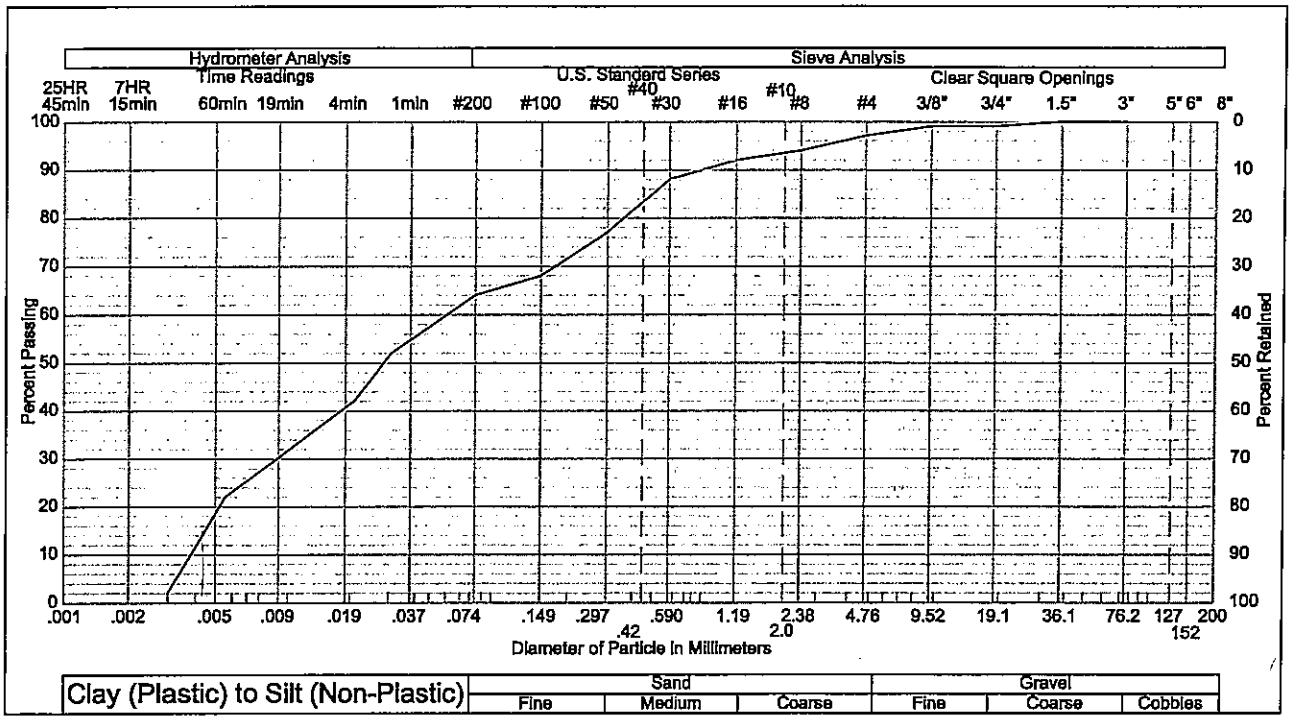
# Gradation Test Results

Geotechnical Engineering Group, Inc.

Job No. 1,276

Date: August, 2003

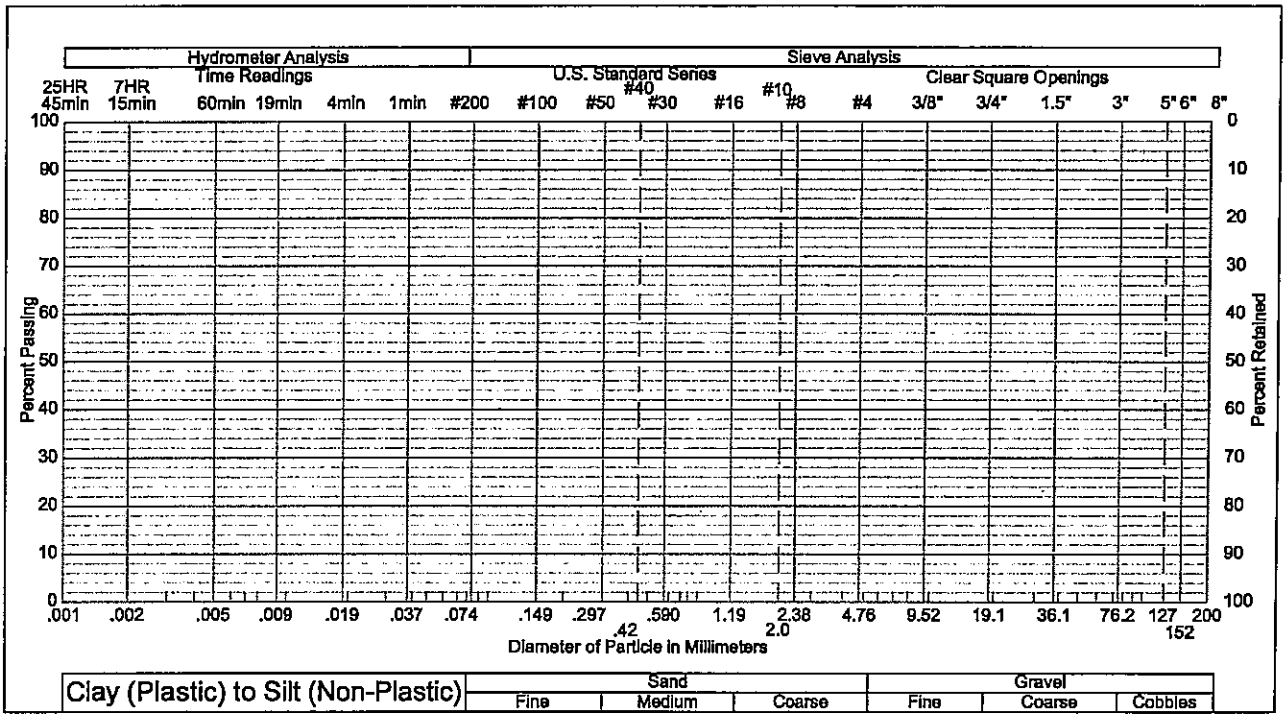
Fig. B-17




Sample of: Clay, silty, sandy (CL)
From: TH- 35 and 36 @ 0 to 5 foot depth, bulk combined

Gravel: 3 %
Silt & Clay: 63 %
Plasticity Index: 5

Sand: 34 %
Liquid Limit: 30




Sample of:
From:

Gravel: %
Silt & Clay: %
Plasticity Index:

Sand: %
Liquid Limit:

# Gradation Test Results

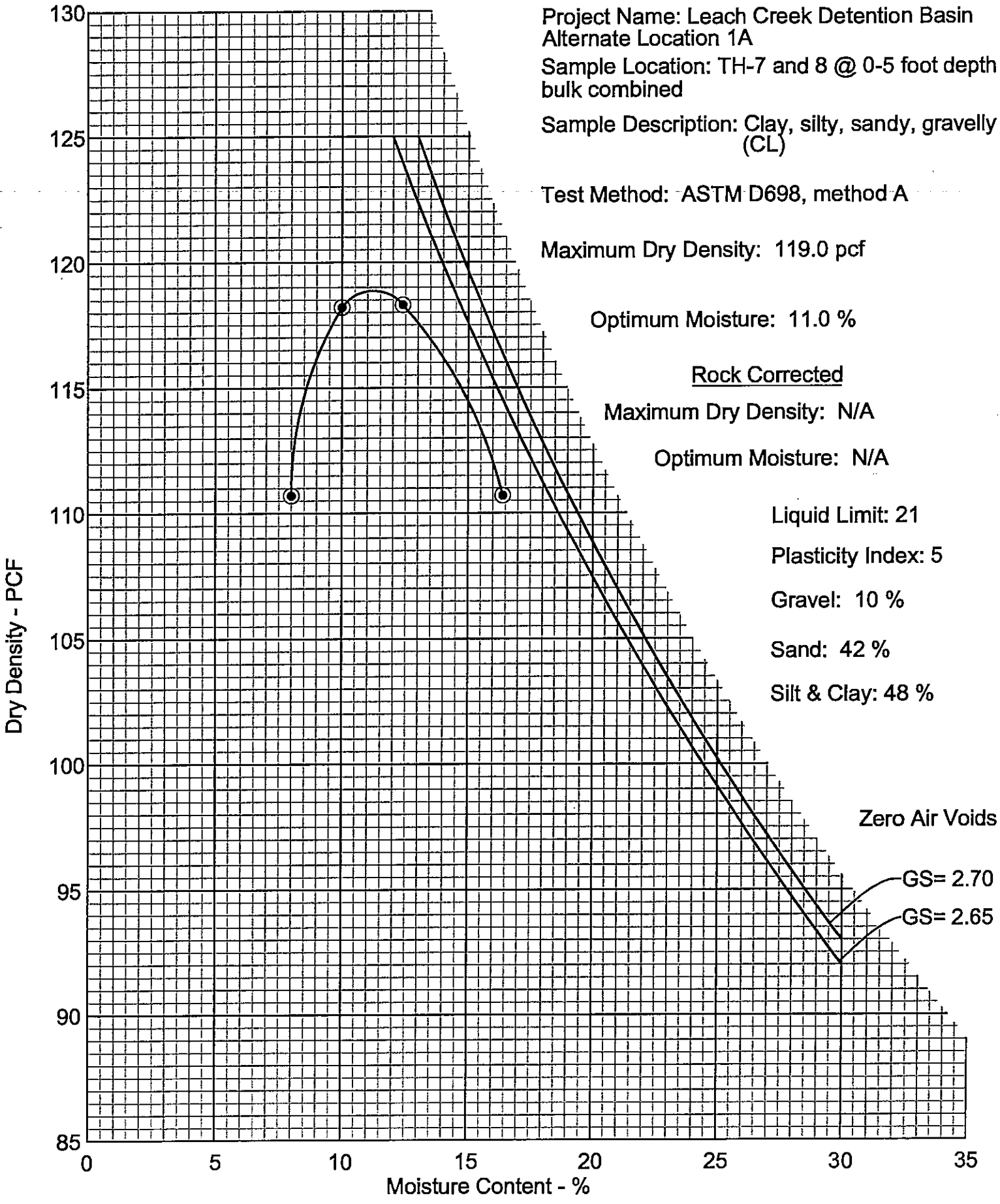
Job No. 1,276

Geotechnical Engineering Group, Inc.

Date: August, 2003

Fig. B-18

# Geotechnical Engineering Group, Inc.
# Moisture- Density Relationship




Project Name: Leach Creek Detention Basin Alternate Location 1A

Sample Location: TH-7 and 8 @ 0-5 foot depth bulk combined

Sample Description: Clay, silty, sandy, gravelly (CL)

Test Method: ASTM D698, method A

Maximum Dry Density: 119.0 pcf

Optimum Moisture: 11.0 %

Rock Corrected

Maximum Dry Density: N/A

Optimum Moisture: N/A

Liquid Limit: 21

Plasticity Index: 5

Gravel: 10 %

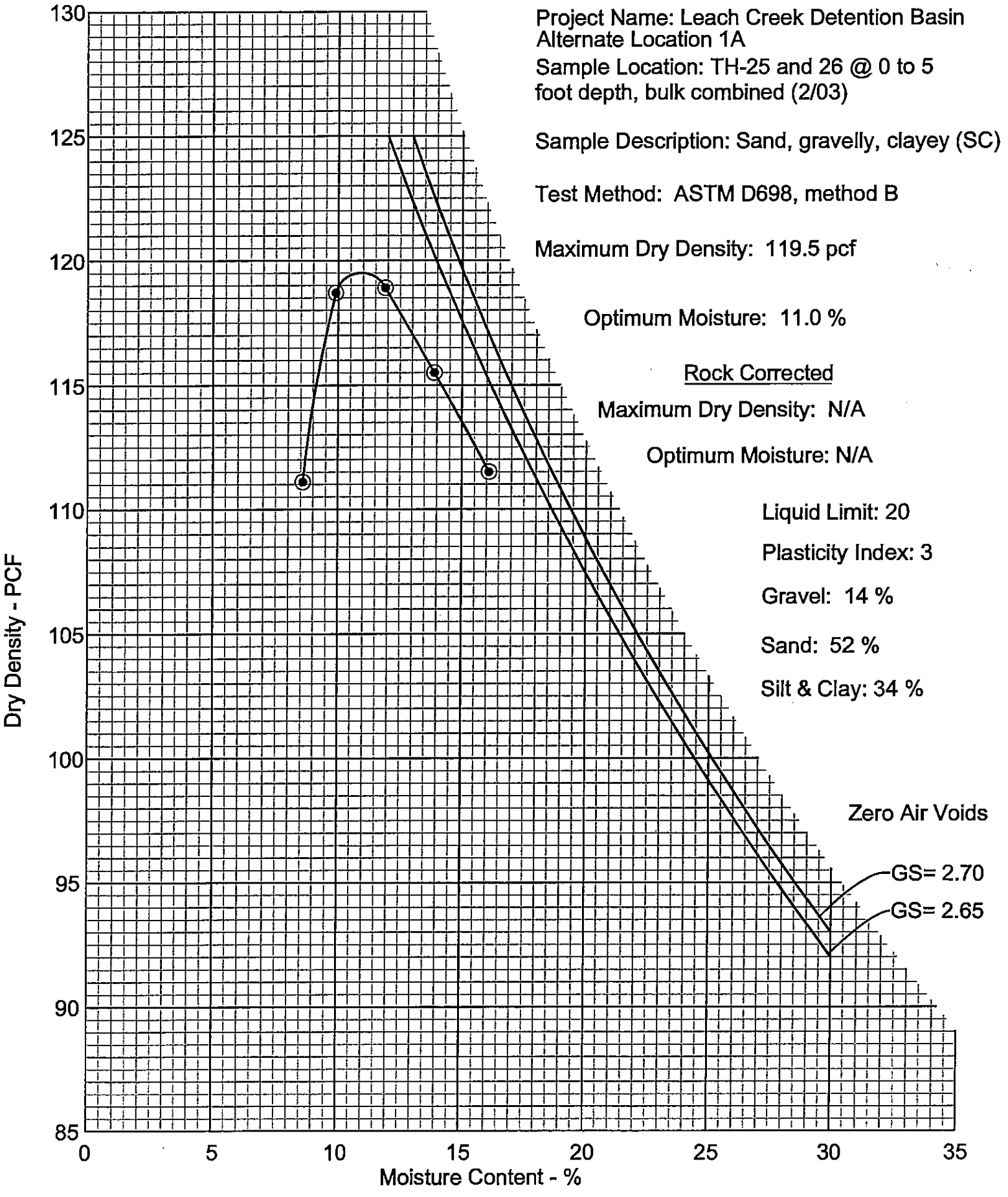
Sand: 42 %

Silt & Clay: 48 %

Job No. 1,276

Fig. B-19

# Geotechnical Engineering Group, Inc.
# Moisture- Density Relationship




Project Name: Leach Creek Detention Basin Alternate Location 1A

Sample Location: TH-25 and 26 @ 0 to 5 foot depth, bulk combined (2/03)

Sample Description: Sand, gravelly, clayey (SC)

Test Method: ASTM D698, method B

Maximum Dry Density: 119.5 pcf

Optimum Moisture: 11.0 %

Rock Corrected

Maximum Dry Density: N/A

Optimum Moisture: N/A

Liquid Limit: 20

Plasticity Index: 3

Gravel: 14 %

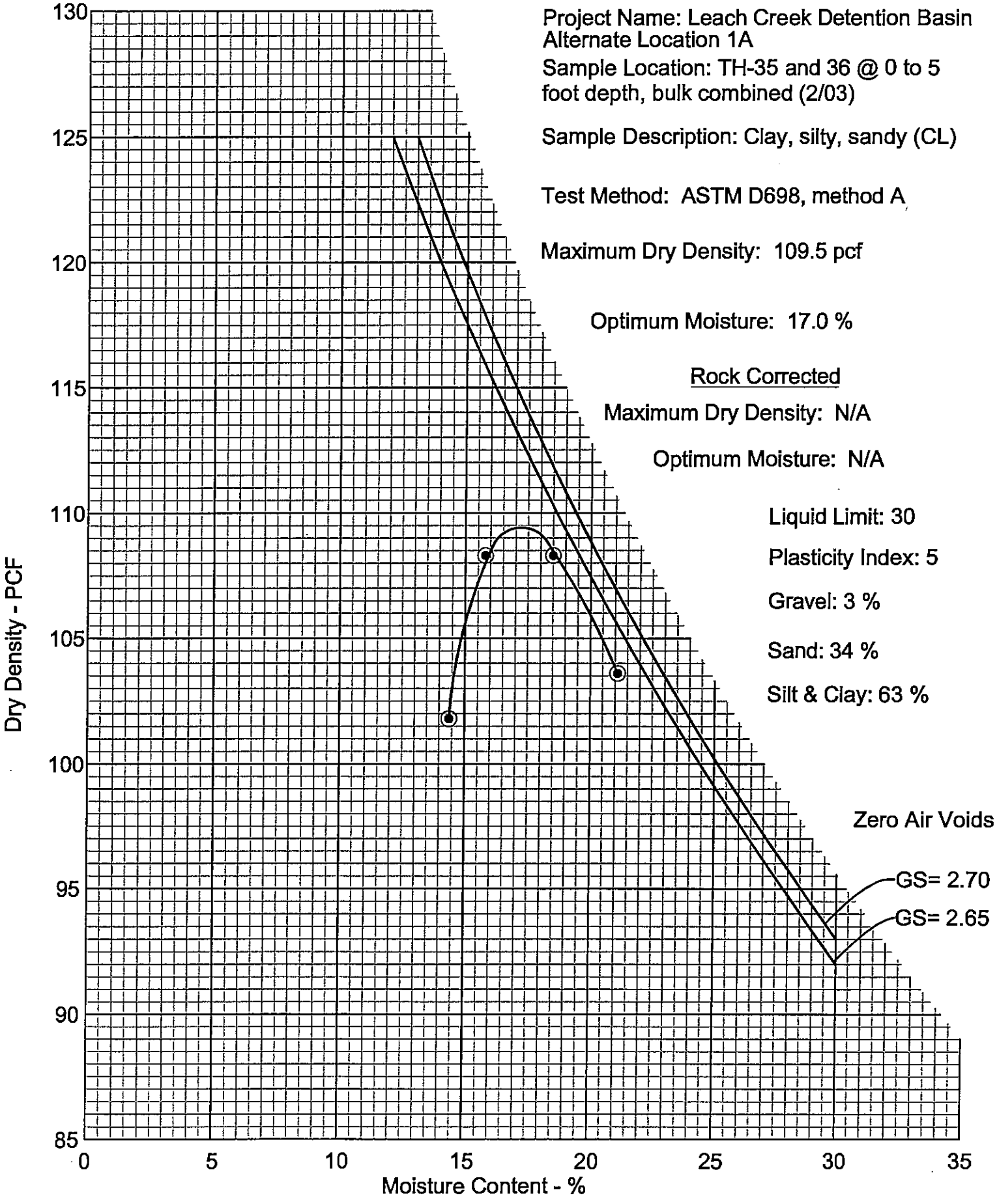
Sand: 52 %

Silt & Clay: 34 %

Job No. 1,276

Fig. B-20

# Geotechnical Engineering Group, Inc.
# Moisture- Density Relationship




Project Name: Leach Creek Detention Basin Alternate Location 1A

Sample Location: TH-35 and 36 @ 0 to 5 foot depth, bulk combined (2/03)

Sample Description: Clay, silty, sandy (CL)

Test Method: ASTM D698, method A

Maximum Dry Density: 109.5 pcf

Optimum Moisture: 17.0 %

Rock Corrected

Maximum Dry Density: N/A

Optimum Moisture: N/A

Liquid Limit: 30

Plasticity Index: 5

Gravel: 3 %

Sand: 34 %

Silt & Clay: 63 %

Job No. 1,276

Fig. B-21

Geotechnical Engineering Group, Inc.

# Hydraulic Conductivity ASTM D5084

Job Name: Leach Creek Dam | Job No.: 1,276 | Technician: JCH | Date: 1/30/03
Sample Location: TH-12 | Depth: 4' | Lab Number: N/A
Description: Clay, silty, sandy (CL)

MDD (pcf): N/A | OMC (%): N/A | DD (pcf): 109.3 | MC (%): 11.7 | % Comp: N/A
Compaction Method: ASTM D698, Method A | Test Method: C (Falling Head/Rising Tail)

| Sample Height, intial/final (in) | | |
|---|---|---|
| #1 | 1.45 | 1.42 |
| #2 | 1.42 | 1.42 |
| #3 | 1.49 | 1.42 |
| #4 | 1.46 | 1.42 |
| Average | 1.46 | 1.42 |

| Sample Diameter, initial/final (in) | | |
|---|---|---|
| Top | 1.94 | 1.91 |
| Middle | 2.02 | 2.04 |
| Bottom | 2.02 | 2.03 |
| Average | 1.99 | 1.99 |

Initial Wet Mass (g): 145.6

| Moisture | | |
|---|---|---|
| | Initial | Final |
| Tare# | 7L | FA |
| Tare Mass (g) | 15.7 | 8.5 |
| Tare and Wet (g) | 340.1 | 163.1 |
| Tare and Dry (g) | 306.0 | 135.8 |

## B-Coefficient

| Cell Volume (cc) | Initial Cell Pressure (psi) | Final Cell Pressure (psi) | Initial Pore Pressure (psi) | Final Pore Pressure (psi) | Base Volume (cc) | Top Volume (cc) | B |
|---|---|---|---|---|---|---|---|
| | 41.6 | 51.6 | 39.7 | 49.0 | | | 93 |
| | 51.6 | 61.6 | 49.7 | 59.2 | | | 95 |

Temp (C) = 27
$a_{in}$ ($m^2$) = 1.97E-05
$a_{out}$ ($m^2$) = 1.97E-05
L (m) = 3.70E-02
A ($m^2$) = 2.01E-03
$R_T$ = 0.833
k (m/s)** = 9.4E-09
**$k_{20}$ (m/s)**** = **7.9E-09**
Void Ratio: 0.35
Pore Volume (cc): 25.71
Volume Flowed (cc): 34.58
Pore Volumes Flowed: 1.3
Back Pressure* (psi): 59.6
Confining Pressure* (psi): 2.1
Max. Stress (psi): 2.5 | Min. Stess (psi): 1.6

## Hydraulic Conductivity

| Elapsed Time (sec) | Cell Pressure (psi) | Base Pressure (psi) | Top Pressure (psi) | Base Volume (cc) | Top Volume (cc) | Head Loss, $h_1$ (m) | Head Loss, $h_2$ (m) | Conductivity, k (m/s) | Hydraulic Gradiendt |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 61.6 | 60.0 | 59.2 | 0.28 | 9.63 | | | | |
| 1200 | 61.7 | 60.0 | 59.2 | 0.95 | 8.96 | 1.037 | 0.969 | 1.02E-08 | 26 |
| 3000 | 61.7 | 60.0 | 59.2 | 1.81 | 8.10 | 0.969 | 0.882 | 9.44E-09 | 24 |
| 4320 | 61.7 | 60.0 | 59.2 | 2.39 | 7.52 | 0.882 | 0.823 | 9.48E-09 | 22 |
| 6360 | 61.7 | 60.0 | 59.2 | 3.20 | 6.72 | 0.823 | 0.741 | 9.30E-09 | 20 |
| 7800 | 61.7 | 60.0 | 59.2 | 3.71 | 6.17 | 0.741 | 0.687 | 9.50E-09 | 19 |
| 9120 | 61.7 | 60.0 | 59.2 | 4.20 | 5.74 | 0.687 | 0.641 | 9.49E-09 | 17 |

*Average for duration of test. **Average for last four readings.

Remarks: Pore Volume estimated from final moisture content.

Geotechnical Engineering Group, Inc.

# Hydraulic Conductivity ASTM D5084

Job Name: Leach Creek Dam | Job No.: 1,276 | Technician: JCH | Date: 2/4/03
Sample Location: TH-12 | Depth: 9' | Lab Number: N/A
Description: Clay, silty, sandy (CL)

MDD (pcf): N/A | OMC (%): N/A | DD (pcf): 93.5 | MC (%): 8.5 | % Comp: N/A
Compaction Method: ASTM D698, Method A | Test Method: C (Falling Head/Rising Tail)

| Sample Height, intial/final (in) | | |
|---|---|---|
| #1 | 1.18 | 1.14 |
| #2 | 1.17 | 1.14 |
| #3 | 1.21 | 1.14 |
| #4 | 1.18 | 1.14 |
| Average | 1.19 | 1.14 |

| Sample Diameter, initial/final (in) | | |
|---|---|---|
| Top | 1.88 | 1.81 |
| Middle | 1.90 | 1.82 |
| Bottom | 1.89 | 1.83 |
| Average | 1.89 | 1.82 |

Initial Wet Mass (g): 88.5

| Moisture | | |
|---|---|---|
| | Initial | Final |
| Tare# | J | GEG |
| Tare Mass (g) | 8.1 | 8.4 |
| Tare and Wet (g) | 232.4 | 107.7 |
| Tare and Dry (g) | 214.9 | 90.0 |

## B-Coefficient

| Cell Volume (cc) | Initial Cell Pressure (psi) | Final Cell Pressure (psi) | Initial Pore Pressure (psi) | Final Pore Pressure (psi) | Base Volume (cc) | Top Volume (cc) | B |
|---|---|---|---|---|---|---|---|
| | 40.8 | 50.8 | 39.8 | 49.2 | | | 94 |
| | 50.6 | 60.6 | 49.7 | 59.5 | | | 98 |

## Hydraulic Conductivity

| Elapsed Time (sec) | Cell Pressure (psi) | Base Pressure (psi) | Top Pressure (psi) | Base Volume (cc) | Top Volume (cc) | Head Loss, $h_1$ (m) | Head Loss, $h_2$ (m) | Conductivity, k (m/s) | Hydraulic Gradiendt |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 61.0 | 60.0 | 59.8 | 2.91 | 4.59 | | | | |
| 30 | 61.0 | 60.0 | 59.8 | 3.31 | 3.84 | 0.226 | 0.168 | 1.62E-06 | 6 |
| 60 | 61.0 | 60.0 | 59.8 | 3.99 | 3.35 | 0.168 | 0.108 | 2.41E-06 | 4 |
| 90 | 61.0 | 60.0 | 59.8 | 4.32 | 3.00 | 0.108 | 0.074 | 2.06E-06 | 2 |
| 120 | 61.0 | 60.0 | 59.8 | 4.52 | 2.77 | 0.074 | 0.052 | 1.93E-06 | 2 |
| 150 | 61.0 | 60.0 | 59.8 | 4.65 | 2.61 | 0.052 | 0.037 | 1.86E-06 | 1 |
| 180 | 61.0 | 60.0 | 59.8 | 4.76 | 2.51 | 0.037 | 0.026 | 1.93E-06 | 1 |

Temp (C) = 25
$a_{in}$ ($m^2$) = 1.97E-05
$a_{out}$ ($m^2$) = 1.97E-05
L (m) = 3.01E-02
A ($m^2$) = 1.81E-03
$R_T$ = 0.882
k (m/s)** = 1.9E-06
**$k_{20}$ (m/s)**** = **1.7E-06**
Void Ratio: 0.29
Pore Volume (cc): 15.77
Volume Flowed (cc): 36.22
Pore Volumes Flowed: 2.3
Back Pressure* (psi): 59.9
Confining Pressure* (psi): 1.1
Max. Stress (psi): 1.2 Min. Stess (psi): 1.0

*Average for duration of test. **Average for last four readings.

Remarks: Pore Volume estimated from final moisture content.

Geotechnical Engineering Group, Inc.

# Hydraulic Conductivity ASTM D5084

Job Name: Leach Creek Dam | Job No.: 1,276 | Technician: JCH | Date: 2/3/03
Sample Location: TH-13 | Depth: 5' | Lab Number: N/A
Description: Clay, silty, sandy (CL)

MDD (pcf): N/A | OMC (%): N/A | DD (pcf): 107.2 | MC (%): 12.8 | % Comp: N/A
Compaction Method: ASTM D698, Method A | Test Method: C (Falling Head/Rising Tail)

| Sample Height, intial/final (in) | | |
|---|---|---|
| #1 | 4.30 | 3.71 |
| #2 | 4.29 | 3.70 |
| #3 | 4.29 | 3.70 |
| #4 | 4.30 | 3.70 |
| Average | 4.30 | 3.70 |

| Sample Diameter, initial/final (in) | | |
|---|---|---|
| Top | 1.97 | 1.90 |
| Middle | 1.99 | 2.12 |
| Bottom | 1.98 | 1.99 |
| Average | 1.98 | 2.00 |

Initial Wet Mass (g): 419.7

| Moisture | | |
|---|---|---|
| | Initial | Final |
| Tare# | MR | JRS |
| Tare Mass (g) | 8.7 | 8.3 |
| Tare and Wet (g) | 190.5 | 441.3 |
| Tare and Dry (g) | 169.9 | 374.0 |

## B-Coefficient

| Cell Volume (cc) | Initial Cell Pressure (psi) | Final Cell Pressure (psi) | Initial Pore Pressure (psi) | Final Pore Pressure (psi) | Base Volume (cc) | Top Volume (cc) | B |
|---|---|---|---|---|---|---|---|
| | 71.2 | 81.2 | 70.1 | 79.7 | | | 96 |

## Hydraulic Conductivity

| Elapsed Time (sec) | Cell Pressure (psi) | Base Pressure (psi) | Top Pressure (psi) | Base Volume (cc) | Top Volume (cc) | Head Loss, $h_1$ (m) | Head Loss, $h_2$ (m) | Conductivity, k (m/s) | Hydraulic Gradiendt |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 84.0 | 79.1 | 76.3 | 0.23 | 9.83 | | | | |
| 55560 | 84.0 | 79.1 | 76.3 | 6.29 | 3.95 | 2.456 | 1.850 | 2.76E-09 | 17 |
| 65760 | 84.0 | 79.1 | 76.3 | 7.20 | 3.08 | 1.850 | 1.759 | 2.67E-09 | 16 |
| 75420 | 84.0 | 79.1 | 76.3 | 8.03 | 2.21 | 1.759 | 1.673 | 2.81E-09 | 15 |
| 78420 | 84.0 | 79.1 | 76.3 | 8.26 | 1.96 | 1.673 | 1.648 | 2.71E-09 | 15 |

Temp (C) = 26
$a_{in}$ ($m^2$) = 1.97E-05
$a_{out}$ ($m^2$) = 1.97E-05
L (m) = 1.09E-01
A ($m^2$) = 1.99E-03
$R_T$ = 0.857
k (m/s)** = 2.7E-09
**$k_{20}$ (m/s)** =** **2.3E-09**
Void Ratio: 0.30
Pore Volume (cc): 65.23
Volume Flowed (cc): 61.13
Pore Volumes Flowed: 0.9
Back Pressure* (psi): 77.7
Confining Pressure* (psi): 6.3
Max. Stress (psi): 7.7 | Min. Stess (psi): 4.9

*Average for duration of test. **Average for last four readings.

Remarks: Pore Volume estimated from final moisture content. Final sample dimensions taken after triaxial shear.

Geotechnical Engineering Group, Inc.

# Hydraulic Conductivity ASTM D5084

Job Name: Leach Creek Dam | Job No.: 1,276 | Technician: JCH | Date: 7/30/03
Sample Location: TH-25&26 | Depth: 0-5' | Lab Number: N/A
Description: Sand, clayey, gravelly (SC)

MDD (pcf): 119.5 | OMC (%): 11.5 | DD (pcf): 115.8 | MC (%): 9.7 | % Comp: 96.9
Compaction Method: ASTM D698, Method A | Test Method: C (Falling Head/Rising Tail)

| Sample Height, intial/final (in) | | |
|---|---|---|
| #1 | 1.41 | 1.41 |
| #2 | 1.42 | 1.42 |
| #3 | 1.41 | 1.41 |
| #4 | 1.43 | 1.43 |
| Average | 1.42 | 1.42 |

| Sample Diameter, initial/final (in) | | |
|---|---|---|
| Top | 1.93 | 1.93 |
| Middle | 1.93 | 1.93 |
| Bottom | 1.93 | 1.93 |
| Average | 1.93 | 1.93 |

Initial Wet Mass (g): 138.3

| Moisture | | |
|---|---|---|
| | Initial | Final |
| Tare# | LP | JAS |
| Tare Mass (g) | 15.7 | 8.5 |
| Tare and Wet (g) | 254.2 | 155.6 |
| Tare and Dry (g) | 233.2 | 134.3 |

## B-Coefficient

| Cell Volume (cc) | Initial Cell Pressure (psi) | Final Cell Pressure (psi) | Initial Pore Pressure (psi) | Final Pore Pressure (psi) | Base Volume (cc) | Top Volume (cc) | B |
|---|---|---|---|---|---|---|---|
| | 31.1 | 41.1 | 30.3 | 38.3 | | | 80 |
| | 41.0 | 51.0 | 40.1 | 49.3 | | | 92 |
| | 50.9 | 60.9 | 49.9 | 59.6 | | | 97 |
| | | | | | | | |
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| | | | | | | | |
| | | | | | | | |

Temp (C) = 24
$a_{in}$ ($m^2$) = 1.97E-05
$a_{out}$ ($m^2$) = 1.97E-05
L (m) = 3.60E-02
A ($m^2$) = 1.89E-03
$R_T$ = 0.910
k (m/s)** = 2.2E-07
**$k_{20}$ (m/s)**** = **2.0E-07**
Void Ratio: 0.29
Pore Volume (cc): 20.03
Volume Flowed (cc): 42.93
Pore Volumes Flowed: 2.1
Back Pressure* (psi): 59.3
Confining Pressure* (psi): 1.8
Max. Stress (psi): 3.0 | Min. Stess (psi): 0.8

## Hydraulic Conductivity

| Elapsed Time (sec) | Cell Pressure (psi) | Base Pressure (psi) | Top Pressure (psi) | Base Volume (cc) | Top Volume (cc) | Head Loss, $h_1$ (m) | Head Loss, $h_2$ (m) | Conductivity, k (m/s) | Hydraulic Gradiendt |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 60.9 | 59.8 | 58.2 | 0.40 | 9.57 | | | | |
| 540 | 60.9 | 59.8 | 58.2 | 9.27 | 0.68 | 1.591 | 0.688 | 2.92E-07 | 19 |
| 0 | 61.1 | 60.0 | 58.1 | 0.42 | 9.46 | | | | |
| 540 | 61.1 | 60.0 | 58.1 | 9.20 | 0.67 | 1.795 | 0.902 | 2.39E-07 | 25 |
| 0 | 61.1 | 60.0 | 58.1 | 0.16 | 10.00 | | | | |
| 540 | 61.1 | 60.0 | 58.1 | 9.04 | 1.06 | 1.836 | 0.930 | 2.37E-07 | 26 |
| 0 | 61.1 | 60.0 | 58.1 | 0.16 | 9.92 | | | | |
| 600 | 61.1 | 60.0 | 58.1 | 9.79 | 0.25 | 1.831 | 0.851 | 2.40E-07 | 24 |
| 0 | 61.1 | 60.1 | 58.9 | 0.11 | 9.87 | | | | |
| 960 | 61.1 | 60.1 | 58.9 | 9.24 | 0.87 | 1.339 | 0.418 | 2.28E-07 | 12 |
| 0 | 61.1 | 60.1 | 58.9 | 0.05 | 9.93 | | | | |
| 120 | 61.1 | 60.1 | 58.9 | 1.97 | 8.00 | 1.345 | 1.150 | 2.45E-07 | 32 |
| 240 | 61.1 | 60.1 | 58.9 | 3.46 | 6.52 | 1.150 | 0.999 | 2.20E-07 | 28 |
| 360 | 61.1 | 60.1 | 58.9 | 4.73 | 5.25 | 0.999 | 0.870 | 2.16E-07 | 24 |
| 480 | 61.1 | 60.1 | 58.9 | 5.84 | 4.16 | 0.870 | 0.758 | 2.16E-07 | 21 |
| 600 | 61.1 | 60.1 | 58.9 | 6.79 | 3.23 | 0.758 | 0.663 | 2.10E-07 | 18 |
| | | | | | | | | | |
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*Average for duration of test. **Average for last four readings.

Remarks: Pore Volume estimated from final moisture content.

Geotechnical Engineering Group, Inc.

# Hydraulic Conductivity ASTM D5084

Job Name: Leach Creek Dam | Job No.: 1,276 | Technician: JCH | Date: 8/6/03
Sample Location: TH-35&36 | Depth: 0-5' | Lab Number: N/A
Description: Clay, silty, sandy (CL)

MDD (pcf): 109.5 | OMC (%): 17.0 | DD (pcf): 114.8 | MC (%): 17.9 | % Comp: 104.8
Compaction Method: ASTM D698, Method A | Test Method: C (Falling Head/Rising Tail)

| Sample Height, intial/final (in) | | |
|---|---|---|
| #1 | 1.25 | 1.25 |
| #2 | 1.26 | 1.26 |
| #3 | 1.27 | 1.27 |
| #4 | 1.27 | 1.27 |
| Average | 1.26 | 1.26 |

| Sample Diameter, initial/final (in) | | |
|---|---|---|
| Top | 1.93 | 1.93 |
| Middle | 1.93 | 1.93 |
| Bottom | 1.94 | 1.94 |
| Average | 1.93 | 1.93 |

Initial Wet Mass (g): 131.2

| Moisture | | |
|---|---|---|
| | Initial | Final |
| Tare# | L16 | B13 |
| Tare Mass (g) | 8.2 | 8.0 |
| Tare and Wet (g) | 252.9 | 141.5 |
| Tare and Dry (g) | 215.7 | 121.7 |

## B-Coefficient

| Cell Volume (cc) | Initial Cell Pressure (psi) | Final Cell Pressure (psi) | Initial Pore Pressure (psi) | Final Pore Pressure (psi) | Base Volume (cc) | Top Volume (cc) | B |
|---|---|---|---|---|---|---|---|
| | 31.0 | 41.0 | 30.6 | 39.4 | | | 88 |
| | 41.0 | 51.0 | 40.6 | 49.8 | | | 92 |
| | 51.0 | 61.0 | 50.6 | 59.9 | | | 93 |
| | 60.8 | 70.8 | 60.5 | 70.0 | | | 95 |

## Hydraulic Conductivity

| Elapsed Time (sec) | Cell Pressure (psi) | Base Pressure (psi) | Top Pressure (psi) | Base Volume (cc) | Top Volume (cc) | Head Loss, $h_1$ (m) | Head Loss, $h_2$ (m) | Conductivity, k (m/s) | Hydraulic Gradiendt |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 70.8 | 69.9 | 68.9 | 0.38 | 9.80 | | | | |
| 890 | 70.7 | 69.9 | 68.6 | 7.64 | 2.45 | 1.182 | 0.650 | 1.12E-07 | 20 |
| 0 | 70.9 | 70.0 | 67.9 | 0.31 | 9.54 | | | | |
| 96 | 70.9 | 70.0 | 67.9 | 1.36 | 8.45 | 1.945 | 1.836 | 1.00E-07 | 57 |
| 141 | 70.8 | 70.0 | 67.9 | 1.80 | 8.01 | 1.836 | 1.792 | 8.99E-08 | 56 |
| 192 | 70.8 | 70.0 | 67.9 | 2.31 | 7.51 | 1.792 | 1.740 | 9.63E-08 | 54 |
| 475 | 70.8 | 70.0 | 67.9 | 4.65 | 5.36 | 1.740 | 1.512 | 8.28E-08 | 47 |
| 613 | 70.6 | 69.9 | 67.8 | 5.35 | 4.49 | 1.512 | 1.433 | 6.49E-08 | 45 |
| 709 | 70.6 | 69.9 | 67.8 | 5.93 | 3.89 | 1.433 | 1.373 | 7.43E-08 | 43 |
| 0 | 70.9 | 69.9 | 67.6 | 0.17 | 9.65 | | | | |
| 40 | 70.7 | 69.9 | 67.6 | 0.51 | 9.33 | 2.098 | 2.065 | 6.61E-08 | 64 |
| 1540 | 70.6 | 69.8 | 67.4 | 7.06 | 2.85 | 2.065 | 1.473 | 3.76E-08 | 46 |
| 0 | 70.6 | 69.8 | 67.4 | 0.20 | 9.59 | | | | |
| 227 | 70.6 | 69.8 | 67.4 | 1.35 | 8.41 | 2.164 | 2.046 | 4.12E-08 | 64 |
| 299 | 70.5 | 69.8 | 67.4 | 1.68 | 8.09 | 2.046 | 2.013 | 3.77E-08 | 63 |
| 330 | 70.5 | 69.8 | 67.4 | 1.82 | 7.95 | 2.013 | 1.999 | 3.75E-08 | 62 |
| 386 | 70.5 | 69.8 | 67.4 | 2.08 | 7.70 | 1.999 | 1.973 | 3.90E-08 | 62 |

*Average for duration of test. **Average for last four readings.

Temp (C) = 24
$a_{in}$ ($m^2$) = 1.97E-05
$a_{out}$ ($m^2$) = 1.97E-05
L (m) = 3.20E-02
A ($m^2$) = 1.89E-03
$R_T$ = 0.910
k (m/s)** = 3.9E-08
**$k_{20}$ (m/s)** = 3.5E-08**
Void Ratio: 0.32
Pore Volume (cc): 19.46
Volume Flowed (cc): 21.69
Pore Volumes Flowed: 1.1
Back Pressure* (psi): 68.8
Confining Pressure* (psi): 1.9
Max. Stress (psi): 3.5 Min. Stess (psi): 0.6

Remarks: Pore Volume estimated from final moisture content.

Geotechnical Engineering Group, Inc.

# Consolidated Triaxial Compression, ASTM D 4767-95

Job Name: Leach Creek Dam  Job No.: 1,276  Technician: JCH  Date: 2/10/03
Sample Location: TH-12  Depth: 9'  Lab Number:
Description: Clay, silty, sandy (CL)

MDD (pcf): N/A  OMC (%): N/A

| Confining Pressure: 5 psi | Initial | Final |
|---|---|---|
| Dry Density (pcf) | 109.8 | 102.7 |
| Moisture Content (%) | 10.8% | 21.1% |
| Saturation (%) | 33.6% | 37.9% |
| Height (in.) | 4.51 | 3.93 |
| Diameter (in.) | 1.93 | |
| Cross-Sec. Area (in$^2$) | 2.93 | 3.60 |
| Void Ratio | 0.34 | 0.38 |
| Specific Gravity* | 2.65 | |

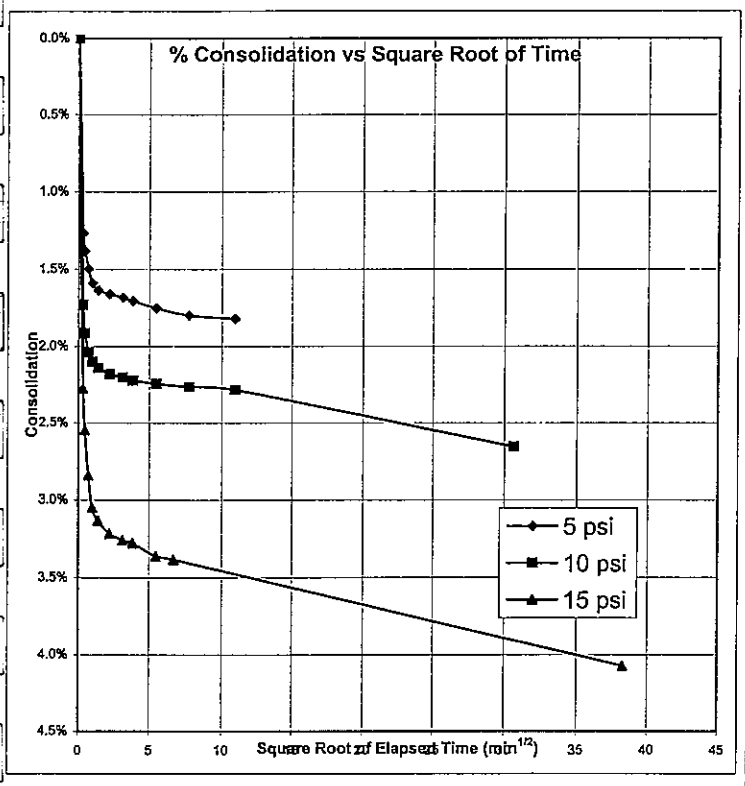
*Assumed

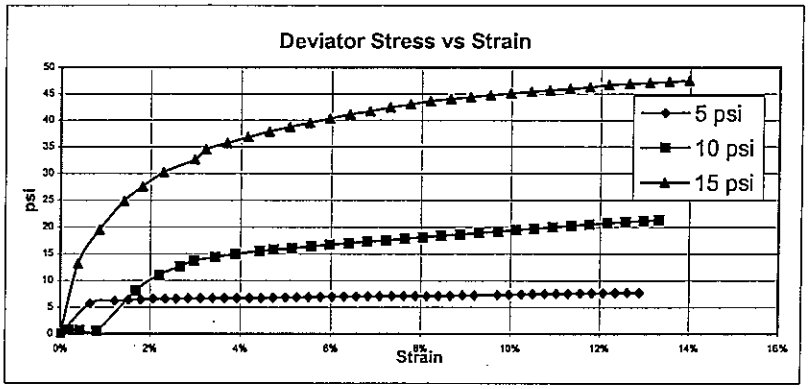
| Confining Pressure: 10 psi | Initial | Final |
|---|---|---|
| Dry Density (pcf) | 100.9 | 94.7 |
| Moisture Content (%) | 4.7% | 23.5% |
| Saturation (%) | 39.0% | 42.8% |
| Height (in.) | 4.44 | 3.85 |
| Diameter (in.) | 2.06 | |
| Cross-Sec. Area (in$^2$) | 3.34 | 4.10 |
| Void Ratio | 0.39 | 0.43 |
| Specific Gravity* | 2.65 | |

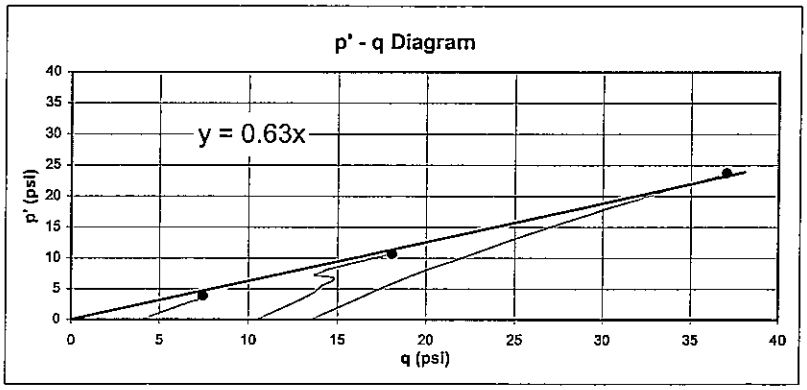
*Assumed

| Confining Pressure: 15 psi | Initial | Final |
|---|---|---|
| Dry Density (pcf) | 113.2 | 120.1 |
| Moisture Content (%) | 8.1% | 18.8% |
| Saturation (%) | 31.6% | 27.4% |
| Height (in.) | 4.35 | 3.74 |
| Diameter (in.) | 2.07 | |
| Cross-Sec. Area (in$^2$) | 3.35 | 3.68 |
| Void Ratio | 0.32 | 0.27 |
| Specific Gravity* | 2.65 | |

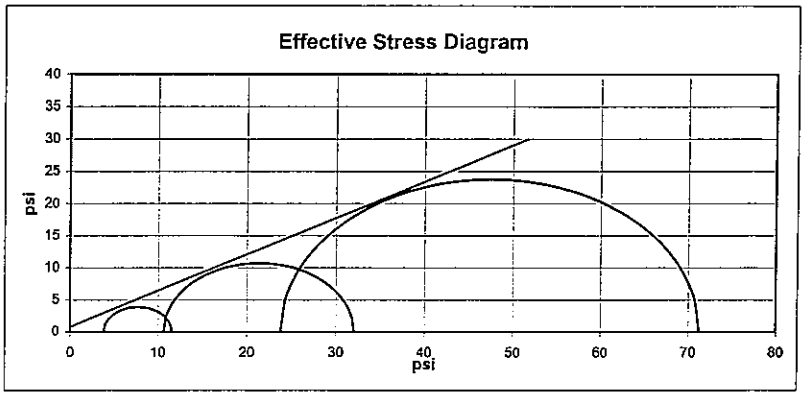
*Assumed




| | 5 psi | 10 psi | 15 psi |
|---|---|---|---|
| B Coefficient | 95 | 95 | 96 |
| $t_{50}$ (min) | 0.16 | 0.25 | 0.15 |
| Back Pressure (psi) | 90.5 | 89 | 70.3 |
| Effective Stress (psi) | 4.0 | 10.4 | 13.5 |
| Minor Eff. Stress (psi) | 3.6 | 6.3 | 11.9 |
| Major Eff. Stress (psi) | 4.0 | 10.4 | 13.5 |
| Deviator Stress (psi) | 7.7 | 21.4 | 47.5 |
| Stain @ Failure (%) | 12.9% | 13.3% | 14.0% |
| Shear Rate (in/min) | 0.0241 | 0.0369 | 0.0393 |




Failure Criteria: Maximum Load  Angle of Internal Friction: 34.0 degrees  C: 0.00 psi

Fig. B-27

Geotechnical Engineering Group, Inc.

# Consolidated Triaxial Compression, ASTM D 4767-95

Job Name: Leach Creek Dam  Job No.: 1,276  Technician: JCH  Date: 1/27/03
Sample Location: TH-13  Depth: 5'  Lab Number:
Description: Clay, silty, sandy (CL)

MDD (pcf): N/A  OMC (%): N/A

| Confining Pressure: 5 psi | | |
|---|---|---|
| | Initial | Final |
| Dry Density (pcf) | 120.6 | 106.1 |
| Moisture Content (%) | 12.8% | 18.4% |
| Saturation (%) | 27.1% | 35.9% |
| Height (in.) | 4.30 | 3.70 |
| Diameter (in.) | 1.98 | |
| Cross-Sec. Area (in$^2$) | 3.08 | 4.06 |
| Void Ratio | 0.27 | 0.36 |
| Specific Gravity* | 2.65 | |

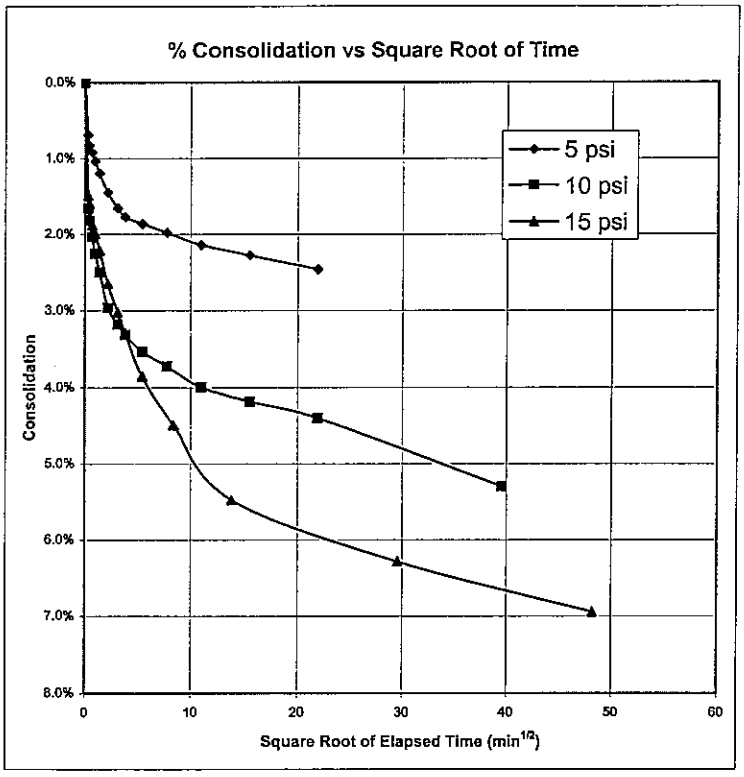
*Assumed

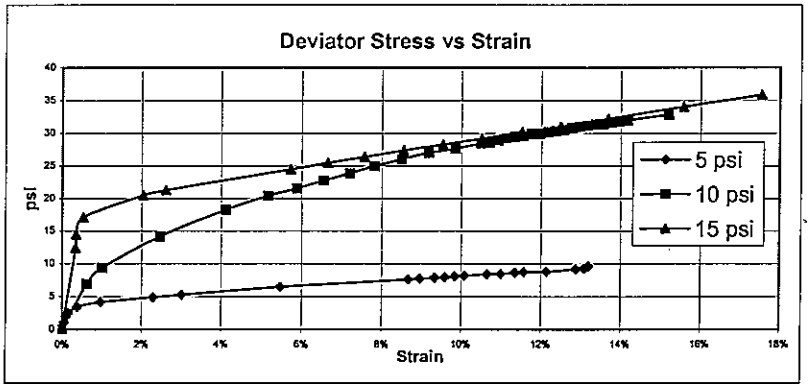
| Confining Pressure: 10 psi | | |
|---|---|---|
| | Initial | Final |
| Dry Density (pcf) | 129.4 | 125.5 |
| Moisture Content (%) | 10.8% | 15.3% |
| Saturation (%) | 21.8% | 24.2% |
| Height (in.) | 3.68 | 3.09 |
| Diameter (in.) | 1.97 | |
| Cross-Sec. Area (in$^2$) | 3.05 | 3.75 |
| Void Ratio | 0.22 | 0.24 |
| Specific Gravity* | 2.65 | |

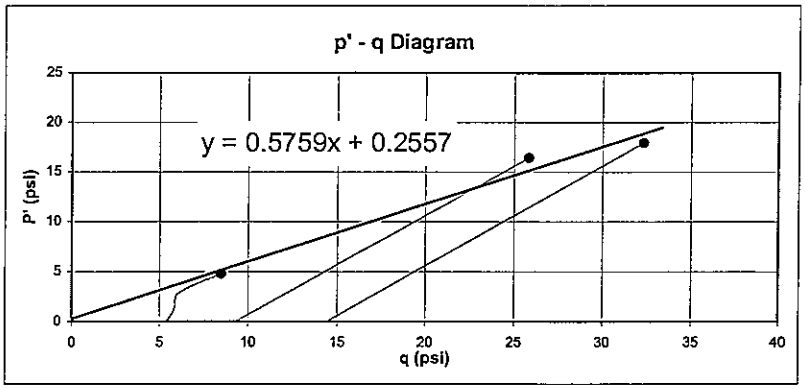
*Assumed

| Confining Pressure: 15 psi | | |
|---|---|---|
| | Initial | Final |
| Dry Density (pcf) | 109.0 | 120.7 |
| Moisture Content (%) | 13.6% | 17.0% |
| Saturation (%) | 34.1% | 27.1% |
| Height (in.) | 4.21 | 3.45 |
| Diameter (in.) | 2.05 | |
| Cross-Sec. Area (in$^2$) | 3.31 | 3.64 |
| Void Ratio | 0.34 | 0.27 |
| Specific Gravity* | 2.65 | |

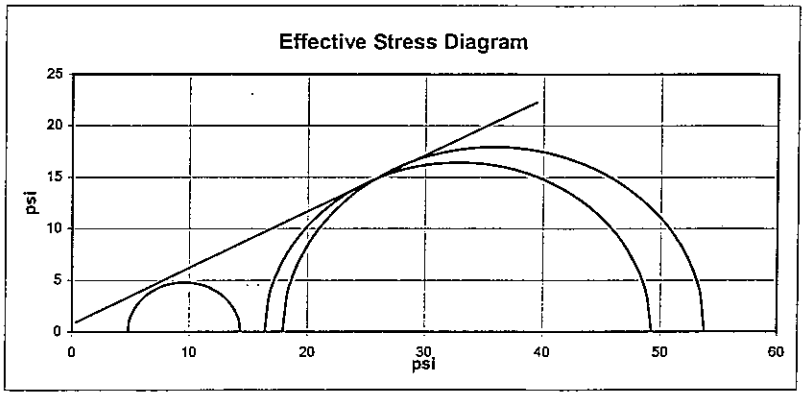
*Assumed




| | 5 psi | 10 psi | 15 psi |
|---|---|---|---|
| B Coefficient | 96 | 96 | 97 |
| $t_{50}$ (min) | 7.25 | 9.00 | 16.80 |
| Back Pressure (psi) | 78.8 | 80.8 | 80.1 |
| Effective Stress (psi) | 5.4 | 9.3 | 14.4 |
| Minor Eff. Stress (psi) | 3.2 | 9.3 | 14.4 |
| Major Eff. Stress (psi) | 5.4 | 9.4 | 14.4 |
| Deviator Stress (psi) | 9.6 | 32.8 | 35.9 |
| Stain @ Failure (%) | 13.2% | 15.2% | 17.6% |
| Shear Rate (in/min) | 0.0009 | 0.0015 | 0.0018 |




Failure Criteria: Maximum Load  Angle of Internal Friction: 29.9 degrees  C: 0.26 psi

Fig. B-28

Geotechnical Engineering Group, Inc.

# Consolidated Triaxial Compression, ASTM D 4767-95

Job Name: Leach Creek Dam  Job No.: 1,276  Technician: JCH  Date: 2/17/03
Sample Location: TH-25&26  Depth: 0-5'  Lab Number:
Description: Sand, clayey, gravelly (SC)

MDD (pcf): 119.5  OMC (%): 11.0  Compaction Method: ASTM D698, Method A

| Confining Pressure: 5 psi | Initial | Final |
|---|---|---|
| Dry Density (pcf) | 132.3 | 129.2 |
| Moisture Content (%) | 11.9% | 15.6% |
| Saturation (%) | 20.0% | 21.9% |
| Height (in.) | 3.97 | 3.36 |
| Diameter (in.) | 1.93 | |
| Cross-Sec. Area (in$^2$) | 2.92 | 3.53 |
| Void Ratio | 0.20 | 0.22 |
| Specific Gravity* | 2.65 | |

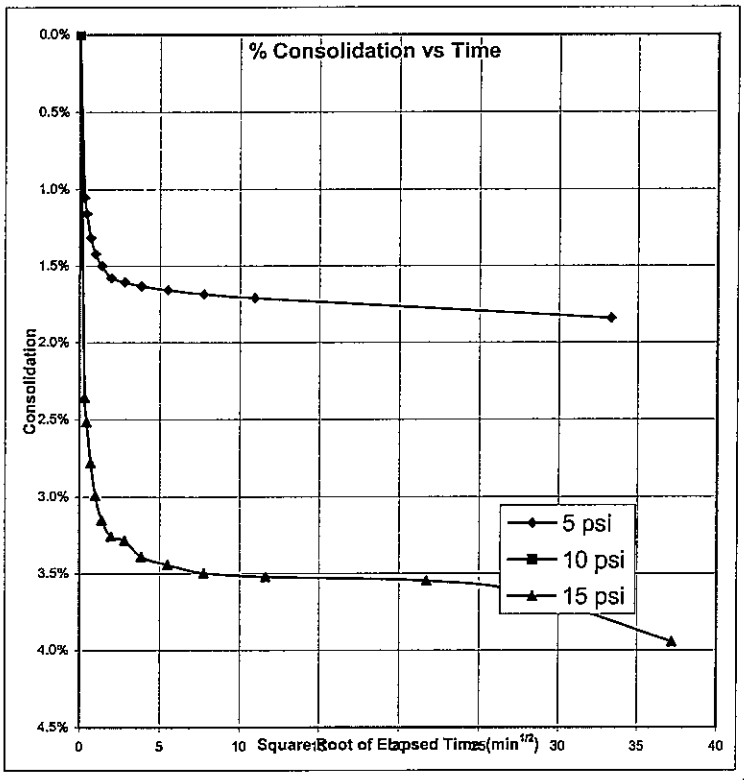
*Assumed

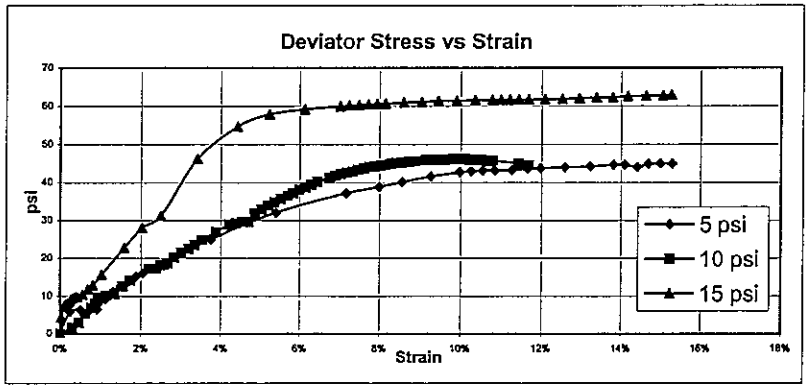
| Confining Pressure: 10 psi | Initial | Final |
|---|---|---|
| Dry Density (pcf) | 134.1 | 131.9 |
| Moisture Content (%) | 10.4% | 14.6% |
| Saturation (%) | 18.9% | 20.3% |
| Height (in.) | 3.96 | 3.47 |
| Diameter (in.) | 1.92 | |
| Cross-Sec. Area (in$^2$) | 2.89 | 3.35 |
| Void Ratio | 0.19 | 0.20 |
| Specific Gravity* | 2.65 | |

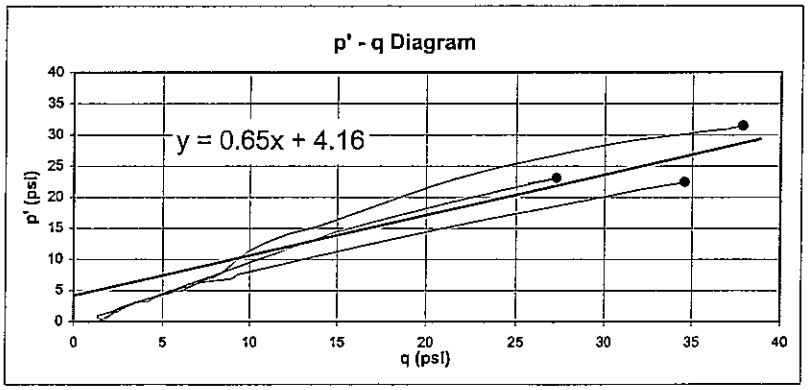
*Assumed

| Confining Pressure: 15 psi | Initial | Final |
|---|---|---|
| Dry Density (pcf) | 130.0 | 127.1 |
| Moisture Content (%) | 10.1% | 14.3% |
| Saturation (%) | 21.4% | 23.2% |
| Height (in.) | 3.90 | 3.31 |
| Diameter (in.) | 1.94 | |
| Cross-Sec. Area (in$^2$) | 2.95 | 3.56 |
| Void Ratio | 0.21 | 0.23 |
| Specific Gravity* | 2.65 | |

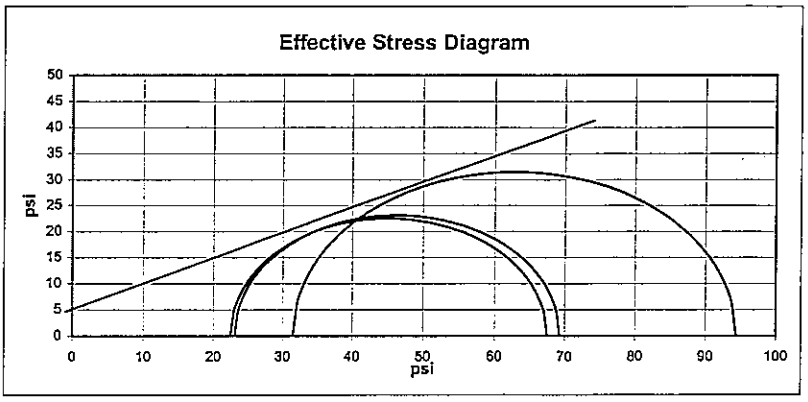
*Assumed




| | 5 psi | 10 psi | 15 psi |
|---|---|---|---|
| B Coefficient | 96 | 96 | 95 |
| $t_{50}$ (min) | 5.55 | ---- | 4.92 |
| Back Pressure (psi) | 49.8 | 38.7 | 79.2 |
| Effective Stress (psi) | 1.3 | 1.9 | 1.7 |
| Minor Eff. Stress (psi) | 0.5 | 0.5 | -1.9 |
| Major Eff. Stress (psi) | 12.1 | 4.2 | 6.4 |
| Deviator Stress (psi) | 45.0 | 46.2 | 62.9 |
| Stain @ Failure (%) | 15.3% | 12.3% | 15.3% |
| Shear Rate (in/min) | 0.0067 | 0.0028 | 0.0070 |




Failure Criteria: Maximum Load  Angle of Internal Friction: 32.9 degrees  C: 4.16 psi

Fig. B-29

Geotechnical Engineering Group, Inc.

# Consolidated Triaxial Compression, ASTM D 4767-95

Job Name: Leach Creek Dam  Job No.: 1,276  Technician: JCH  Date: 2/17/03
Sample Location: TH-35&36  Depth: 0-5'  Lab Number:
Description: Clay, silty, sandy (CL)

MDD (pcf): 109.5  OMC (%): 17.0  Compaction Method: ASTM D698, Method A

| Confining Pressure: 5 psi | Initial | Final |
|---|---|---|
| Dry Density (pcf) | 130.8 | 128.3 |
| Moisture Content (%) | 20.0% | 22.0% |
| Saturation (%) | 21.0% | 22.5% |
| Height (in.) | 3.99 | 3.37 |
| Diameter (in.) | 1.93 | |
| Cross-Sec. Area ($in^2$) | 2.92 | 3.52 |
| Void Ratio | 0.21 | 0.22 |
| Specific Gravity* | 2.65 | |

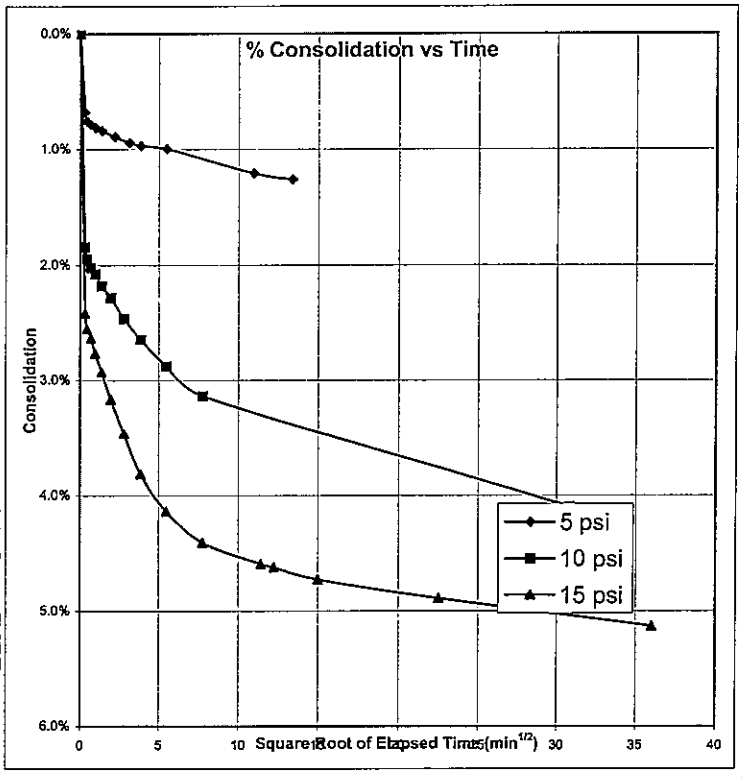
*Assumed

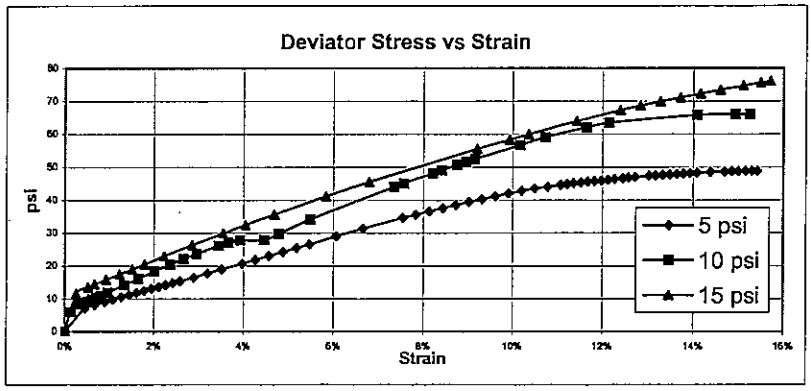
| Confining Pressure: 10 psi | Initial | Final |
|---|---|---|
| Dry Density (pcf) | 130.6 | 129.2 |
| Moisture Content (%) | 17.6% | 19.1% |
| Saturation (%) | 21.1% | 21.9% |
| Height (in.) | 3.98 | 3.37 |
| Diameter (in.) | 1.94 | |
| Cross-Sec. Area ($in^2$) | 2.96 | 3.53 |
| Void Ratio | 0.21 | 0.22 |
| Specific Gravity* | 2.65 | |

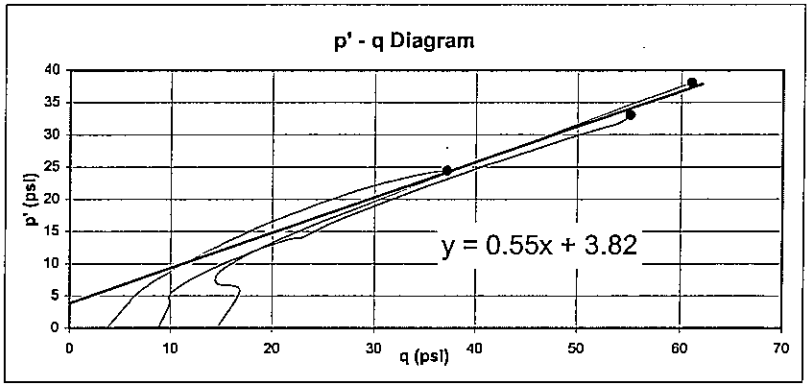
*Assumed

| Confining Pressure: 15 psi | Initial | Final |
|---|---|---|
| Dry Density (pcf) | 129.6 | 127.7 |
| Moisture Content (%) | 18.0% | 19.7% |
| Saturation (%) | 21.6% | 22.8% |
| Height (in.) | 3.89 | 3.28 |
| Diameter (in.) | 1.93 | |
| Cross-Sec. Area ($in^2$) | 2.92 | 3.51 |
| Void Ratio | 0.22 | 0.23 |
| Specific Gravity* | 2.65 | |

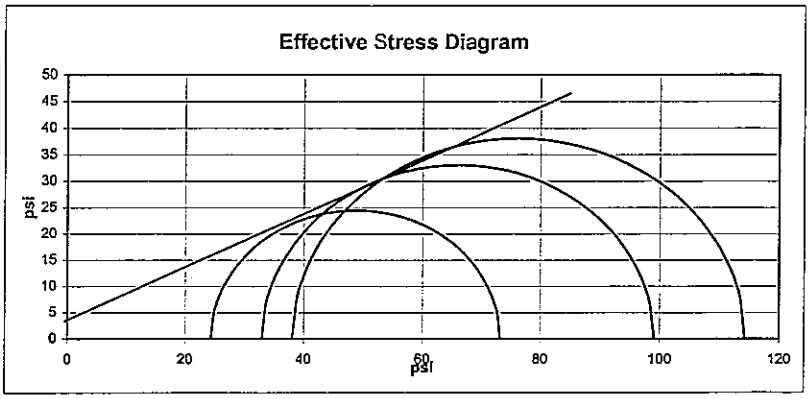
*Assumed




| | 5 psi | 10 psi | 15 psi |
|---|---|---|---|
| B Coefficient | 96 | 98 | 97 |
| $t_{50}$ (min) | 12.25 | 17.54 | 9.24 |
| Back Pressure (psi) | 51.0 | 51.1 | 59.6 |
| Effective Stress (psi) | 3.7 | 8.8 | 14.6 |
| Minor Eff. Stress (psi) | 1.1 | 4.4 | 6.0 |
| Major Eff. Stress (psi) | 12.7 | 22.2 | 23.0 |
| Deviator Stress (psi) | 48.8 | 66.1 | 76.1 |
| Stain @ Failure (%) | 15.4% | 15.2% | 15.7% |
| Shear Rate (in/min) | 0.0064 | 0.0023 | 0.0023 |




Failure Criteria: Maximum Load  Angle of Internal Friction: 28.7 degrees  C: 3.82 psi

Fig. B-30

JOB NO. 1,276

Geotechnical Engineering Group, Inc.

TABLE
B-I

# SUMMARY OF LABORATORY TEST RESULTS

| HOLE | DEPTH (FEET) | NATURAL MOISTURE (%) | DRY DENSITY (PCF) | Atterberg Limits | | Swell / Consolidation | | PASSING NO. 200 SIEVE (%) | WATER SOLUBLE SULFATES (ppm) | SOIL TYPE |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | SWELL (%) | CONFINING PRESSURE (PSF) | | | |
| TH-2 | 9 | 7.6 | -- | 32 | 14 | | | 72 | | Shale |
| TH-3 | 9 | 5.5 | 118 | | | -0.2 | 1,000 | | | Shale |
| TH-4 | 9 | 7.4 | 120 | | | +0.7 | 1,000 | | | Shale |
| TH-5 | 4 | 4.7 | -- | | | | | 41 | | Sand, clayey (SC) |
| TH-6 | 9 | 6.8 | 91 | | | -5.7 | 1,000 | | | Clay, silty, sandy (CL) |
| | 14 | 7.6 | 97 | 25 | 6 | | | 54 | | Clay, silty, sandy (CL) |
| TH-7 and 8 bulk combined | 0'-5' | -- | -- | 21 | 5 | | | 48 | 2,800 | Clay, silty, sandy, gravelly (CL) |
| TH-7 | 5 | 6.1 | -- | 24 | 6 | | | 39 | | Sand, clayey (SC) |
| | 14 | 4.6 | -- | | | | | 20 | | Gravel, clayey, sandy (SC) |
| TH-8 | 2 | 5.0 | 108 | | | -0.6 | 1,000 | | | Sand, clayey, gravelly (GC) |
| | 9 | 7.2 | 106 | | | | | 42 | | Sand, clayey, gravelly (SC) |
| | 14 | 9.9 | 121 | 35 | 18 | | | 90 | | Shale |
| TH-9 | 9 | 4.6 | 116 | | | 0.0 | 1,000 | | | Sand, clayey, gravelly (SC) |
| | 14 | 4.0 | -- | | | | | 25 | | Sand, clayey, gravelly (SC) |
| | 24 | 8.4 | 132 | 34 | 17 | | | 82 | | Shale |
| TH-10 | 4 | 5.3 | 101 | | | -0.6 | 500 | | | Clay, silty, sandy (CL) |
| | 14 | 8.2 | 117 | 33 | 15 | | | 77 | | Shale |

JOB NO. 1,276

Geotechnical Engineering Group, Inc.

**TABLE**
**B-I**

# SUMMARY OF LABORATORY TEST RESULTS

| HOLE | DEPTH (FEET) | NATURAL MOISTURE (%) | DRY DENSITY (PCF) | Atterberg Limits | | Swell / Consolidation | | PASSING NO. 200 SIEVE (%) | WATER SOLUBLE SULFATES (ppm) | SOIL TYPE |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | SWELL (%) | CONFINING PRESSURE (PSF) | | | |
| TP-11 | 4 | 7.7 | 113 | | | +1.2 | 500 | | | Clay, silty, sandy (CL) |
| | 10 | 10.4 | 76 | 30 | 16 | | | 73 | | Clay, silty, sandy, (CL) |
| | 14 | 5.3 | -- | | | | | 14 | | Sand, gravelly, silty (SM) |
| TP-12 | 4 | 11.7 | 110 | | | | | | | Clay, silty, sandy (CL) |
| | 6 | 10.8 | 99 | | | -5.2 | 1,000 | | | Clay, silty, sandy (CL) |
| | 9 | 8.4 | 94 | | | | | | | Clay, silty, sandy (CL) |
| | 10.5 | 12.2 | 110 | 31 | 14 | | | 65 | | Clay, silty, sandy (CL) |
| | 14 | 5.2 | 114 | | | -0.4 | 1,000 | | | Sand, clayey, gravelly (SC) |
| | 29 | 11.4 | 113 | 34 | 18 | | | 81 | | Shale |
| TH-13 | 2 | 8.0 | 104 | | | -3.1 | 1,000 | | | Clay, silty, sandy (CL) |
| | 5 | 12.8 | 107 | | | | | | | Clay, silty, sandy (CL) |
| | 6 | 8.3 | 111 | | | -0.5 | 1,000 | | | Clay, silty, sandy (CL) |
| | 9 | 8.1 | 109 | | | -1.2 | 1,000 | | | Clay, silty, sandy (CL) |
| | 14.5 | 9.9 | 110 | | | | | 51 | | Clay, silty, sandy (CL) |
| | 25 | 9.6 | 115 | 21 | 3 | | | 19 | | Sand, silty, gravelly (SM) |
| TH-14 | 9 | 6.6 | 108 | | | | | 27 | | Sand, clayey, gravelly (SC) |
| | 10 | 5.3 | 110 | 20 | 3 | | | 21 | | Sand, clayey, gravelly (SC) |
| TH-15 | 4 | 6.5 | 104 | | | -1.9 | 1,000 | | | Clay, silty, sandy (CL) |
| | 14 | 7.3 | 100 | | | -1.3 | 1,000 | | | Clay, silty, sandy (CL) |
| TH-16 | 2 | 6.7 | 120 | 31 | 15 | | | 73 | | Shale |
| TH-19 | 9 | 7.2 | 122 | 31 | 13 | | | 84 | | Shale |
| TH-20 | 9 | 6.7 | -- | | | | | 25 | | Sand, clayey, gravelly (SC) |

JOB NO. 1,276

Geotechnical Engineering Group, Inc.

TABLE
B-I

# SUMMARY OF LABORATORY TEST RESULTS

| HOLE | DEPTH (FEET) | NATURAL MOISTURE (%) | DRY DENSITY (PCF) | Atterberg Limits | | Swell / Consolidation | | PASSING NO. 200 SIEVE (%) | WATER SOLUBLE SULFATES (ppm) | SOIL TYPE |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | SWELL (%) | CONFINING PRESSURE (PSF) | | | |
| TH-21 | 2 | 7.9 | 96 | 23 | 7 | | | 53 | | Clay, silty, sandy (CL) |
| TH-22 | 9 | 6.8 | -- | 36 | 19 | | | 86 | | Shale |
| TH-23 | 9 | 11.5 | 113 | 26 | 10 | | | 69 | | Clay, silty, sandy (CL) |
| TH-25 and 26 Bulk Combined | 0'-5' | 3.8 | -- | 20 | 3 | | | 34 | 4,100 | Sand, clayey, gravelly (SC) |
| TH-31 | 19 | 6.1 | 123 | 32 | 18 | | | 87 | | Shale |
| TH-32 | 14 | 6.1 | -- | 31 | 13 | | | 84 | | Shale |
| TH-33 | 14 | 6.8 | 111 | 31 | 12 | | | 74 | | Shale |
| TH-35 and 36 Bulk Combined | 0-5 | 10.3 | -- | 30 | 5 | | | 63 | 700 | Clay, silty, sandy (CL) |

JOB NO. 1,276

Geotechnical Engineering Group, Inc.

## TABLE B-II

# SUMMARY OF LABORATORY TEST RESULTS

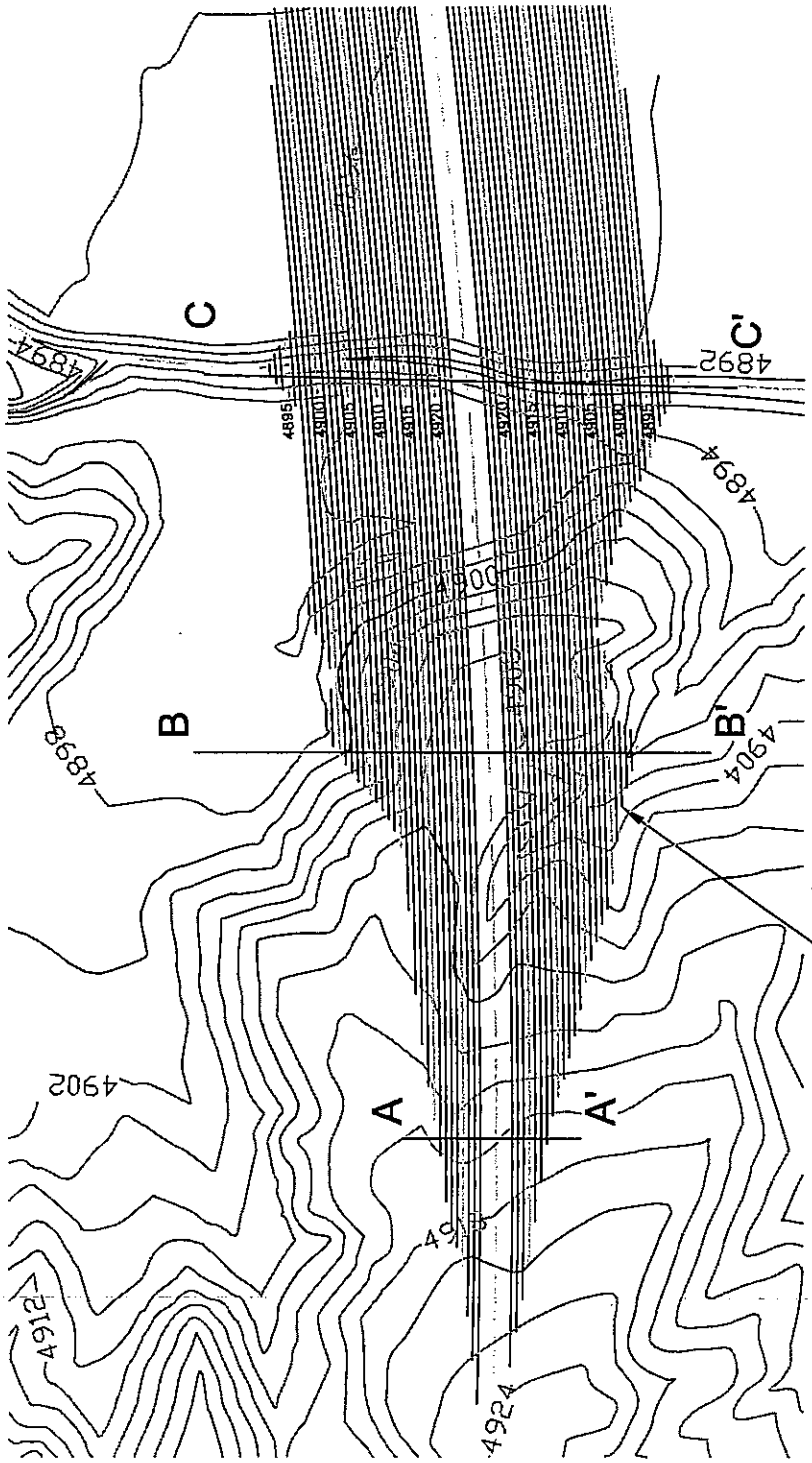
| HOLE | DEPTH (FEET) | ASTM D698 | | HYDRAULIC CONDUCTIVITY (IN/SEC) | Angle of Internal Friction Ø (Degrees) | Cohesion (psf) | SOIL TYPE |
|---|---|---|---|---|---|---|---|
| | | OPTIMUM MOISTURE (%) | MAXIMUM DRY DENSITY (PCF) | | | | |
| | | | | | | | |
| TH-7 and 8 Bulk Combined | 0'-5' | 119.0 | 11.0 | | | | Clay, silty, sandy, gravelly (CL) |
| | | | | | | | |
| TH-12 | 4 | -- | -- | $3.11X10^{-7}$ | | | Clay, silty, sandy (CL) |
| | 9 | -- | -- | $6.69X10^{-5}$ | 34 | 0 | Clay, silty, sandy (CL) |
| | | | | | | | |
| TH-13 | 5 | | | $9.06X10^{-8}$ | 29.9 | 37 | Clay, silty, sandy (CL) |
| | | | | | | | |
| TH-25 and 26 Bulk Combined | 0'-5' | 119.5 | 11.0 | $7.87X10^{-6}$ | 32.9 | 599 | Sand, clayey, gravelly (SC) |
| | | | | | | | |
| TH-35 and 36 Bulk Combined | 0'-5' | 109.5 | 17.0 | $1.38X10^{-6}$ | 28.7 | 550 | Clay, silty, sandy (CL) |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

# APPENDIX C
## Embankment Cross Sections and Results of Stability Analysis

Note: This figure was prepared based on a site plan provided by city of Grand Junction, Colorado.

N

Scale: 1" = 100'

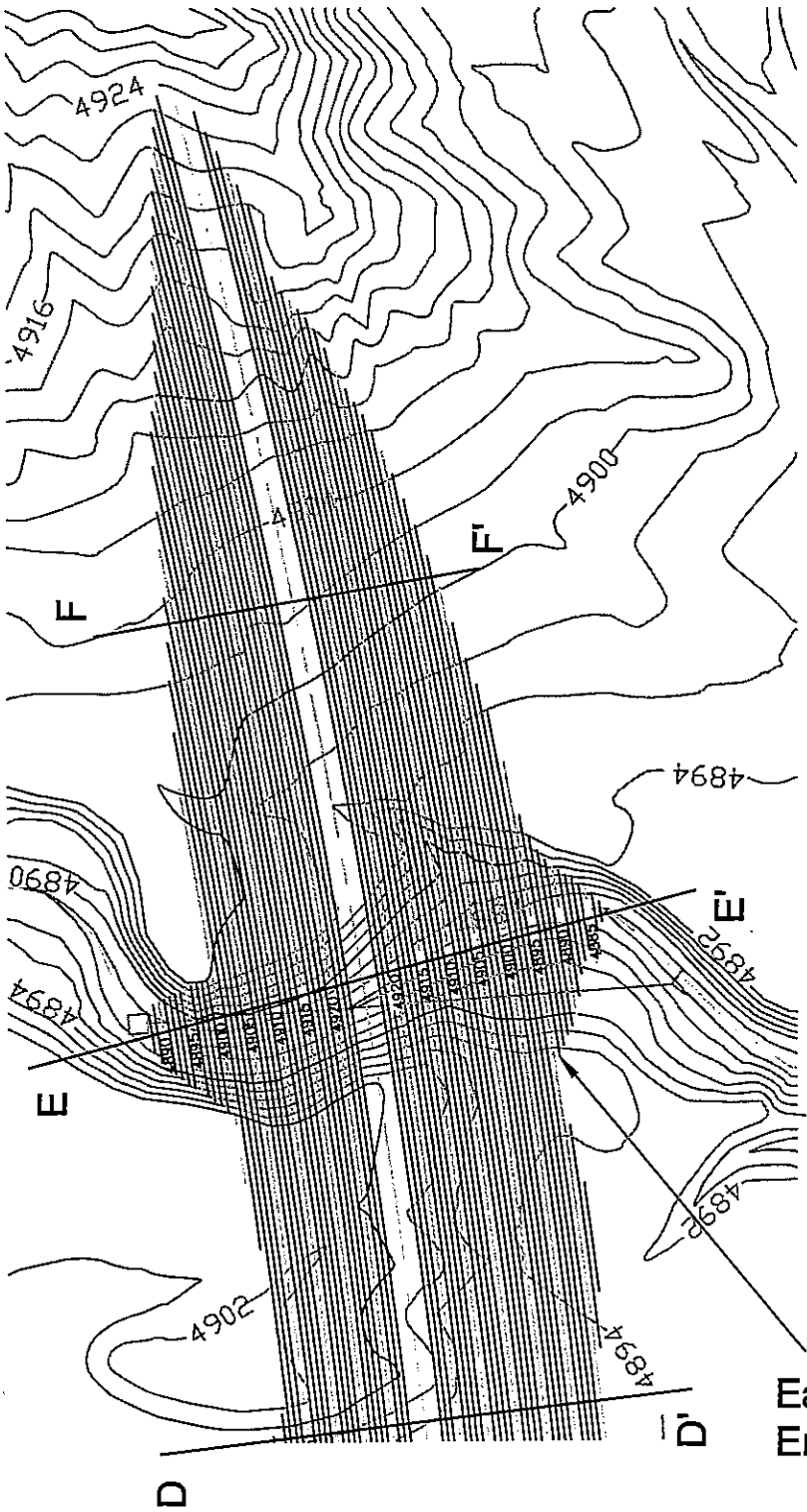



Job No. 1,276 **Embankment Cross Sections** Fig. C-1

Note: This figure was prepared based on a site plan provided by city of Grand Junction, Colorado.

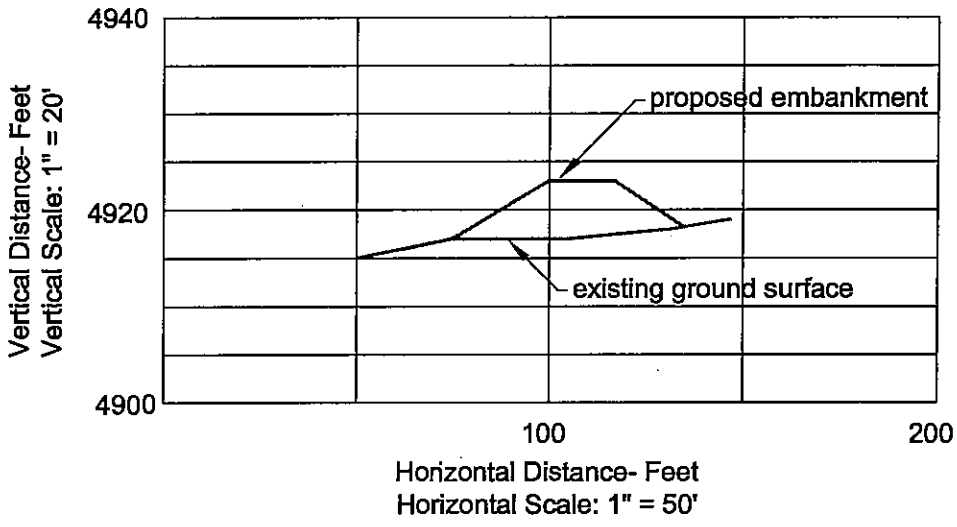
N

Scale: 1" = 100'

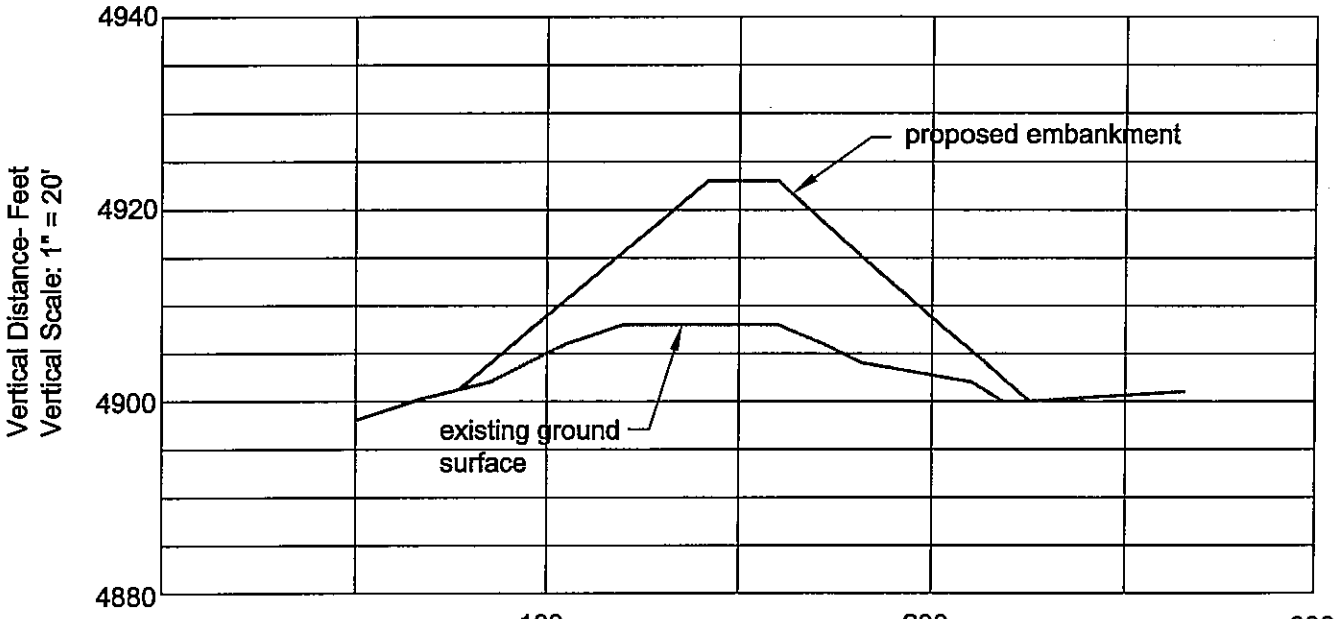



East Portion of Embankment

Job No. 1,276 **Embankment Cross Sections** Fig. C-2

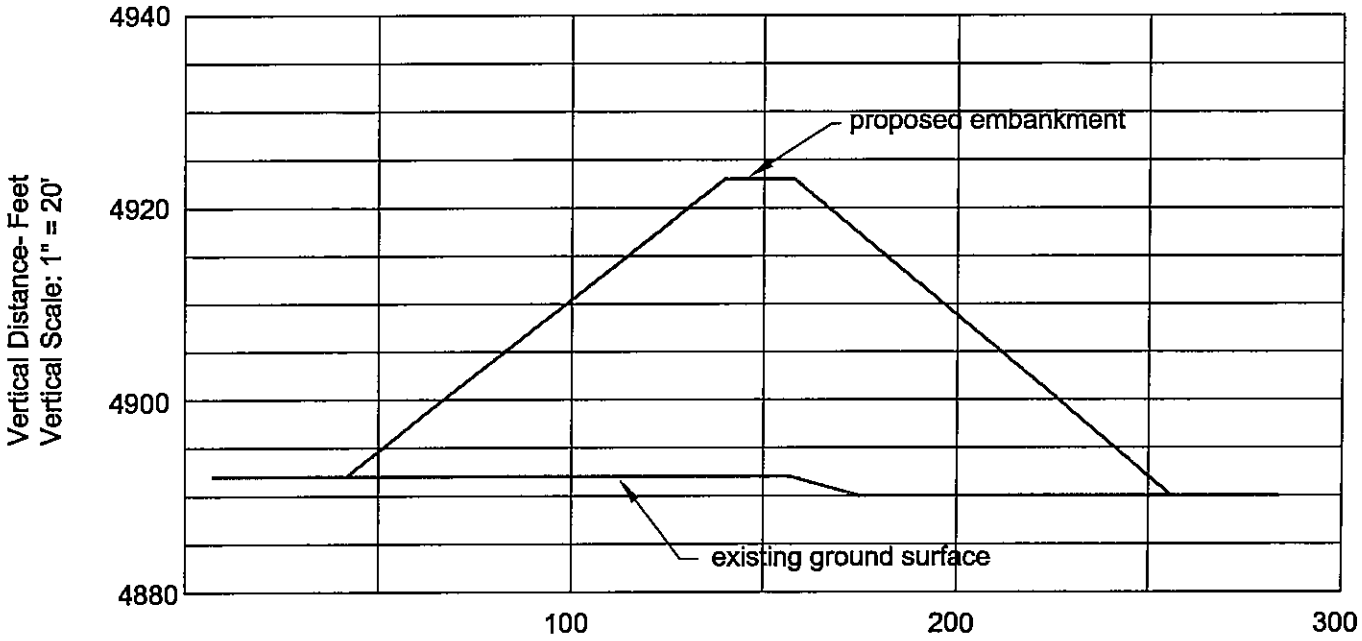



A - A'

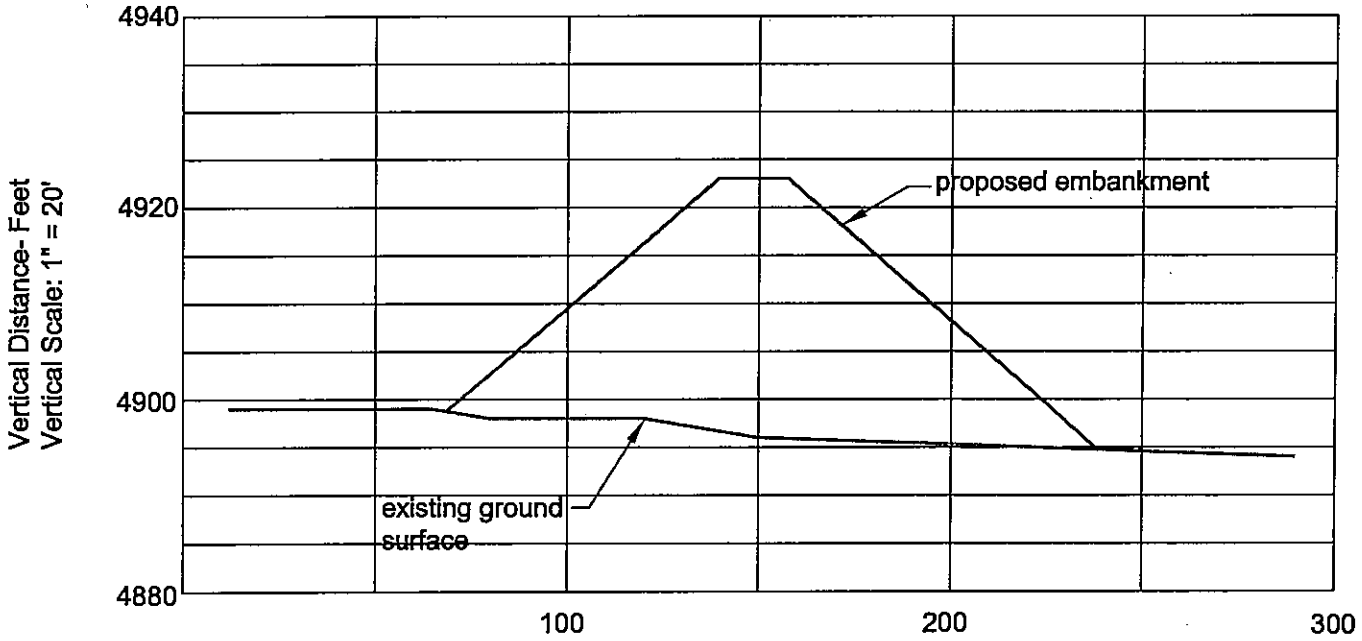



B - B'

Job No. 1,276 **Embankment Cross Sections** Fig. C-3

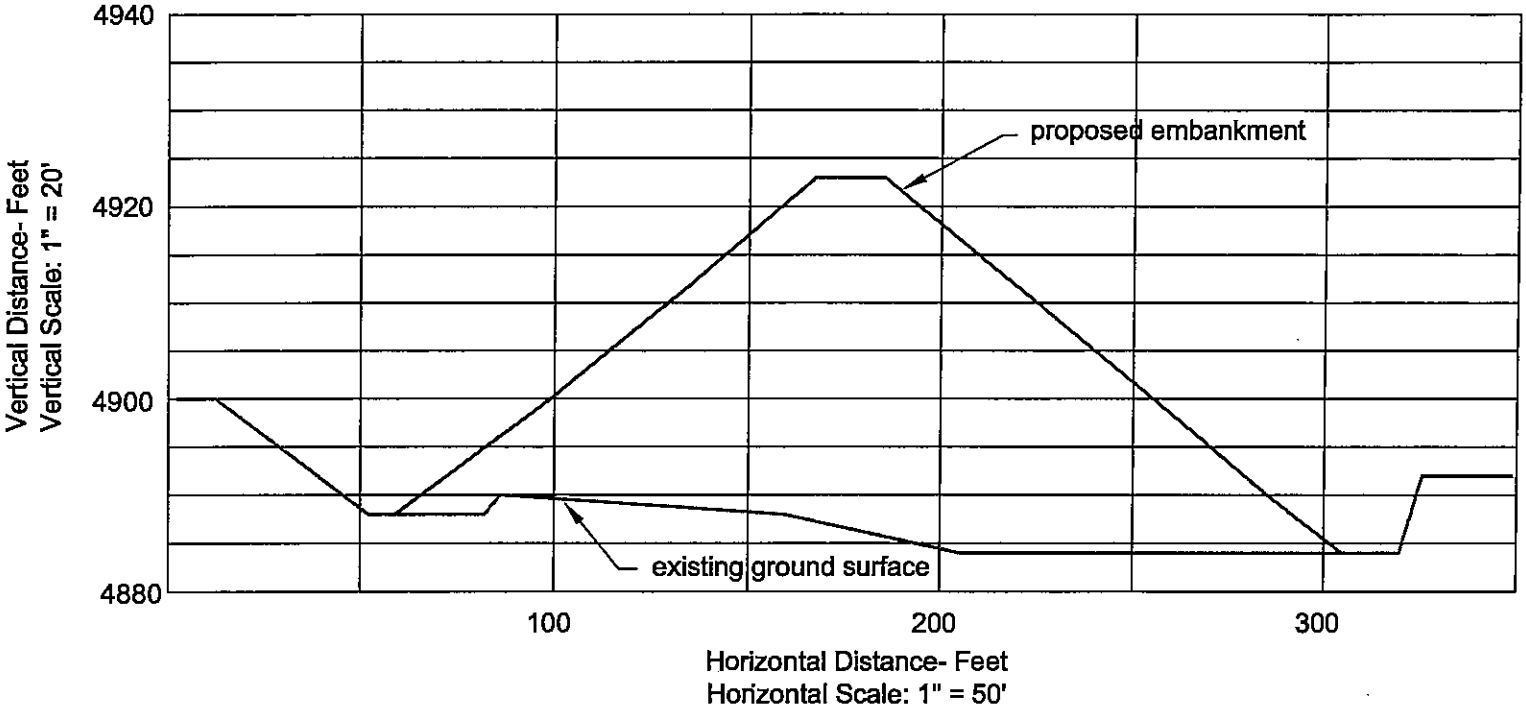



C - C'

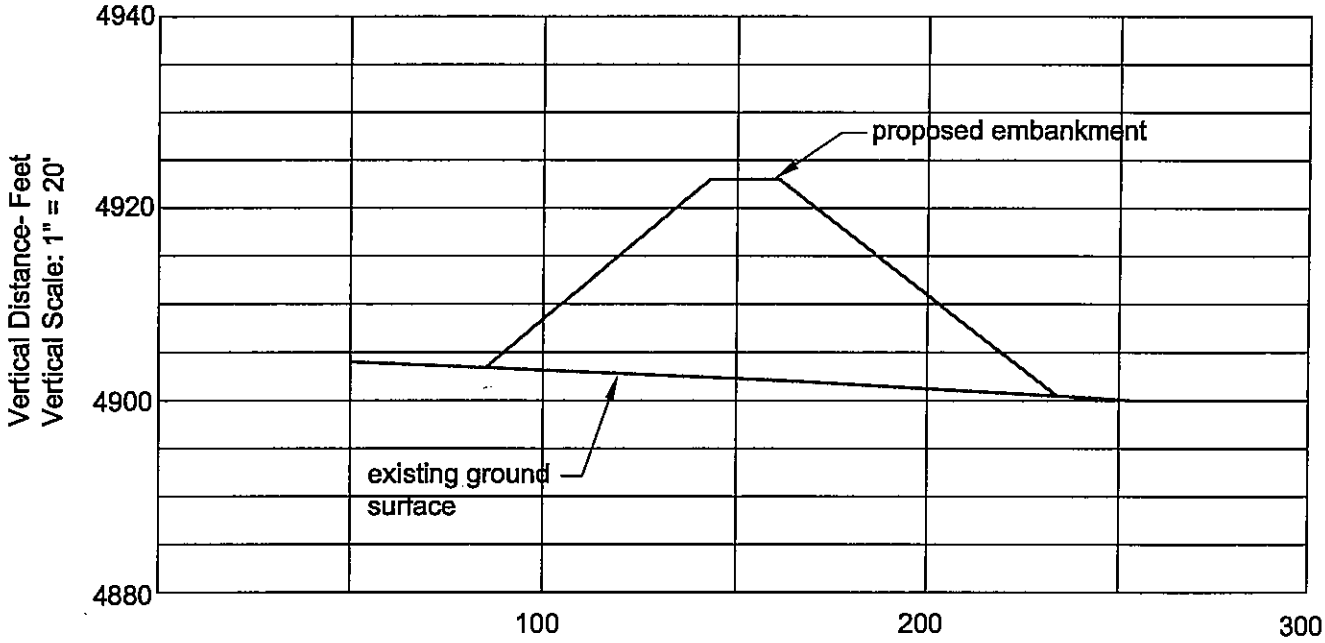



D - D'

Job No. 1,276 **Embankment Cross Sections** Fig. C-4




E - E'




F - F'

Job No. 1,276 **Embankment Cross Sections** Fig. C-5

# *Slide Analysis Information*

## Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Water Pressure Type: Water Surfaces
Data Output: Standard

## Analysis Methods

Bishop simplified
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

## Surface Options

Surface Type: Circular
Radius increment: 10
Minimum Elevation: Not Defined
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack

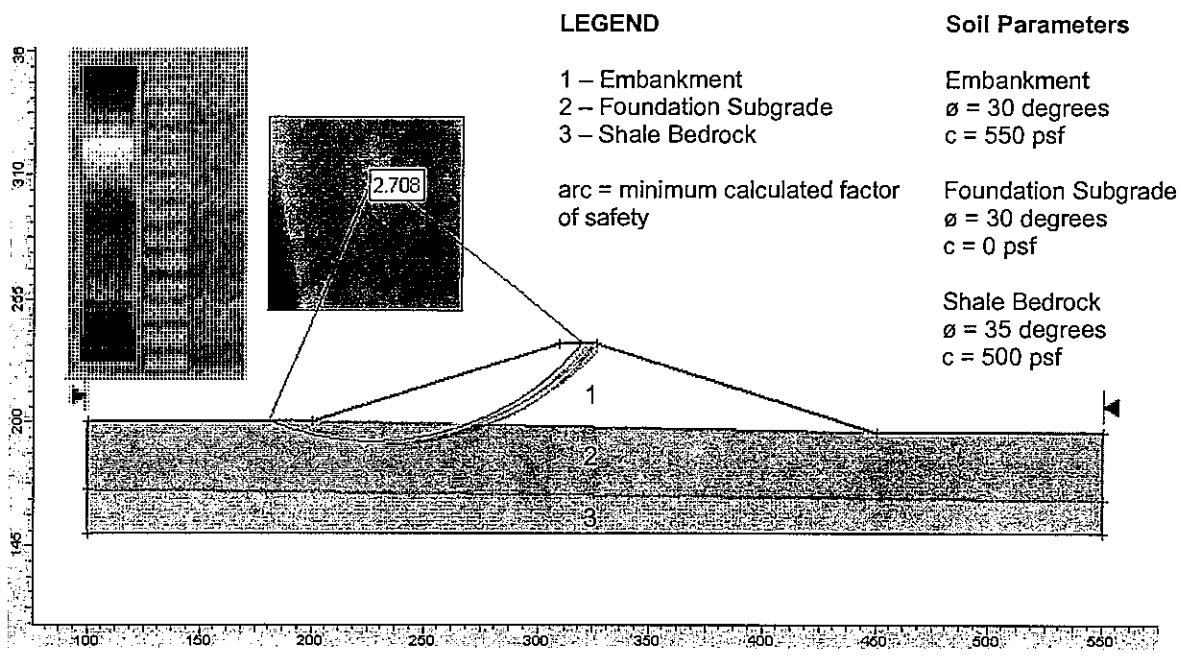
## Material Properties – Based on Laboratory Test Results

Material: Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 124 lb/ft3
Cohesion: 550 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Hu value: 1

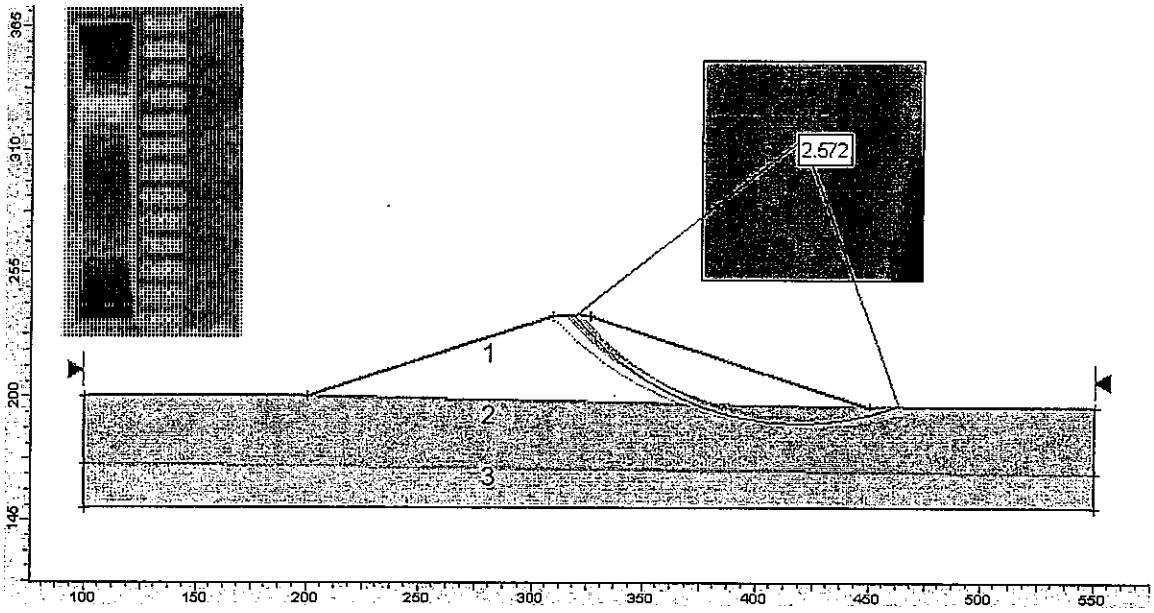
Material: Foundation Subgrade
Strength Type: Mohr-Coulomb
Unit Weight: 121 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Hu value: 1

Material: Shale
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 500 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Hu value: 1

**Job No. 1,276** **Slope Analysis Assumptions** **Fig. C-6**

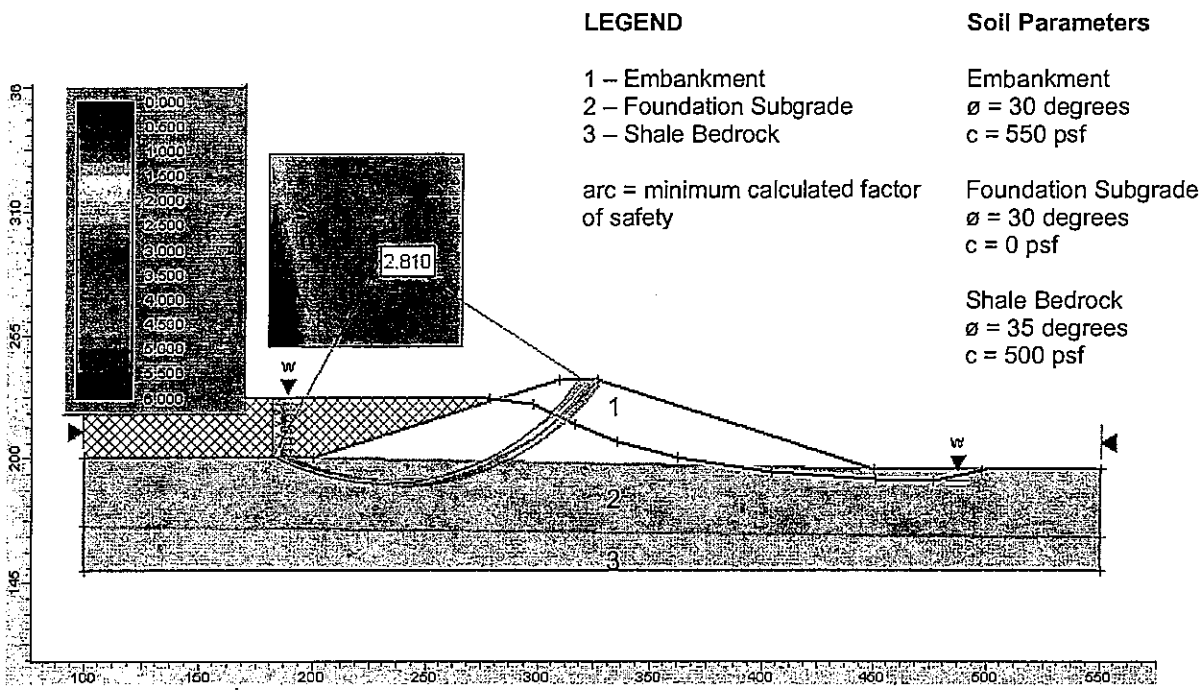



**Upstream – Detention Basin Empty Conditions**
(10 lowest factor of safety surfaces shown, Lowest factor of safety shown)

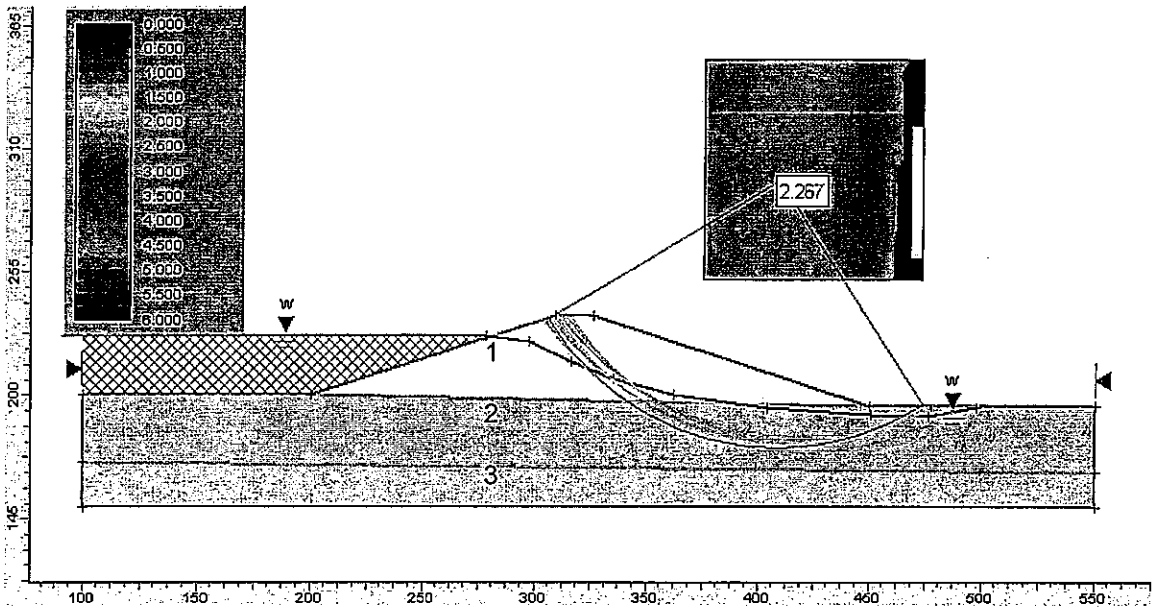



**Downstream – Detention Basin Empty Conditions**
(10 lowest factor of safety surfaces shown, Lowest factor of safety shown)

**Job No. 1,276** **Typical Failure Surfaces** **Fig. C-7**
**Detention Basin Empty Conditions**

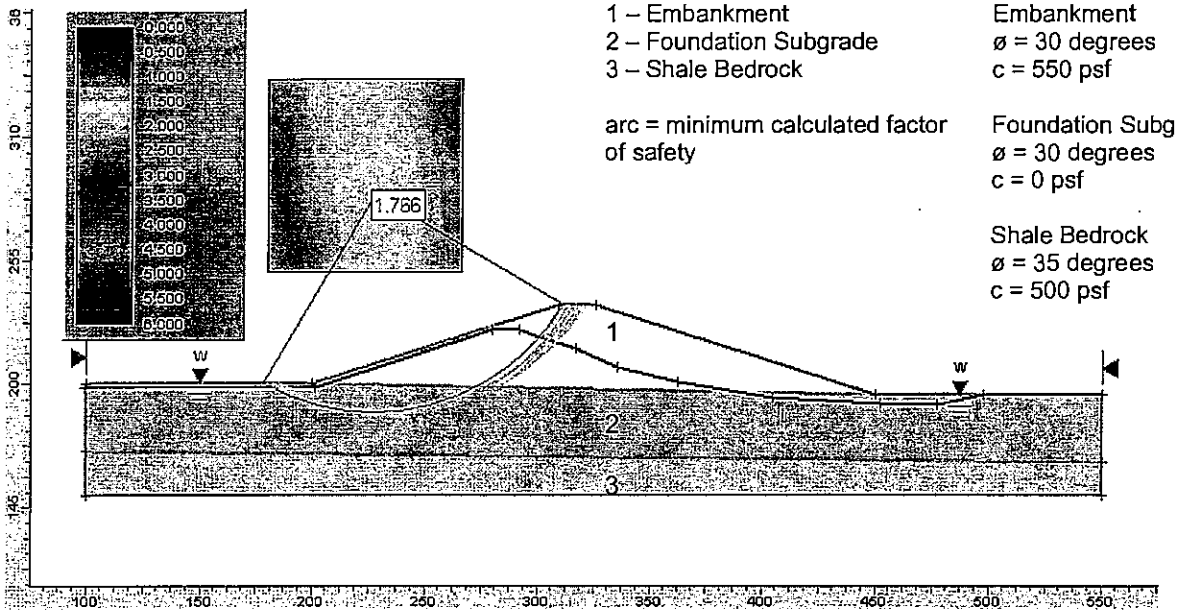



**Upstream – Steady State Conditions**
(10 lowest factor of safety surfaces shown, Lowest factor of safety shown)

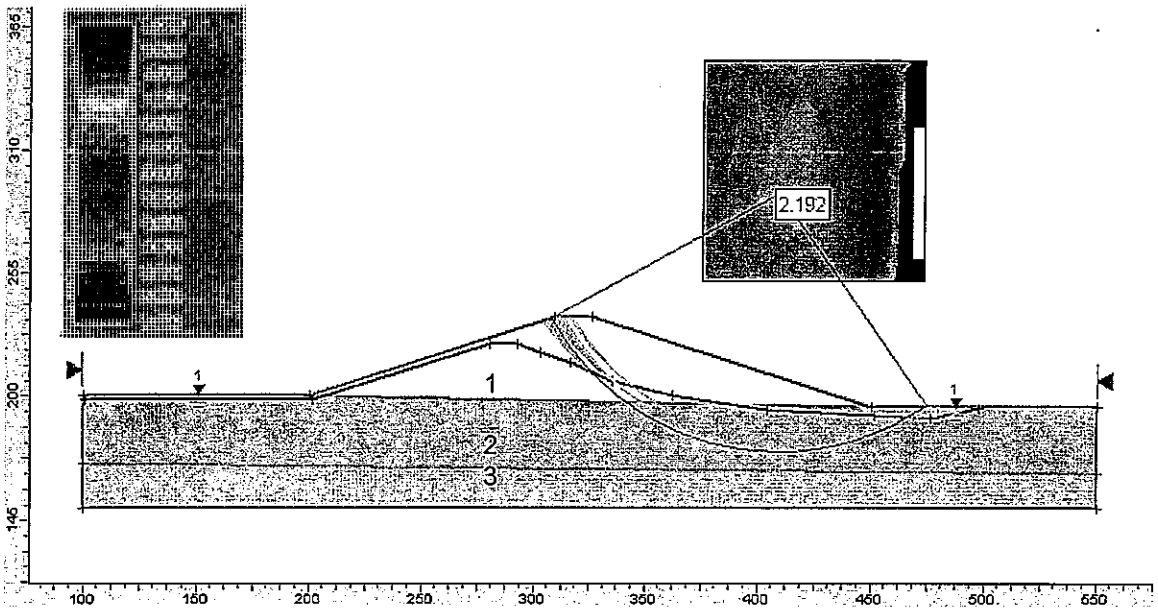



**Downstream – Steady State Conditions**
(10 lowest factor of safety surfaces shown, Lowest factor of safety shown)

**Job No. 1,276** **Typical Failure Surfaces Steady State Conditions** **Fig. C-8**




**Upstream – Rapid Drawdown Conditions**
(10 lowest factor of safety surfaces shown, Lowest factor of safety shown)



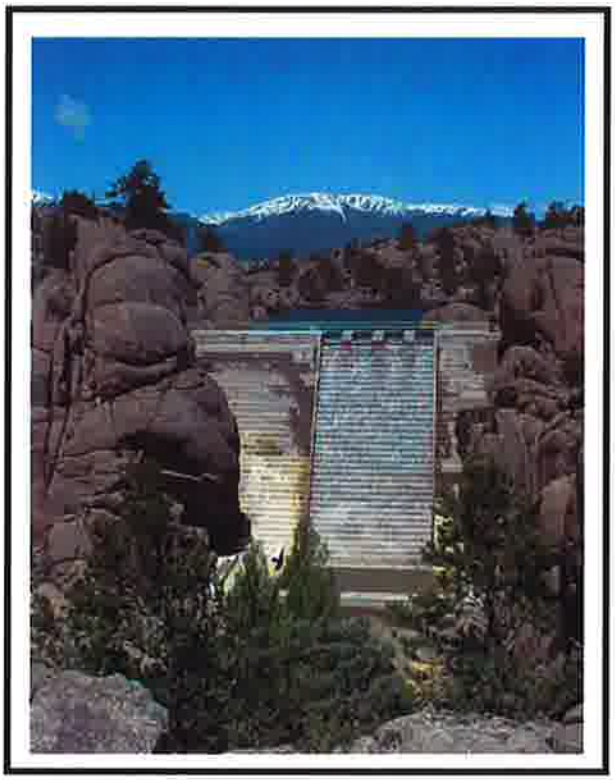

**Downstream – Rapid Drawdown Conditions**
(10 lowest factor of safety surfaces shown, Lowest factor of safety shown)

**Job No. 1,276** **Typical Failure Surfaces** **Fig. C-9**
**Rapid Drawdown Conditions**

# STATE OF COLORADO

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER RESOURCES
OFFICE OF THE STATE ENGINEER
DAM SAFETY BRANCH

# *RULES AND REGULATIONS FOR DAM SAFETY AND DAM CONSTRUCTION*



***EFFECTIVE DATE: JANUARY 1, 2007***

**2-CCR 402-1**

1313 SHERMAN STREET
ROOM 818 CENTENNIAL BUILDING
DENVER, COLORADO
TELEPHONE 303-866-3581
FACSIMILE 303-866-3589
WEBSITE:
http://water.state.co.us

STATE OF COLORADO

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

OFFICE OF THE STATE ENGINEER

# RULES AND REGULATIONS

## FOR

# DAM SAFETY AND DAM CONSTRUCTION

**2-CCR 402-1**

Effective Date:
**January 1, 2007**

**OFFICE OF THE STATE ENGINEER**

**RULES AND REGULATIONS**
**FOR**
**DAM SAFETY AND DAM CONSTRUCTION**

## TABLE OF CONTENTS

**Rule 9. Construction of Jurisdictional Size Dams:**

9.1 **High and Significant Hazard Dams** - For all High and Significant Hazard dams, the owner shall provide an engineer experienced in dam design and construction, who shall be responsible for the following:

9.1.1 **Plan for Construction Observation** - Not less than 30 days prior to construction, the engineer must submit to the State Engineer a general plan for construction observation. The construction observation plan shall include:

9.1.1.1 The date of the start of construction;

9.1.1.2 Names and qualifications of the engineer and staff to be used on the project;

9.1.1.3 A construction observation schedule for the engineer and staff;

9.1.1.4 For dams on rock foundations, a schedule for observations of the foundation by a geologist, or engineering geologist;

9.1.1.5 A schedule for inspection of the gate installation by the gate manufacturer or its representative unless waived by the State Engineer;

9.1.1.6 Identification of the firm that will conduct the construction material tests in the field and in the laboratory; and

9.1.1.7 A schedule of the construction material tests.

9.1.2 **Approval** - Within ten working days of receipt, the State Engineer shall provide written comments and approval, or conditions for approval of the construction observation plan. Construction shall not commence without approval of the observation plan by the State Engineer.

9.1.3 **Pre-Construction Meeting** - Subsequent to submitting the construction observation plan, but no later than two weeks prior to commencement of construction, a meeting shall be held between the engineer, dam owner, State Engineer and the general contractor. The general contractor shall develop and thoroughly explain its construction control plan along with any anticipated construction difficulties. During this meeting, the means used to divert and care for the stream during construction will be identified by the contractor; and if reasonable, the plan will be approved by the State Engineer. The name of the contractors and any principals in charge shall be furnished to the State Engineer at the meeting. Project communication protocol between the owner, engineer and the State Engineer shall be established at the pre-construction meeting.

9.1.4 **Engineer's Observation** - The engineer shall observe the construction of the dam. It is the engineer's responsibility to observe the progress and quality of the construction to determine whether the construction is proceeding in accordance with the approved plans and specifications. The engineer shall endeavor to prevent defects and deficiencies in the construction of the dam and appurtenant structures, and shall disapprove or reject work failing to conform to the approved plans and specifications. To assure independent review and proper quality assurance, in cases where the engineer has a contractual relationship with the general construction contractor to provide engineering services, the owner shall provide an independent, third-party engineer to perform the engineering quality assurance observations.

9.1.5 **Construction Records** - The engineer shall maintain a record of construction that, as a minimum, shall include: daily activity and progress reports; all test results pertaining to construction; photographs sufficient to provide a record of foundation conditions and various stages of the construction through completion; all geologic information obtained; and construction problems and remedies.

9.1.6 **Progress Report** - A construction progress report summarizing the contents of Rule 9.1.5 shall be submitted to the State Engineer every 30 days or more frequently if directed by the State Engineer. A summary report of all the items in Rule 9.1.5 shall be submitted at the end of construction in accordance with Rule 10.

9.1.7 **Notice for Inspection** - The engineer shall give the State Engineer at least five days advance notice of initial materials placement on the dam's foundation, in the cutoff trench, outlet backfill, outlet foundation and any appurtenance requested by the State Engineer in the approval of the plan for construction observation, to allow for observation by the State Engineer.

9.1.8 **Change Order** - When unforeseen site conditions or material availability require that the construction work differ significantly from the approved plans and specifications, a change order, including details, must be provided by the engineer to the State Engineer. No change shall be executed until approved by the State Engineer. Major changes must be submitted in writing with supporting documentation, and approved in writing by the State Engineer. Minor changes may be transmitted verbally by the engineer and approved by the State Engineer verbally.

9.1.9 **Final Inspection** - The engineer shall give the State Engineer at least 10 days advance written notice prior to the projects final construction inspection.

9.1.10 **Completion of Construction** - The engineer shall notify the State Engineer of the completion of the construction in accordance with Rule 10.

9.2 **Low Hazard and NPH Dams** - Low Hazard and NPH dams require the owner to provide an engineer experienced in dam design and construction, who shall be responsible for the following:

9.2.1 **Construction Plan** - Not less than 30 days prior to construction or as soon as possible for dams whose construction season is affected by freezing weather, the engineer shall notify the State Engineer in writing of the date construction will begin, the name of the engineer in charge of the project, and the name of the contractor.

9.2.2 **Engineer Observation** - The engineer shall observe, or provide for the observation by a qualified technician directly responsible to the engineer, the construction work on the dam, the cutoff trench, and outlet works foundation to see that they are in substantial accordance with the approved plans. The engineer shall endeavor to guard against defects and deficiencies in the construction of the dam, and shall disapprove or reject work failing to conform to the approved plans and specifications.

9.2.3 **Inspection, Testing and Reporting** - Tests of construction materials shall be taken and inspections of the construction made to verify that the work is completed in accordance with the approved plans and specifications. Periodic progress reports shall be submitted as requested by the State Engineer. The engineer shall compile a record of all tests conducted, and any problems and remedies, for submittal to the State Engineer at the end of construction.

9.2.4 **Change Orders** - Change orders shall be submitted in accordance with Rule 9.1.8.

9.2.5 **Final Inspection** - The engineer shall give the State Engineer at least 10 days advance written notice prior to the projects final construction inspection.

9.2.6 **Completion of Construction** - The engineer shall notify the State Engineer of the completion of construction in accordance with Rule 10.

**Rule 10. Acceptance of Construction of Jurisdictional Size Dams:**

10.1 **Acceptance of Construction** - Construction for which application has been made pursuant to Rule 5 or Rule 6 shall not be deemed complete nor shall storage of water be permitted until the State Engineer furnishes to the owner a written statement of acceptance, unless temporary approval of storage is granted by the State Engineer. The acceptance shall specify the vertical height, freeboard, length of the dam, the capacity of the reservoir in acre-feet, and any limitation upon, or requirements for the use of the dam. The State Engineer shall furnish the acceptance or denial within 60 days of receipt of a complete notification of completion.

10.2 **Construction Completion Documents** - The engineer shall provide the following construction documentation within 60 days of the final construction inspection in order for the project to be deemed complete:

10.2.1 A written notification that the project is complete and in general conforms with the approved plans, specifications and change orders;

10.2.2 As-constructed drawings that meet the format requirements of Rule 5;

10.2.3 A final construction report containing the following information, if applicable, in accordance with the requirements of Rule 9; a summary of construction, problems encountered, and solutions implemented to resolve the problems; a summary of construction material tests and geologic observations; photographs of construction from exposure of the foundation to completion of construction;

10.2.4 A record of the location of permanent monuments and instrumentation as well as installation details and initial surveys and readings shall be submitted, if applicable;

10.2.5 A schedule for the first filling of the reservoir specifying fill rates, water level elevations to be held for observation, and a schedule for inspecting and monitoring the dam. No filling schedule is required for minor dams rated Low Hazard and all NPH dams or if waived by the State Engineer for good cause shown. The dam owner, however, shall monitor the dam frequently during the first filling; and

10.2.6 A long-term instrumentation monitoring plan for new dams and enlargements (except for minor Low Hazard and all NPH dams) that shall include: the frequency of monitoring; the data recording format; graphical presentation of data; and, the parties who will perform the work.

10.3 The engineer shall provide periodic review of the data included in the long-term monitoring plan on at least an annual basis for the first five years, whereupon the monitoring shall continue in accordance with Rule 15. The engineer shall submit the data and a written assessment of the dam's performance to the State Engineer annually.

10.4 Upon written request by the owner and for good cause shown, the State Engineer may temporarily approve storage of water prior to full compliance with Rule 10. The written request shall include a schedule for compliance with Rule 10, a certification letter signed and sealed by the engineer in accordance with Rule 10.2.1, a schedule for the first filling of reservoir in accordance Rule 10.2.5, and a monitoring plan for observing the behavior of the dam and appurtenances during the initial filling or refilling of the reservoir. For High and Significant Hazard dams, an Emergency Action Plan prepared in accordance with Rule 16 shall be developed by the owner and approved by the State Engineer prior to placing any water in the reservoir. Only a partial reservoir filling will be granted under this Rule. Final acceptance of the construction for full use of the reservoir will not be granted until the requirements of Rule 10 have been satisfactorily completed.

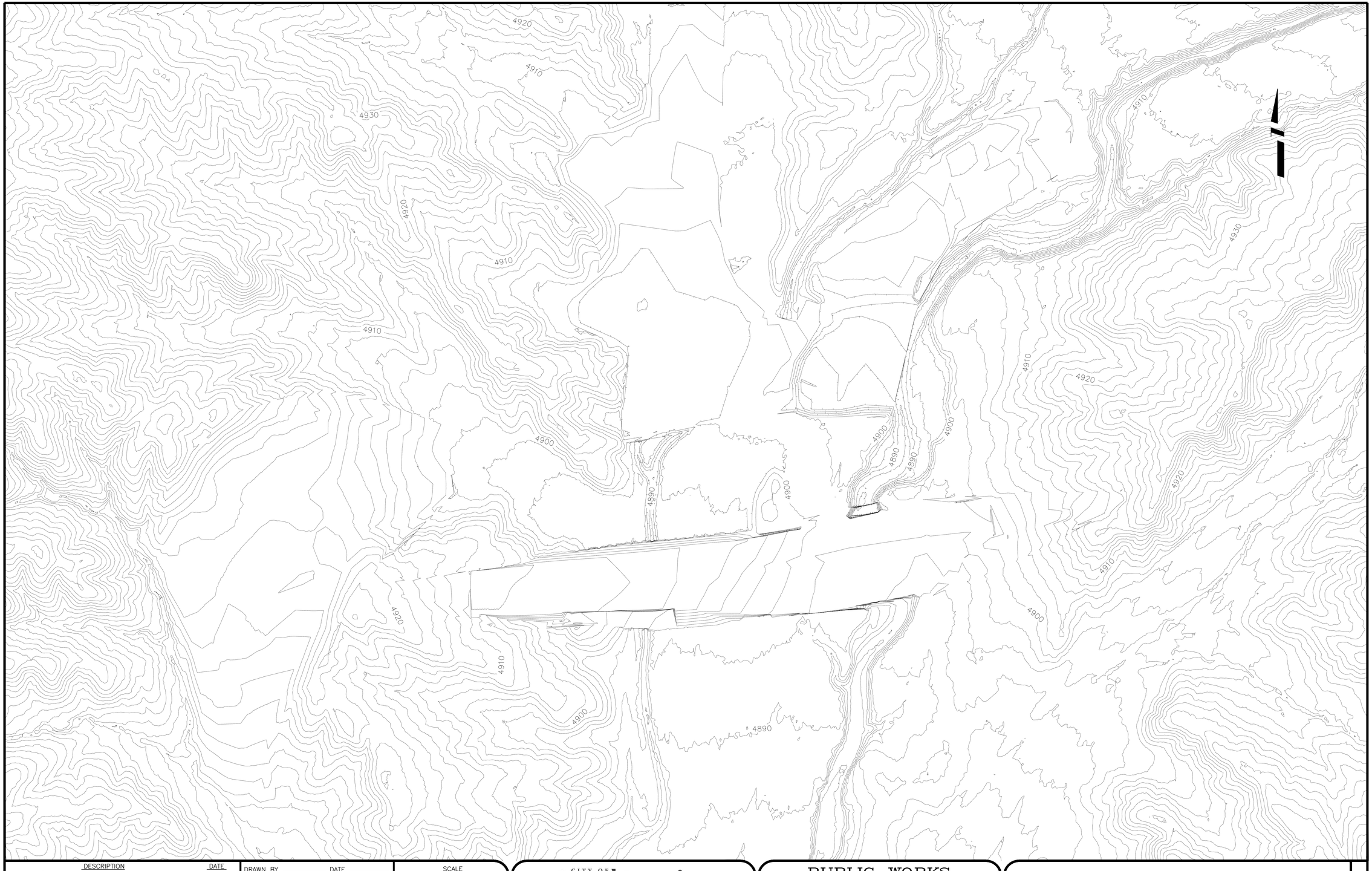
10.5 The engineer and/or owner shall submit an Emergency Action Plan that conforms to Rule 16 within 60 days after the final construction inspection.

33670 cy Cut Needed
for Spillway Completion

30100 cy Material Can
Still be Borrowed from
this Area

66580 cy Fill Needed
for Dam Completion

| DESCRIPTION | DATE | | | SCALE | | | |
|---|---|---|---|---|---|---|---|
| REVISION 1 | – | DRAWN BY | DATE | as shown | CITY OF Grand Junction COLORADO | PUBLIC WORKS AND PLANNING ENGINEERING DIVISION | Leach Creek Detention Basin<br>Dirtwork Still Needed as of August 2014 | 1A |
| REVISION 2 | – | DESIGNED BY | DATE | | | | | |
| REVISION 3 | – | CHECKED BY | DATE | | | | | |
| REVISION 4 | – | APPROVED BY | DATE | | | | | |




| DESCRIPTION | DATE |
|---|---|
| REVISION 1 | – |
| REVISION 2 | – |
| REVISION 3 | – |
| REVISION 4 | – |

DRAWN BY _____ DATE _____
DESIGNED BY _____ DATE _____
CHECKED BY _____ DATE _____
APPROVED BY _____ DATE _____

SCALE
as shown

CITY OF Grand Junction COLORADO

PUBLIC WORKS
AND PLANNING
ENGINEERING DIVISION

Leach Creek Detention Basin
Existing Topo Feb 2015

2A