DEPARTMENT OF ADMINISTRATIVE SERVICES (DAS)

Office of School Construction Grants & Review (OSCG&R)

REQUEST FOR REVIEW OF FINAL PLANS
FORM SCG-042

STATUTORY REF.: C.G.S. Sections 10-282, 10-283, 10-291, 10-294, 10-292

DISTRICT NAME:	FACILITY NAME AND ADDRESS:	STATE PROJECT NUMBER:
Mansfield Public Schools	Mansfield Elementary School 134 Warrenville Rd Mansfield Center, CT 06250	078-0068 N
		PHASE NUMBER: Phase 1 of 3

Estimated date* to begin construction September 2020 Estimated date to complete construction _September 2022_

*** NOTE: Construction must begin within 2 years of grant commitment date to maintain grant eligibility.**

Certification of Approval dates:

	Final Plans & Prof. Cost Estimate	Site Approval (if applicable)
Local Board of Education	7 /30/2020	/ /
School Building Committee	7/23/2020	/ /

We hereby certify that these **final plans and project manual(s)** as prepared for bidding and dated **July 21, 2020**, and the **professional cost estimate**, completed in accordance with Level 3 of ASTM International Standard E1557, Standard Classification of Building Elements and Related Sitework-UNIFORMAT II for this project, dated **July 21, 2020** , have been reviewed and approved for this project on the dates shown above.

For the Town or Regional Board of Education:

Chairperson's Name (Type or print)	Signature	Date**

For the School Building Committee:

Chairperson's Name (Type or print)	Signature	Date**

**** Signature dates cannot precede the date on the submitted plans.**

For the Project Architect/Engineering Firm:

Firm Name (Type or print)	Signature	Telephone No.

We hereby request a review of the final Project Plans, Project Manual, Ineligible and Limited Eligible Costs Worksheet (ICW) FORM SCG-4000, and professional cost estimate as noted above. Copies of all the above referenced documents are either attached, or available.

Superintendent's Name (Type or print)	Signature	Date

NOTE: NO PHASE OF THIS SCHOOL CONSTRUCTION PROJECT SHALL GO OUT TO BID, AND NO PURCHASE ORDER OVER $10,000.00 SHALL BE ISSUED, UNTIL YOU HAVE RECEIVED WRITTEN NOTIFICATION FROM THE STATE DEPARTMENT OF ADMINISTRATIVE SERVICES (DAS) INDICATING APPROVAL OF FINAL PLANS, PROJECT MANUAL, AND COST ESTIMATE.

FORM SCG-042 Request for Review of Final Plans

State Project No. __078-0068 N_____

Project Name: ___Mansfield Elementary School_____

Ryszard Szczypek, AIA, Partner

Name of Contact Person: Scott Pellman - OPM	Telephone: 203-584-1019	Date: 7-23-2020

Certifications of Local Approval:

I certify that I have local jurisdiction over the **State Building Code** and that the plans and project manual dated ___July 21, 2020_____ for the above referenced project comply with all applicable building codes.

_____ _____ _____

Local Building Official's Name Signature Date

I certify that I have local jurisdiction over the **State Fire Safety Code** and that the plans and project manual dated ___ July 21, 2020___ for the above referenced project comply with all applicable fire codes.

_____ _____ _____

Local Fire Marshal's Name Signature Date

I certify that I have local jurisdiction over the **State Health Code** and that the plans and project manual dated ____ July 21, 2020__for the above referenced project comply with all applicable health codes.

_____ _____ _____

Local Health Official's Name Signature Date

I certify that I have local jurisdiction over **Section 504 of the Rehabilitation Act of 1973**, and the Uniform Federal Accessibility Standards (UFAS). I further certify that the plans and project manual dated _ July 21, 2020_ for the above referenced project comply with all applicable accessibility codes.

_____ _____ _____

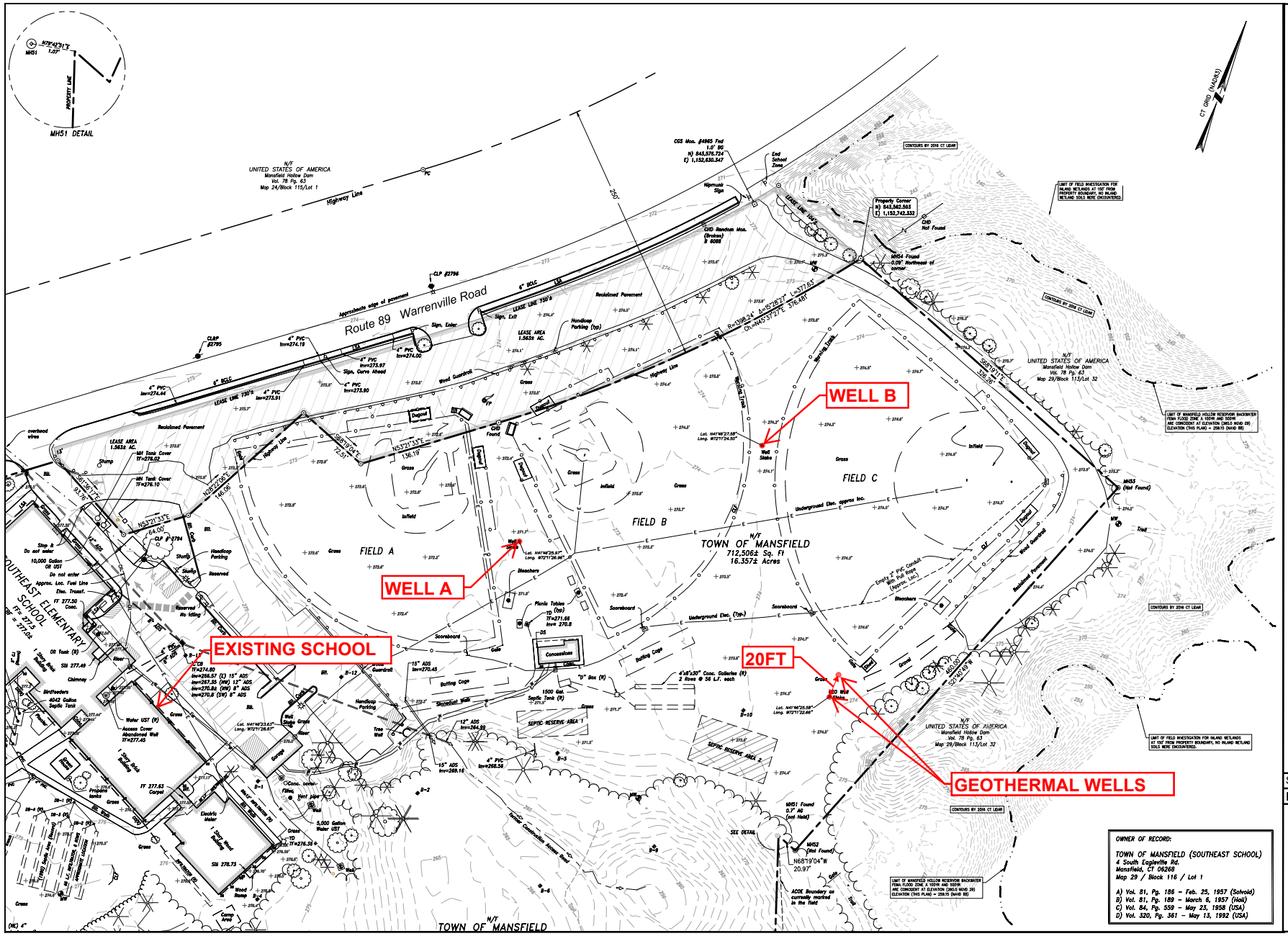
Local Federal 504 Official's Name Signature Date

NOTES:

1.) THE CERTIFICATIONS OF LOCAL APPROVAL NOTED ABOVE MUST BE OBTAINED, AND ARE REQUIRED TO BE PROVIDED, PRIOR TO RECEIVING APPROVAL-TO-BID BY THE STATE DEPARTMENT OF ADMINISTRATIVE SERVICES (DAS) FOR THIS PROJECT. IF THESE CERTIFICATIONS CANNOT BE OBTAINED LOCALLY, PLEASE CONTACT THE DAS, OFFICE OF SCHOOL CONSTRUCTION GRANTS & REVIEW (OSCG&R) FOR ASSISTANCE.

2.) THE OFFICE OF SCHOOL CONSTRUCTION GRANTS & REVIEW (OSCG&R) APPROVED PROJECT PLANS, PROJECT MANUAL AND COST ESTIMATE MUST BE KEPT ON FILE AT THE LOCAL BOARD OF EDUCATION OFFICE UNTIL THE FINAL GRANT PAYMENT HAS BEEN MADE AND THE DAS AUDIT IS COMPLETE ON THIS PROJECT.

3.) ORIGINAL SIGNATURES ARE REQUIRED ON THIS FORM. IF ORIGINAL SIGNATURES ARE NOT AVAILABLE AT THE PLAN REVIEW MEETING, MAIL OR OVERNIGHT DELIVER THIS COMPLETED FORM TO:
The Office of School Construction Grants & Review
450 Columbus Blvd., Suite 1503
Hartford, CT 06103



MANSFIELD ELEMENTARY SCHOOL

134 WARRENVILLE ROAD
MANSFIELD, CT 06286

STATE NO: 20DASY078068N0620
DATE: JULY 22, 2020

Attachment A

COST ESTIMATE

TOWN OF MANSFIELD

Mansfield, Connecticut

WELL DRILLING AND TESTING

for

MANSFIELD ELEMENTARY SCHOOL

134 WARRENVILLE ROAD, MANSFIELD, CT 06286

STATE PROJECT NUMBER: 078-068N
PHASE 1 of 3

TSKP STUDIO
One Hartford Square West
Bldg. 1, Suite 203
146 Wyllys Street
Hartford, CT 06103

JULY 21, 2020

COST ESTIMATE
Well Drilling and Testing for Mansfield Elementary School
Mansfield, CT

A. GEOTHERMAL TEST BORES

Item No.	Description	Quantity	Unit Price, including Material & Installation	Extended Price	Notes
A1	Mobilization and Site Restoration, Lump Sum	1	$ 5,000	$ 5,000	
A2	Drilling 500-Feet Deep Test Bores, Feet	1,000	$ 30	$ 30,000	
A3	Conducting 48-Hour Thermal Conductivity Tests, Lump Sum	1	$ 3,000	$ 3,000	
A4	Submit Written Report With Driller's Log and Conductivity Test Results, Lump Sum	1	$ 1,500	$ 1,500	
A5	Additional Drilling and Testing Contingency	10%		$ 3,500	
			A. Geothermal Test Bores Subtotal	**$ 43,000**	

B. POTABLE WATER SUPPLY WELLS

Item No.	Description	Quantity	Unit Price, including Material & Installation	Extended Price	Notes
B1	Mobilization, Permit, Site Restoration, Lump Sum	1	$ 5,000	$ 5,000	
B2	Drill Two 6" Boreholes, 15 feet into competent bedrock, Feet	30	$ 100	$ 3,000	
B3	Install 6" Diameter Steel Casing, Feet	70	$ 20	$ 1,400	
B4	Continue Drilling 6" Diameter Well in Bedrock, Feet	730	$ 50	$ 36,500	
B5	Conduct Four-Hour Step Pumping Tests, Lump Sum	1	$ 1,500	$ 1,500	

COST ESTIMATE

Well Drilling and Testing for Mansfield Elementary School

Mansfield, CT

	B6	Conduct Four-Hour Safe Yield Pumping Tests, Including Water Sample Collection and Analysis, Lump Sum	1	$ 1,500	$ 1,500
	B7	Water Quality and Yield Report, Lump Sum	1	$ 1,500	$ 1,500
	B8	Drilling, Steel Casing and Testing Contingencies	10%		$ 4,390
				B. Potable Water Supply Wells Subtotal	**$ 54,790**

SUBTOTAL COST A + B =	**$ 97,790**
15% Overhead & Profit =	**$ 14,669**
GRAND TOTAL =	**$ 112,459**

BID FORM

WELL DRILLING AND TESTING
MANSFIELD ELEMENTARY SCHOOL
STATE PROJECT NO. 078-068N, PHASE 1 OF 3

To: **Mansfield Public Schools**
Street Address
Mansfield, CT 06286

Attn: _____

Bid of: _____
(Name of Company)

This proposal is made with the understanding that it will not be withdrawn for 90 days after the scheduled bid opening date.

Furthermore, the undersigned Bidder declares the Project Site, the Invitation to Bidders, the Specifications, Addenda, and the availability of material and labor has been carefully examined and agrees to furnish material and labor to conduct Well Drilling and Testing as specified and scheduled, including all supervision, material, labor, tools, apparatus and implements, freight, permits, removal of debris, and cartage. The undersigned Bidder also agrees to complete the Work in accordance with the Contract Documents within the time limit stated below.

The undersigned Bidder is submitting a copy of this Bid Form with the Category Lump Sum Bids indicated below, plus a copy of the Itemized Unit List with the Unit Prices and Extended Prices indicated therein. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part.

After review of all factors, terms and conditions, including price, the purchasing authority of Mansfield Public Schools reserves the right to reject any and all bids, or any part thereof, or waive defects in same, or accept any proposal deemed to be in the best interest of Mansfield Public Schools.

WELL DRILLING AND TESTING UNIT COST BID FORM

A. Geothermal Test Bores for Closed-Loop Ground Heat Exchanger:

Item	Brief Description	Estimated Quantity and Measure	Bidders Unit Price	Extended Total
1	Mobilization and Site Restoration	1 LS		
2	Drilling two test bores, 500 feet deep each, with piping loop and grout, and capping.	1 LS		
3	Conducting a 48-hour thermal conductivity test on one of test wells.	1 LS		
4	Submit a written report with driller's log and conductivity test results.	1 LS		
5	**Sub-Total for Items 1 – 4**			
6	Drill Wells Deeper Than 500 Feet	Per Foot		

B. Potable Water Supply Wells:

Item	Brief Description	Estimated Quantity and Measure	Bidders Unit Price	Extended Total
7	Mobilization, Obtain Well Drilling Permits, and Site Restoration	1 LS		
8	Drill 6" borehole, 15 feet into competent bedrock	30 LF		
9	Install 6" diameter steel casing	70 LF		
10	Continue drilling 6" diameter well in bedrock	730 LF		
11	Conduct four-hour step pumping tests, Wells A + B	1 LS		
12	Conduct 18-hour safe yield pumping tests, incl. water sample collection and analysis	1 LS		
13	**Sub-Total for Items 7 – 12**			
14	Drill deeper than 35 feet per well into bedrock	Per Foot		
15	Provide Additional 6" Steel Casing	Per Foot		
16	Drill Wells Deeper Than 400 Feet	Per Foot		
17	Extend Safe Yield Pumping Tests greater than 18 hours for Wells A and B	Per Hour		

ADDENDUM RECEIPT

The undersigned Bidder acknowledges receipt of the following addenda:

Addendum No. _____ Date _____

Addendum No. _____ Date _____

Addendum No. _____ Date _____

BIDDER QUALIFICATIONS

If the Bidder is a Corporation, fill out:

The Bidder is a corporation, organized under the laws of _____
having its principal office at _____.
The Principal Officers of said Corporation, with their respective titles and addresses are as follows:

_____
_____
_____
_____
_____

If the Bidder is a Partnership or a Limited Liability Company, the following should be filled out:

The members of the Partnership or LLC with their addresses are as follows:

_____
_____
_____
_____

EXPERIENCE AND ABILITY

The Bidder is required to state below: (1) What work of a similar character to that included in the proposed contract he has done, and give references that will enable the Owner to judge of his experience, ability to meet completion date, skill and business standing; and (2) A brief description of the supervisory staff, and general methods proposed for carrying on the work, indicating therein whether the staff are hired or subcontracted by the Bidder.

_____
_____
_____

FORMS

All sealed Bids must be submitted no later than _____, prevailing time, on _____ either in person or by registered mail or courier.

Completed Bid Forms and Itemized Summary Sheets must be submitted in duplicate.

DATE OF BID AND SIGNATURE OF BIDDER

Name of Bidder

Signed

Title

Mailing Address

State of ( )
County of ( ) ss. ( )

On this _____ day of _____, 2018,

Personally appeared before me

(*_____)
(Name of Person Signing)

(**_____ of _____)
(Title) (Name of Bidder)

signed of the foregoing bid and acknowledged the same to be his free act and deed ** (as such officer and the free act and deed of said corporation) before me.

Notary Public:

* The Bid must be signed by the Bidder if the Bidder is an individual, by one of the partners, if a partnership, or by an authorized officer if a corporation. The person signing must state the capacity in which he signs at the place indicated.

** If the Bidder is a corporation, the blanks enclosed in parentheses in the acknowledgement should be filled in with the name of the corporation, corporate seal, and the title of the person signing. If the Bidder is an individual or partnership, the parentheses should be disregarded.

SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Project Information.
2. Work Covered by the Contract Documents.
3. Work under Separate Contracts
4. Access to Site
5. Coordination with Occupants
6. Work Restrictions
7. Specification Conventions

1.3 PROJECT INFORMATION

A. Project Identification: Mansfield Elementary School

1. Project Location: 134 Warrenville Road, Mansfield, CT 06286

B. Owner: Town of Mansfield

1. Mansfield School Building Committee.

2. Owner's Project Manager: Colliers Project Leaders.

C. Architect: TSKP Studio, 146 Wyllys Street, Suite 1-203, Hartford, CT 06106.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work is defined by the Specifications and consists of the following:

1. Drilling and Testing of Geothermal Wells.

2. Drilling and Testing of Potable Water Supply Wells.

B. Type of Contract:
1. Drilling and Testing will be constructed under a single prime contract.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts.

B. Concurrent Work: Owner may award separate contracts for other operations at the site. Those operations may be conducted simultaneously with work under this Contract.

1.6 ACCESS TO SITE

A. General: Contractor shall have full use of areas designated by the Owner for drilling and testing operations during contract period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of site.

B. Use of Site: Limit use of premises to areas designated by the Owner. Some portions of the site will remain in operation as a school throughout the duration of construction.

C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by drilling and testing operations throughout contract period. Repair damage caused by drilling and testing operations.

1.7 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing & adjacent building(s) during entire contract period. Cooperate with Owner during drilling and testing operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways and other adjacent occupied or used facilities. Do not close or obstruct walkways or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on drilling and testing operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then, if required by the Owner, only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed utility interruptions.

D. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.9 SPECIFICATION CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

PART 1 - GENERAL

1.1 PRE-BID INSPECTION

A. An inspection of the well sites is recommended, for the Contractor to become familiar with the local conditions, and any limitations each site may have. Any Contractor who wishes to inspect the well site MUST contact the Town of Mansfield to arrange an appointment, and must be accompanied on the site by an Owner's representative.

A copy of the Well Site Map is provided in Attachment A.

1.2 DRILLING SEQUENCE

A. As shown on the attached drawings, the Owner desires that two new wells (Proposed Wells A and B) be constructed at the project site. If after drilling and testing, Wells A and B do not meet the water demand needs for the project, a change order may be provided to proceed with the construction and testing of Well C.

1.3 PERMITS & INSURANCE

A. The Contractor shall obtain a well drilling permit from the Town of Mansfield and the local health director prior to drilling. The Owner anticipates obtaining State Department of Public Health Well Site Approvals, which will be provided to the Contractor. The Contractor shall provide the Owner with certificate of insurance, prior to beginning work.

1.4 DRILLING METHOD

A. The well shall be constructed using an air rotary drilling or cable tool rig. The well drilling operations shall comply with all applicable regulations in the State of Connecticut that apply to drinking water supply wells.

1.5 WELL CONSTRUCTION

A. The well construction shall comply with all applicable regulations 111 the State of Connecticut that apply to drinking water supply wells.

1. Prior to well drilling, the Contractor shall install a silt fence and/or hay bale barrier around each well site, to contain all soil and drill cuttings from leaving the immediate area of the well. The Contractor shall also construct a suitable sedimentation basin, into which all water removed from the well during construction will be discharged, to remove all sediment before discharging. This basin layout must be submitted to the Engineer for approval prior to beginning well drilling, and shall be maintained and/or modified in the field as required, to ensure that sediment is being removed from the discharge water.

2. The well drilling borehole must extend through the overburden and extend a minimum of 15 feet into competent and unweathered bedrock. A 6-inch diameter

inner casing shall be grouted to form a sanitary seal according to Connecticut well-drilling code.

3. New steel well casing wall thickness shall be 17 pounds per foot.
4. Wells shall be developed using either pumping or surging techniques. Water withdrawn during development shall be controlled and diverted by the Contractor. Refer to Note I above
5. Beginning at 100 feet, the Contractor shall provide the Owner with an estimate of well yield every 20-feet of depth. The desired minimum well yield in each well is 10gpm.
6. The Contractor shall base their base bid on drilling a 400-foot deep well as measured from the ground surface, with an estimated 20' depth to bedrock at the site. Final payment will be based upon actual depths to bedrock, lengths of steel casing, and depths of drilling completed on the site, and accepted by the Owner.
7. If the well yield obtained at a depth of 400 feet is not satisfactory to the Owner, the Owner reserves the right to ask the Contractor to continue drilling the well. Estimates of yield shall be made every 20 feet until the Owner is satisfied with the apparent yield.
8. Upon completion of drilling and testing, provide a well cap with sanitary seal listed on the Connecticut Department of Public Health list of approved products.
9. The driller shall submit a Well Drilling Completion Report to the Owner and Engineer upon completion of drilling.
10. Upon completion of work at the site, the Contractor shall remove all soil, drill cuttings, and other similar materials generated during well drilling from the site, and restore the well site area to pre-existing conditions or better.

1.6 STEP PUMPING TESTS

A. Conduct a 4-hour duration step test for Wells A and B. Conduct step pumping tests on Wells A and B individually, to estimate safe yield and determine initial pumping rate prior to conducting 18-hour simultaneous yield tests on wells.

B. Install temporary submersible pumps, with capacity of up to IO gpm. Contractor to provide a rigid discharge header with a ball valve to throttle pump discharge, water meter, a smooth ended chrome sampling tap, and sufficient discharge piping to discharge well to designated locations shown on plan. Operate pumps at rates directed by engineer. Contractor to provide an electronic depth to water transducer or similar device, depth to water measurements during the step tests. Remove all equipment upon completion of testing, restore site to original conditions.

C. Note that if the results of the Step Pumping Tests are favorable, submersible pumps and pump testing equipment can be left intact, for use during future long-term safe yield testing.

1.7 SAFE YIELD PUMPING TESTS

A. Upon approval of the step pumping tests, the Contractor shall proceed with the 18-hour simultaneous pumping tests for Wells A and B. Schedule pumping test not to coincide with operation of existing bedrock wells providing water to the School. This may require conducting the safe yield pumping tests during weekends or during school holidays or vacation periods.

B. Install temporary submersible pumps, with capacity of up to IO gpm. Contractor to provide a rigid discharge header with a ball valve to throttle pump discharge, water meter, a smooth ended chrome sampling tap, and sufficient discharge piping to discharge well to designated locations shown on plan. Operate pumps at rates directed by Engineer, which will be determined by the Step Pumping Test. Contractor to provide water meter and electronic depth to water transducer and data logger or similar device, to measure flow rate and water depth measurements during test.

C. Record depth to water readings for the following durations in each well:

1. Prior to test stmi- Hourly water level measurements from 48 hours before start of test to stmi time of test.
2. During pumping test- Water level measurements every IO minutes, for the duration of the pump test.
3. Upon shutdown of test- Every 10 minutes for the first two hours, and then hourly for the next 46 hours.
4. Perform periodic quality control checks of depth to water with hand held depth to water meters.

D. Record well discharge flow rates every 30 minutes. Measure instantaneous flow rate as well as record totalizer reading every 30 minutes during pumping.

E. Drawdowns in each well must be stabilized during the last 12 hours of the pumping test. Stabilization is defined as a water level drop in the well of less than I feet over a 12-hour period, while maintaining a constant pumping rate. Contractor shall adjust pumping rate at each well to obtain water level stabilization. All adjustments to pumping rates must be communicated to Engineer.

F. If extensions beyond 18 hours to the pump test are required to obtain stabilization, obtain authorization from the Engineer, and extend test as directed.

G. During the last 6 hours of the pumping tests, assuming stabilization has occurred, the Contractor shall sub-contract with a State certified laboratory to collect water samples from each well, and have them analyzed for parameters lists in Attachment B. Submit name and ce1 1ification credential of test laboratory with b i d .

H. Upon completion of the safe yield tests, remove all equipment upon completion of testing, and restore site to original or better conditions.

1.8 DELIVERABLES

A. Submit copies of the following information to the Engineer and Owner:

1. Well Drilling Completion Report
2. Completed DPH Yield Test Log Form (Attachment C)
3. Copy of pumping test data in both paper and excel spreadsheet form, showing date, time, depth to water in each well, pumping rate, measured drawdown in each well, and any notes regarding adjustments made during pumping test.
4. Copies of laboratory results from the Contractor's Certified laboratory, for the water quality parameters provided in Attachment B.

END OF SECTION

SECTION 170100 – TEST BORE FOR CLOSED-LOOP GROUND HEAT EXCHANGER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the furnishing of all equipment, materials and labor reasonably incidental for the complete installation of two (2) closed-loop ground heat exchanger test bores with one (1) bore being tested.

B. Work shall be conducted in accordance with the requirements of this Section.

C. The Contractor is responsible for securing all required drilling permits in the name of the Owner. The Contractor shall pay for all permitting costs.

D. As part of the bid, the Contractor is required to break out unitary pricing ($/linear ft.) for casing the bore. Should it be determined necessary to case the bore during the installation, this unitary price will be used.

E. Scope: Two (2) vertical bores shall be installed according to these specifications. The completed bores shall be located so that it is incorporated into the final ground-loop heat exchanger design. A completed vertical test bore shall consist of the SDR-09 vertical bore with an approved polyethylene u-bend assemble installed to the completed bore depth with an approved grouting material installed in the bore annulus. Vertical bore can be drilled by a mud-rotary drilling rig or by a compressed-air drilling rig whichever is most feasible based on geological conditions. Drilling contractor shall provide a detailed test bore report for each bore. The report shall include the following information:

1. Each formation type encountered (drill log)
2. Each formation depth (in feet)
3. Depth of any significant cracks, fissures or caverns encountered
4. All water bearing ones and if encountered:
   a. Zone depths
   b. Estimated flow rate
5. Type of drilling equipment used (i.e. mud-rotary, air-rotary, air-hammer, etc.), and rig model number
6. Bag quantity of drill mud used where applicable
7. Total time to drill the test bore excluding shutdowns to obtain water or mechanical breakdowns.
8. A completed, signed report shall be supplied immediately at the conclusion of the drilling process.
9. The Work also includes flushing and purging of the test bore piping system. The closed-loop ground heat exchanger consists basically of polyethylene heat fusion joined piping formed into vertical loops, for future connection to the extended range water-source heat pump units to provide an ARI 330 ground source closed-loop heat pump system.
10. Contractor to provide 20’-0” length of 6” steel casing as part of the base bid. Contractor to provide a unit price per linear foot for additional steel casing over the 20’-0” length.

1.2 REFERENCES

A. American Society for Testing and Materials

1. ASTM D1693 -Standard Test Method for Environmental Stress -Cracking of Ethylene Plastics.
2. ASTM D2321 -Standard Practice for Underground Installation of Thermoplastic for Sewers and Other Gravity-Flow Applications.
3. ASTM D2447- Standard Specification for Polyethylene (PE) Plastic Pipe Schedules 40 and 80 Based on Controlled Outside Diameter.
4. ASTM D2487 -Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D2513-OQ -Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
6. ASTM D2683 -Standard Specification for Socket -Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
7. ASTM D2837 -Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
8. ASTM D3035-95 -Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
9. ASTM D3261 -Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
10. ASTM D3350 -Standard Specification for Polyethylene Plastic Pipe and Fittings Material.

1.3 SUBMITTALS

A. Shop Drawings: Detailed 1/8-inch scale layout drawings of the closed-loop ground heat exchanger test bores showing all other existing underground utilities and relationship to new proposed bore field for coordination purposes.

B. Product Data: Submit manufacturer's product data and installation instructions for closed-loop ground heat exchanger piping, materials and products.

C. Manufacturer's Certificate: Pipe manufacturer shall supply a notarized document confirming compliance with the specifications of this Section.

D. Warranty: D/L must submit 2-year parts and labor warranty certificate covering all work performed.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: 1/8-inch scale record drawings and dimensions showing exact location of the test bores.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Connecticut EPA standards.

1.6 QUALIFICATIONS

A. Contractor: Firms regularly engaged in installation of closed-loop ground heat exchanger, and/or projects of similar scope of the type, material and size required; whose installations have been in satisfactory use in similar service for not less than five years. The contractor shall supply, with the bid, information on past jobs of similar scope. The following information must be supplied:

1. Name of project/customer.
2. Location of project.
3. Customer contact name (reference) with phone numbers.
4. Project designer/engineer.
5. Date of installation.
6. Number of wells.
7. Depth of wells.
8. Grout used.

B. Manufacturer: Company specializing in manufacturing of closed-loop ground heat exchanger products and tools of the types, material and size required; whose products have been in satisfactory use in similar service for not less than three years.

C. Installer: The Drilling Contractor shall be licensed in the State of Connecticut. Installers shall have at least two years of successful installation experience on projects with closed-loop ground heat exchanger work and/or projects of similar scope to that required for this project. Drilling Contractor must have experience at mixing and pumping pre-engineered cementitious grout materials with simultaneous placement of the pipe assembly and tremie tube from the bottom of the borehole to the top.

D. Fabricator must have completed a certification training program offered by the International Ground Source Heat Pump Association (IGSHPA) or approved manufacturers' certification program and shall have at least two years of successful installation experience. The only acceptable method of joining buried plastic pipe system is by heat fusion process. Each ground heat exchanger fabricator must have performed a fusion procedure under direct supervision of an IGSHPA Certified Heat Fusion Technician, an IGSHPA approved manufacturer's certification program or a DOT certified heat fusion technician. Each certified technician must attend a retraining school annually.

1.7 PRE-INSTALLATION CONFERENCE

A. Convene a minimum of one week prior to commencing Work of this Section.

B. Facility director shall be notified 72 hours prior to commencing with Work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Pipe, fittings and cementitious grouting material shall be stored on site in designated area that will not interfere with the operations of the Owner.

C. All pipe fittings are to be sealed to prevent debris, rodents and other foreign material from entering the piping system.

D. Palletized cementitious grouting materials are to be protected from the weather with a

protective cover.

E. Topsoil shall not be muddy or frozen.

1.9 FIELD MEASUREMENTS

A. It is the contractor's responsibility to call the Connecticut One Call System to determine if any existing underground utilities are located in the proposed test bore site. The Contractor will coordinate with the Owner or Owner's representative to locate any "Customer/Owner" underground utilities not covered by the Connecticut One Call System. If any "marked" or located underground utilities are damaged during the test bore operation, it will be the Contractor's responsibility to properly repair and return the utility to service.

B. Ensure the proper site protection is in place for the moving, setting up, operating and removal of the drill rig and other support vehicles or equipment, including protection of curbs and sidewalks, protection of existing trees, shrubs and lawn. Contractor will inform the Owner of any obstacles to the drilling operation before actions are taken to remove obstacles.

1.10 WARRANTY

A. Furnish minimum twenty-five-year warranty for piping.

PART 2 - PRODUCTS

2.1 CLOSED-LOOP GROUND HEAT EXCHANGER PIPING AND MATERIALS

A. Manufacturers: Polyethylene pipe shall be manufactured by NuMex Plastics or approved equal.

B. The only acceptable pipe and fittings material for the underground portion of the ground heat exchanger is high-density polyethylene. Specifications for the polyethylene heat exchanger are as follows:

1. General: All pipe and heat-fused material shall be manufactured from virgin polyethylene extrusion compound material in accordance with ASTM D-2513, Sections 4.1 and 4.2. Pipe shall be manufactured to outside diameters, wall thickness and respective tolerances as specified in ASTM D3035 or D2447.

2. Material:
   a. The material shall maintain a 1600 psi Hydrostatic Design Basis at 73.4 degrees F per ASTM D2837, and shall be listed in PPI TR4 as a PE4710 piping formulation. The material shall be a high-density extrusion compound having a minimum cell classification of PE445574C or higher as specified in ASTM D-3350 except this material shall exhibit zero failure (F0) when tested for a minimum of 192 hours under ASTM D-1693, condition C, as required in ASTM D3350.
   b. Fittings shall meet the requirements of ASTM D2683 (for socket fusion

fittings) or ASTM D3261 (for butt/saddle fusion fittings).

3. Dimensions:
   a. Pipe with a diameter through 1-1/4 inch (nominal) shall only be manufactured in accordance with ASTM D3035 with a dimension ratio (DR) of **9** and rated for **200 psi.**

4. Markings: Sufficient information shall be permanently marked on the length of the pipe. The appropriate ASTM pipe standard defines this information. All fittings shall also be similarly marked. Marked information shall include:
   a. Manufacturer's name.
   b. Nominal size.
   c. Pressure rating.
   d. Relevant ASTM standards.
   e. Cell classification number.
   f. Date of manufacture.

5. All piping used for the u-bend heat exchanger (pipe located in the borehole) will have factory hot-stamped lengths impressed on the side of the piping indicating the length of the heat exchanger to that point. The length shall read zero on the u-bend end and the actual heat exchanger total length on the other end.

2.2 PIPE JOINING METHODS

A. The only acceptable method for joining the buried pipe system is by the heat fusion process. Joining shall be of the socket, butt, saddle fusion, or electro fusion methods in accordance with the pipe manufacturer's procedures.

B. All fusion technicians shall be IGSHPA certified and properly trained and shall have executed quality fusion joints.

2.3 U-BEND/PIPE ASSEMBLY

A. The u-bend fitting shall be injection molded from PE4710 resin having a cell classification of PE445574C with a UV stabilizer of C. U-bends constructed by fusing two 90-degree bends together shall not be allowed. The u-bends shall be factory butt fused to continuous lengths of SDR 9 pipe, which has been extruded from resin identical to the u-bend. The u-bend/pipe assembly shall have pipe lengths long enough to reach to final grade from the bottom of the bore so that no field fusion welds are required below the header pit elevation. U-bend assemblies shall be factory pressure tested to 200 psi for a minimum of 5 minutes. On completion of testing, the pipe ends shall be immediately plugged to prevent foreign objects from entering the pipe.

2.4 THERMALLY ENHANCED CEMENTITIOUS GROUT

A. Grout Submittals: The successful bidder must provide submittals for approval by the Owner/Engineer on the grout and grout equipment 15 days prior to beginning work.

B. Grout Type: A Thermally enhanced cementitious grout shall be used to fill the annular space between the polyethylene pipe and the earth in all vertical well bores. The function of the grout is to facilitate the heat transfer between the u-loop and the surrounding earth formation while effectively sealing the borehole to prevent leakage

of surface contaminants into the aquifers and/or cross-contamination between aquifers. The grout shall have a minimum thermal conductivity of 1.0 BTU/hr-FT-°F. No other backfill material shall be accepted. The grout shall be a cementitious-based grout, principally composed of two parts of finely graded silica quartz sand and one-part Portland cement (Type I or Type II), and may contain a stabilizer admixture to enhance pumping properties and to control working time. The grout shall be pre-blended dry at the factory and delivered to the jobsite in sealed bags. No additives except water shall be added in the field. Thermally enhanced bentonite grout approved by CTDEP with a thermal conductivity greater than or equal to grout specified may be substituted.

C. Grout Mixing: Use a continuous paddle-mixer to mix the grout; batch mixing of grout shall not be allowed. The maximum water content of the grout shall not exceed 17% by dry weight of the grout mix. The grout shall be mixed with a Continuous Grout Mixer having an on-board roto-meter to precisely control the amount of water added. The grout shall contain a suitable admixture to achieve a slump of 6 to 11 inches at 17% water content, and shall exhibit an ASTM unconfined 28-day compressive strength greater than 3,000 psi. The mixed grout shall have a minimum specific gravity of 2.18 or density of 18.1 lbs/gallon.

D. Grout Placement: The boreholes shall be filled with grout throughout the entire depth of the borehole by pumping the grout through a tremie pipe extending from the grout pump at the surface to the bottom of the borehole using a coil-tubing unit. Although the tremie pipe will be withdrawn from the borehole as the grout is being pumped, the tremie pipe discharge opening must always be kept at a level below the top of the rising grout. A pressure gauge must be installed on the tremie line to indicate the location of the tremie pipe discharge.

1. In the event that a geological formation is encountered that prevents the grouting material from forming a solid seal, either a 3/8 inch (9.5 mm) or ¾ inch (19 mm) granular cementitious material may be used through that specific formation zone. Upon completion of that specific zone, the grout slurry shall continue to be used until reaching the surface of the vertical bore.
2. Grout type/manufacturer and percent solids shall be reported immediately to the engineer following bore completion.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which ground heat exchanger test bore system is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to owner/engineer's recommendations.

B. The Contractor shall provide temporary water tanks and temporary electrical power as may be required for completion of work.

C. A water supply to fill temporary storage tanks will not be made available by the Owner.

3.2 INSTALLATION

A. Loop Insertion and Grouting

1. Drill borehole in accordance with local, State or Federal requirements. Follow all requirements for borehole drilling as prescribed by the State of Connecticut. The contractor will be responsible for receiving permission in writing from the State of Connecticut prior to proceeding and shall be responsible for maintaining any drilling logs that may be required.
   a. The Contractor shall provide a written description (drill log) of the subsurface geology encountered during the drilling operation by a visual inspection of the drill cuttings. Information provided shall include: description of drill rig type and drill bit, drilling rates in feet per minute and types of formations. The Contractor shall provide this information for each change in geology for the entire depth of the bore hole and record the changes on the test bore report worksheet.

   b. The Contractor shall advise the Owner/Engineer immediately in writing of the presence and depths of water, cavernous formations or any adverse drilling condition requiring casing of the bore hole. The contractor shall stop drilling operations until a response is received.

2. The borehole shall be clean and of a maximum diameter listed on the test bore report worksheet to facilitate the installation of the u-bend assembly and a tremie pipe. Care shall be taken so as not to stretch, crush, cut, or kink the pipe during installation.

3. Immediately prior to being placed in the borehole, the u-bend assembly shall be flow tested to ensure that there are no kinks, bends or pinches. The test shall consist of forcing clean water into one end of the assembly, and visually inspecting the discharge. If damage or an obstruction exists, that loop shall not be used.

4. If the driller has drilled deeper than indicated on the test bore report worksheet, special precautions shall be taken so that the sealed pipe ends do not "drop" into the open borehole below graded surface. If a buoyant condition exists, the u-bend shall be staked and tied at the surface to prevent the assembly from "floating" out of the bore prior to the "setting" of the cementitious-based grout.

5. Prior to grouting, the u-bend assembly shall be pressurized with water to achieve a minimum internal pressure of 50 psi, and the ends shall be temporarily plugged to maintain this pressure. To prevent the collapse of the pipe resulting from the external force created by the grout's hydrostatic pressure, the pressure in the u-bend assembly shall be maintained until the grout has set.

6. Since some settling may occur after initial placement of the grout material, the installer shall monitor each test borehole and continue adding grout as required to bring the grout level up to the trench grade.

7. Borehole locations shall be individually surveyed after drilling is complete. The survey shall locate the test boreholes accurately from one or more known local survey benchmarks. The contractor shall furnish the Engineer/Owner a drawing indicating the test borehole locations

8. The contractor shall provide temporary security measures to protect the test bore and thermal conductivity testing equipment from vandalism until testing is complete. The Owner takes no responsibility for damage to or theft of Contractor's equipment while said equipment is on site.

9. Following completion of thermal conductivity testing, the Contractor shall flush and seal the heat exchanger piping. The loop shall be no higher than 1-foot above grade.

10. At the conclusion of drilling operations, the Contactor shall remove all drill cutting and trash from the site.

11. The Contractor shall provide temporary metallic enclosure left at or above grade for protecting the heat exchanger piping. A dimensioned "as-drilled" location plan has to be included in the final report.

3.3 ELAPSED TIME BEFORE TESTING

A. AIR ROTARY DRILLING: A minimum delay of five days between loop grouting and testing is required.

B. MUD ROTARY DRILLING: A minimum delay of three days between loop grouting and testing is required.

3.4 TESTING AND DOCUMENTATION

A. Testing is required on only one (1) borehole.

B. The Contractor shall insulate the supply and return piping between the bore hole piping and the thermal conductivity test and the exposed heat exchanger pipes above grade to ensure proper results.

C. Initial Ground Temperature shall be obtained by measuring and recording the loop temperature as the water returns from the test loop before start-up of the conductivity test.

D. Bore Thermal Conductivity: The Contractor shall utilize the in-situ testing equipment and methodology of an independent testing agency (in strict compliance with the recommendations of IGSHPA) to conduct a thermal conductivity of the completed geothermal test bore. The thermal conductivity of the grout shall be established using a constant hot water source, which will simulate a load by adding a controlled amount of heat to the bore piping water. The heat flux rate shall be 15 to 25 Watts/foot of bore hole depth as that is the expected peak load on the heat exchanger U-Bend. In order to avoid potential power quality problems or power interruptions, the use of a portable generator is required (10 KW minimum). The contractor shall trend the heat transfer of the test bore fluid over a period of 48 hours at 5-minute intervals and provide graphs showing temperature versus time and temperature versus natural log of time to provide the actual thermal conductivity value and thermal diffusivity values. The process used shall be approved by the engineer prior to commencement of testing.

1. Equipment required for the test are the following:

a. Ground heat exchanger in place (grouted)
b. Constant hot water source
c. Data acquisition system to measure and record
   1) Temperature in & temperature out
   2) Flow rate
   3) Volts and Amps or Watts

2. The test procedure to do the in-situ tests is outlined below.
   a. Locate in-situ trailer near well bore to minimize above ground pipe exposure.
   b. Flush loop to remove all debris, cap and set overnight, if possible, to obtain the most accurate ground temperature.
   c. Connect ground loop to trailer.
   d. Insulate loop leads to trailer to reduce temperature bias.
   e. Finish filling loop and in-situ system with water.
   f. Start data acquisition system, name the data file, adjust data recording rate to desired value, show the desired variables on screen in graph and digital form, begin recording data from the initial circulation.
   g. Turn on pump and circulate the water for 15 to 30 minutes to obtain an average ground temperature. Circulate water at a high rate to flush the system, to eliminate air in the system. Adjust valve to maintain 10 to 15 psi pressure on the system. Minimize break-out if there is some air left in the lines by having a higher system pressure.
   h. Adjust the flow rate at the test rate depending on the loop size. Make certain that the flow is turbulent, i.e. 6.0 gpm for 1-1/4" pipe will provide high Reynolds Number and stable flow.
   i. Turn on the heaters to the desired wattage value.
   j. Monitor screen for any anomalies in the data and periodically check for leaks in the pipe connections. Bleed air from the system as necessary and recharge from the water reservoir if necessary. Minimize any addition of water to the system after the test has begun.
   k. When the temperature versus time curve begins to flatten out after a period of eighteen to twenty hours shut the heaters off and allow the temperature to decay for a period of time. If a qualitative heat dissipation rate is desired, then run the decay period until the loop temperature approaches the original ground temperature.
   l. Shut the pump off and then log off the data acquisition system, making sure the file is closed and the data is saved. Transfer the data from the hard drive to a floppy diskette and provide a copy to engineer.
   m. Remove insulation from the lines and disconnect the loop lines from the trailer and cap.

E. Grout Permeability: The grout mixture shall exhibit a nominal bulk grout permeability of 10^{-8} cm/second by using the "Falling-Head Method" (defined in the United States Army Corp of Engineers' Civil Engineering Manual No. EM 1110-2-1906, "Laboratory Soils Testing") as recommended by the U.S. Environmental Protection Agency. The average grout/pipe system nominal permeability shall be determined by using an experimental set-up as outlined in ASTM D 5084-90, and shall have a maximum nominal permeability rate of 1x 10^{-5} cm/sec.

F. The Contractor shall document in writing on the test bore report worksheet and final

report, formation thermal conductivity and the formation thermal diffusivity.

G. Final Report shall be organized in a single document including the test bore report worksheets and three copies shall be submitted to the Project Engineer.

3.5 FIELD QUALITY CONTROL

A. Before backfilling the test bores, they shall be flushed and purged of air and flow tested to ensure all portions of the closed-loop ground heat exchanger test bores are properly flowing. A portable temporary purging unit shall be utilized and shall consist of the following:
   1. Purge pump -high volume and high head.
   2. Open reservoir.
   3. Filter assembly.
   4. Connecting piping.
   5. Connecting hoses.

B. Using the purging unit described above, flush and purge each test bore free of air, dirt and debris. A minimum velocity of 2 feet second in each piping section must be maintained for a minimum of fifteen minutes to remove all air. A change of more than 1 inch in the level of fluid in the purge pump tank during pressurization indicates air still trapped in the system. After the flushing and purging operation with the supply and return lines, the pipe shall be capped and sealed at a point two feet below grade with an identifying marker at least one-foot above grade indicating the depth of the pipes.

3.6 FINISH GRADE PREPARATION

A. Perform all finish grading necessary to bring the site back to its original elevation. Finish grading shall consist of using screened topsoil brought to the site by the test bore contractor.

B. After completion and approval of finish grading, remove any excess topsoil from site.

END OF SECTION