CORAL SPRINGS IMPROVEMENT DISTRICT
WASTEWATER TREATMENT PLANT
CLASS I INJECTION WELL
TECHNICAL SPECIFICATIONS
CITY OF CORAL SPRINGS
BROWARD COUNTY, FLORIDA

GERAGHTY & MILLER, INC.
Ground-Water Consultants

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TECHNICAL SPECIFICATIONS

PART 1 - GENERAL

1.01 SCOPE: The work described in these Specifications and accompanying plans is for the construction and testing of one Class I injection well and one dual-completion monitor well, for the Coral Springs Improvement District Wastewater Treatment Plant in the City of Coral Springs, Florida. The new injection well will go "on line" as soon as it is completed and approved by the FDER (Florida Department of Environmental Regulation).

The wells shall be drilled into aquifers containing saline water under pressure. The shallow aquifer contains potable water at the well site; it is required that the saltier water from the deep aquifers be handled so that there shall be no spills upon the ground. Requirements are set forth in these specifications regarding the handling of salty water, drilling fluids, and cuttings. Requirements also are set forth for controlling the flow of the well during construction and providing a closed, steel-lined circulation system for all drilling operations. A Drilling pad will be required to enclose both injection and monitor wells and shall be constructed to retain spillage of water from drilling and related operations. Water-table monitor wells will be installed around the pad. Due precautions should be taken to prevent spills; any spillage of fluids shall be returned to the closed-circulation systems. In the event of any unusual occurrences during construction activities (e.g. on-site spills, artesian flows, large volumes of circulation losses, etc.), the Contractor will inform the Consultant so the FDER and other applicable agencies may be informed immediately.

At the completion of drilling, the Contractor shall remove the closed-circulation system and its appurtenances which are not part of the completed well and leave the site in good condition, acceptable to the Owner. After demobilization is complete, the drilling pad should be

clean and free of debris, but it is not intended to be in "like new" condition at that time.

1.02 OUTLINE SPECIFICATIONS OF INJECTION AND MONITOR WELLS:

A. Contractor shall submit a detailed construction schedule prior to the commencement of any site work. The construction schedule shall include a proposed spud date.

B. Site Preparation and Mobilization

1. Site clearing, excavation, and placing structural fill as necessary

2. Set pit pipe

3. Construction of pad and water-table monitor wells

4. Equipment set-up

C. Drilling and Testing - Injection Well (IW-2)

1. Drill nominal 60-inch-diameter hole to approximately 170 feet below land surface. Conduct inclination surveys at 60-foot intervals.

2. Set and cement in place 52-inch-diameter, 0.375-inch wall thickness steel casing to approximately 170 feet below land surface. Conduct temperature log after each stage of cementing.

3. Drill a nominal 52-inch-diameter hole from 170 feet below land surface to approximately 1000 feet below land surface. Conduct inclination surveys at 60-foot intervals and run caliper log upon completion.

4. Set and cement in place a 44-inch-diameter, 0.375-inch wall-thickness steel surface casing to approximately 1000 feet below land surface. Conduct temperature log after each stage of cementing.

5. Drill 12-1/4-inch-diameter pilot hole from approximately 1000 feet to approximately 2300 feet below land surface, collecting cores as directed by the Consultant. Conduct inclination surveys at 60-foot intervals.

6. Conduct geophysical logging as directed by the Consultant.

7. Conduct straddle-packer tests as directed by the Consultant.

Note: Until the base of the USDW has been determined in the injection well and approval has been received from the Florida Department of Environmental Regulation, monitor-well drilling below 1100 feet will not be permitted.

8. Ream nominal 44-inch-diameter hole from the bottom of the 44-inch-diameter casing to approximately 2300 feet below land surface. Conduct inclination surveys at 60-foot intervals during reaming and run caliper log upon completion.

9. Set and cement in place 34-inch-diameter, 0.375-inch wall-thickness steel casing to approximately 2300 feet below land

surface. Conduct temperature log after each stage of cementing.

10. Drill 12-1/4-inch-diameter pilot hole from approximately 2300 feet to approximately 3000 feet below land surface. Conduct inclination surveys at 60-foot intervals. Collect cores during pilot-hole drilling as directed by the Consultant.

11. Conduct geophysical logging as directed by the Consultant

12. Conduct straddle-packer tests as directed by the Consultant.

13. Ream nominal 34-inch-diameter hole from approximately 2300 feet to approximately 3000 feet below land surface. Conduct inclination surveys at 60-foot intervals during reaming and run caliper log upon completion.

14. Set 24-inch-diameter, 0.500-inch wall-thickness seamless steel casing to approximately 3000 feet below land surface (length dependent upon field conditions), and cement in place from approximately 3000 feet below land surface up to a depth of approximately 100 feet. Conduct temperature log after each stage of cementing.

15. Conduct cement-bond log on final casing.

16. Conduct pressure test on final casing.

17. Cement last 100 feet of 24-inch-diameter casing to surface.

18. Drill nominal 24-inch-diameter borehole from bottom of final casing to approximately 3500 feet below land surface.

19. Collect water samples from injection zone.

20. Conduct television survey from surface to bottom of open borehole.

21. Conduct geophysical logging in the open hole as directed by the Consultant.

22. Conduct controlled injection test.

23. Conduct temperature log.

24. Conduct radioactive tracer survey.

D. Drilling and Testing - Dual-Completion Monitor Well

1. Install pit pipe.

2. Drill nominal 36-inch-diameter borehole to approximately 170 feet below land surface. Conduct inclination surveys at 60 foot intervals.

3. Set and cement in place 24-inch-diameter, 0.375-inch wall-thickness steel conductor casing to approximately 170 feet below land surface. Conduct temperature log after each stage of cementing.

4. Drill nominal 24-inch-diameter hole from 170 feet below land surface to approximately 1100 feet below land surface. Conduct inclination surveys at 60 foot intervals.

5. Set and cement in place 16-inch-diameter, 0.375-inch wall-thickness steel casing to approximately 1100 feet below land surface. Conduct temperature log after each stage of cementing.

Note: Until the base of the USDW has been determined in the injection well and approval has been received from the Florida Department of Environmental Regulation, monitor-well drilling below 1100 feet will not be permitted.

6. Conduct cement-bond log on 16-inch-diameter casing.

7. Conduct pressure test on 16-inch-diameter casing.

8. Drill nominal 16-inch-diameter borehole from 1100 feet below land surface to approximately 1500 feet below land surface. Conduct inclination surveys at 60 foot intervals.

9. Conduct geophysical logs:
   a) caliper log
   b) gamma-ray log

10. Set 1500 feet of 6-5/8-inch-diameter, 0.562-inch-wall-thickness steel monitor casing and cement in place to 1200 feet below land surface.

11. Conduct cement-bond logs in the 6-5/8-inch-diameter casing.

12. Conduct a pressure test on 6-5/8-inch-diameter casing.

13. Drill nominal 6-inch-diameter borehole to 1600 feet below land surface.

14. Conduct geophysical logs:
    a) caliper log
    b) gamma-ray log

15. After ensuring that both monitor zones are open to the formation and producing water, they are to be disinfected.

NOTE: The Contractor must keep in mind that this is a test-injection well program and that the depths are approximate. Also, the Contractor should be aware that the sequence of testing such as coring, geophysical logging, and injection testing described in this outline may be changed in order of occurrence, or deleted, and additional testing may be required.

1.03 LOCAL GEOLOGIC CONDITIONS: It is anticipated that the boreholes will encounter beds of limestone, sandstone, clay and varying amounts of unconsolidated shell and sand to a depth of approximately 170 feet below land surface. Below this depth, clay and marl with variable amounts of sand, limestone and shell are present to a depth of approximately 1100 feet. Permeable zones contain brackish water under pressure and flowing conditions will be present. It is intended that the 44-inch-diameter surface casing should case off of the squeezing clays of the Hawthorn Formation. Below approximately 1000 feet, interbedded layers of limestone and dolomite may be found and cavities may be encountered.

Information regarding subsurface conditions is intended to assist the Contractor in preparing his bid. The Owner or Consultant does not guarantee its accuracy or that it is necessarily indicative of conditions to be encountered in drilling the well. The Contractor shall satisfy himself regarding all local conditions affecting his work by personal investigation and neither the information on local geology, nor that derived from maps or plans nor from the Owner or his agents or employees

shall act to relieve the Contractor of any responsibility hereunder or from fulfilling any and all of the terms and requirements of the Contract and Technical Specifications.

1.04 SITE PREPARATION: Within the limits of the staging area as shown on the Contract Drawings, the Contractor shall clear and grub trees (as directed), stumps, down timber, brush, and other objects standing on or protruding from the ground. All roots shall be grubbed and removed to a minimum of 18 inches below the surface of the ground. Holes caused by grubbing operations shall be filled to the elevations shown on the drawings. All material and debris resulting from clearing and grubbing operations shall be burned or otherwise disposed of in a manner approved by the Consultant. It shall be the responsibility of the Contractor to obtain any permits that are required for these procedures.

The Contractor will be required to construct and maintain an all-weather temporary access road. The Contractor shall include the cost of this road in the lump-sum pay item for mobilization and demobilization.

All depth references for drilling and logging operations will be made to a surveyed-measurement point at each well that will be referenced to NGVD (National Geodetic Vertical Datum) of 1929. The measurement points (for both injection and monitoring wells) shall be professionally surveyed and certified prior to the onset of drilling activities.

The cost for all site preparation shall be included in the lump-sum pay item for Mobilization and Demobilization, as shown in the Bid Proposal.

1.05 DRILLING PAD: At the site of the injection well and dual-zone monitor well, the Contractor shall build a suitable concrete pad as work floor for each drilling rig and to retain all drilling fluids in the vertical and horizontal directions. The pad shall have approximate

dimensions of 120 feet by 100 feet and be formed with 2 feet of curbing to contain spills of water and drilling fluids including a method of returning them to the required closed-circulation system. The Contractor shall submit complete construction details and design calculations including load requirements certified by a professional engineer and receive approval, before beginning construction.

The cost of the drilling pad shall be included in the lump-sum pay item for Mobilization and Demobilization of each well.

1.06 WATER SUPPLY: It shall be the responsibility of the Contractor to provide all pumping and piping necessary to perform the injection test. The responsibility shall be upon the Contractor to provide and maintain, at his own expense, an adequate supply of water for domestic consumption and construction needs at the construction site. Any necessary permits required to obtain a water supply shall be obtained by the Contractor at his expense. The cost for all water supply shall be included in the lump-sum price for the injection well.

1.07 ELECTRICITY: All electric current required by the Contractor shall be furnished at his own expense. All temporary lines will be furnished, installed, connected, and maintained by the Contractor at his cost in a workmanlike manner satisfactory to the Owner and Consultant and shall be removed by the Contractor in like manner at his expense at the completion of the work.

1.08 WATER-TABLE MONITOR WELLS: The Contractor shall install four small-diameter monitor wells in the area around the injection well drilling pad. The purpose of these wells will be to monitor the water-table aquifer for increases in chlorides due to spills of salty water during drilling operations and (possibly) to pump out the shallow aquifer to reduce any contaminant level to normal if a spill occurs. The

Contractor shall be financially responsible for the cost of all cleanup activities attributable to his drilling operations at the site, including installation and pumping of additional monitor wells if necessary.

These wells shall be cased with 2-inch-diameter Schedule 80 PVC pipe to a depth of approximately 15 feet, or tapping the water table. The bottom five feet of PVC pipe shall be perforated as shown on the Contract Drawings. The size of the slots shall be compatible with the gravel to be used, and shall be approved by the Consultant before installation.

PVC casings shall be lowered into a predrilled hole and cemented in place, in accordance with the detail shown on the drawings. Each well casing shall be provided with an access box at the surface as called for on the Contract Drawings.

After completion, each monitor well shall be pumped until the water is clear, and a one-quart sample shall be collected, properly labeled, and transmitted to the Consultant. No work other than pad construction may be performed until the monitor wells have been completed and the water samples are received by the Consultant, allowing the Consultant to analyze each water sample for chlorides (mg/L), conductivity (umhos), temperature (°F), and water level (msl) and deliver the results to the regulatory agencies prior to commencement of drilling activities. Cost of the monitor wells for the entire job will be included in the lump-sum price for the injection well.

1.09 DAILY LOG: The Contractor shall maintain a detailed daily log of his operations on each rig during the construction of the injection well and the deep monitor well. The logs shall be on IADC Forms and shall give a brief description of all formations encountered, footage and size of hole drilled, depth and sizes of all casings installed in the wells, fluid losses, complete record of drilling fluids added, water-level

changes and the depths at which they occurred, cementing operations, repair time, and other such pertinent data as may be required by the Consultant. All depths shall be referenced to previously-surveyed measuring points. Two copies of each daily log shall be submitted to the Consultant on a daily basis.

1.10 RECORD DRAWING: Upon completion of the work, the Contractor shall supply the Consultant with a reproducible record drawing of each well. The drawings shall show hole and casing diameters and depths and other information that may be required by the Consultant and regulatory agencies, including well-head details. All depth references will be made to the surveyed measuring points.

1.11 REMEDIAL WORK: If remedial work proves to be necessary to make a well acceptable and come within the regulations and/or Specifications because of accident, loss of tools, defective material, or for any other cause, the Contractor shall propose a method of correcting the problem, in writing. Suggested methods shall be reviewed and approved by the Consultant before work proceeds. Such work shall be performed at no additional cost to the Owner and it shall not extend the length of the Contract. The Contractor is notified that all specifications shall be met, including hole straightness and setting of casings to the points designated by the Consultant.

1.12 ABANDONMENT OF WELL BY CONTRACTOR: Any hole in which the Contractor voluntarily stops work, and/or fails to complete in a satisfactory manner, in accordance with the regulations and/or Specifications and approved changes, shall be considered as abandoned by him. If the Owner declares the hole abandoned by the Contractor, then no payment will be made for the abandoned hole. All abandoned holes shall be properly plugged and sealed by the Contractor at his own cost in accordance with Federal, state, and local regulations. All salvageable

material furnished by the Contractor may be removed and remain his property. The Contractor shall submit his plan of action for abandonment and plugging. Casings may be removed only with the permission and approval of the Consultant.

1.13 FIELD OFFICE: The Contractor shall provide a suitable, weatherproof field office for use by the Consultant and his representatives. It shall be located in a position which, in the opinion of the Consultant, is adequate for supervision and inspection of the work, including at least one full-size window facing the injection-well drilling rig. The Contractor shall furnish an entire field-office trailer consisting of at least three rooms. The trailer shall be supplied with the following: water, sanitary facilities, lighting, heating, air-conditioning, at least one telephone, a private telephone line, outdoor colored light indicating incoming calls, local telephone service, $200 per month in long-distance telephone service, a photocopying machine, two desks (at least one unattached), chairs, a four drawer legal-sized filing cabinet, and janitor service. The cost of this field office and maintenance thereof shall be included in the lump-sum price of the wells. The office shall be fully functional, including utility hook-ups before any drilling may commence.

1.14 GUARANTEE: The Contractor guarantees that the work and service to be performed under the Contract and all workmanship, materials, and equipment performed, furnished, used, or installed in the work shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Contract Documents; that the strength of all parts of all manufactured equipment shall be adequate and as specified; and that performance test requirements of the Contract Documents shall be fulfilled. The Contractor shall repair, correct, or replace all damage to the work resulting from failures covered by the guarantee. The Contractor guarantees that all the work performed under the Contract

Documents shall be in strict accordance with the terms of the injection-well construction permit issued to Coral Springs Improvement District by the Department of Environmental Regulation. The guarantee shall remain in effect for one year from the date of final acceptance by the Owner.

1.15 STANDBY TIME: The Consultant may order the Contractor to stop his operations so that extra work not included in the Specifications, such as testing and additional data collected, can be performed. The Consultant will advise the Contractor when he proposes to do this and will schedule his request so it causes a minimum of delay. The Contractor will be reimbursed at hourly rates which will be listed in the Bid Proposal Form. All extra work must be approved by the Consultant in writing in advance.

The Contractor shall include the cost of 120 hours of standby time in the lump-sum price of the injection well, and 60 hours of standby time in the lump-sum price of the monitor well.

PART 2 - OPERATING REQUIREMENTS

2.01 GENERAL: It is essential that salty or brackish water produced from any source during the drilling operations is prevented from contaminating the shallow aquifer which contains fresh water. Any water produced during the drilling shall be confined to the circulation system and drilling pad.

The drilling will be accomplished using a circulation system designed and constructed so that under no conditions shall there be an overflow. The Contractor shall be required to take all necessary steps to prevent accidental spillages from occurring. Tanks for the circulation system shall be steel and leakproof. The entire circulation system for each well shall be within the curbed drilling pad. The Contractor shall submit plans for the circulation system to the Consultant for approval.

In no case will a system capable of storing less than 2000 cubic feet (15,000 gallons) of fluid and cuttings be considered. Written approval from the Consultant will be required before the Contractor is allowed to proceed.

Flowing conditions in the injection well shall be kept under control at all times. Drilling mud and/or salt may be used as weight material to keep the drilling fluid at a density necessary to suppress the flow. Naturally-occurring brines such as those produced from oil wells shall not be used as drilling fluid or weight material. Any salt for use in these operations must be stored on the drilling pad and an approved waterproof cover provided and used. As flowing conditions are anticipated during the drilling of the injection well and the dual-zone monitor well, the Contractor shall furnish and install a suitable blow-out preventer for each well. The blow-out preventer to be provided will be a commercially-available, hydraulically-operated, single annular preventer or approved equivalent. Manufacturers specifications pertaining to the type of preventer proposed for use by the drilling contractor shall be approved by the Consultant before drilling of each well commences and shall be used during drilling operations below the 44-inch-diameter casing in the injection well and below the 16-inch-diameter casing in the monitor well to ensure Contractor's capability to control potential flowing conditions prior to penetrating the Floridan Aquifer. When no work is being done on a well, a preventer shall be put in place. Each crew from each well will also test the operation of the blow-out preventer on the well once per week in the presence of the Consultant to demonstrate proficiency in its operation.

Drill cuttings and drilling fluid shall be removed from each drilling site and disposed of at an approved location. The Contractor shall furnish to the Consultant and Owner, prior to beginning construction, the name and location of his disposal site along with documentation that the

site has been approved by the appropriate regulatory agencies. The fluid displaced from the borehole during cementing operations shall be considered excess drilling fluid and shall be disposed of in an approved manner. All costs of disposal shall be included in the lump-sum price of each well.

When all casings are being set and cemented in place, it is the Contractor's responsibility to insure that these operations are conducted in such a manner that the casing collapse and burst strengths (with safety factor) are not exceeded and the casings are not caused to fail. A temperature log shall be conducted after each stage of cementing on all casings. The log shall be run at the appropriate time interval after completion of pumping, as per cementing company recommendations.

2.02 EQUIPMENT REQUIREMENTS: Equipment in first-class working order shall be provided. The Contractor shall use his own drilling equipment having the minimum capabilities necessary to do the described work. No unnecessary delays or work stoppages will be tolerated because of equipment failure. They will not be considered a valid reason for extending the length of the Contract. The Contractor shall be held responsible and payment may be withheld for damages to a well due to any cause of negligence, faulty operation, or equipment failure.

The Contractor shall provide and operate equipment capable of handling the largest load that will be placed upon the rigs' drilling and supporting equipment. If conditions develop in the field that prove the rigs and supporting equipment that had been supplied by the Contractor are incapable of completing a well, the Contractor will be required to provide a larger rig with the necessary capacity at his own cost.

The drilling rigs employed in drilling the injection well and the dual-zone monitor well shall each use a geolograph capable of recording

drilling time and weight of the tool string. This information shall be recorded continuously by the Contractor and records or copies furnished to the Consultant daily. The chart recorder on each rig shall be fully functional before well drilling commences and shall continue to operate and record during all drilling, reaming, cementing, and runs into the well with drill bits or casing.

2.03 DRILLING METHODS: The conventional mud-rotary method will be employed for all drilling of each well through the setting of the surface casings, approximately 1000 feet below land surface. All drilling below this point shall be done by the reverse-circulation rotary method, and there shall be no discharge of drilling fluids and/or formation fluids. During all reaming operations, the Contractor must incorporate the use of a lead bit or stinger and staged drilling assembly to facilitate the tracking of the pilot holes. A closed-circulation system shall be used for the drilling fluids, employing suitable devices such as screens, shale shakers, and settling tanks to remove cuttings. There are no means of handling or disposing of drilling fluids on the site.

2.04 CONDITIONS AND HAZARDS: The Contractor should be advised and be aware of difficult drilling conditions and problems he may encounter during the drilling, construction, and testing of the wells. Typical examples he may have to cope with include, but are not limited to, lost circulation, cavities and fractured zones in the Floridan Aquifer; and potential squeezing zones and sand intervals within the Hawthorn Clays, along with attendant caving problems. A priority requirement of these Specifications is the drilling of straight holes and setting all casings to specified depths. Hole straightness, which will permit casings to be set at specified depths and facilitate achievement of proper cement seals, shall not be sacrificed for drilling speed. These and other pertinent factors shall be taken into consideration by the Contractor in planning and executing the work.

The goal of this program is the successful completion of the two wells described in these Contract Documents. In the event of any problems or difficulty which, in the Consultant's opinion, may jeopardize the successful completion of a well in accordance with construction permit, current regulations, or Contract Documents and approved changes, it is the Contractor's responsibility to perform work required to successfully remedy any problem and perform such surveys and testing as necessary to demonstrate the problem has been solved and that the well is in compliance with the Contract Documents. The Contractor shall bear all costs of testing, surveys and work deemed necessary by the Consultant, Owner and or the appropriate regulatory agencies to confirm that the problem has been resolved or corrected and that the construction is in compliance with the Technical Specifications and any approved changes, and all appropriate regulations. In the event a problem occurs, the Contractor will be notified in writing by the Consultant. The Contractor will submit to the Consultant his plan of action to identify and/or solve the problem and the Consultant will review the plan of action. In the event the problem is considered serious enough to jeopardize successful completion of the well, in accordance with the drawings and Specifications, the Consultant may request technical concurrence from the regulatory and scientific agencies in accordance with the construction permits. No monies will be paid for the time spent by the Contractor during the entire period of review and approval. The Consultant will notify the Contractor that:

a. Plan of action is acceptable;

b. Plan of action is acceptable with Consultant's suggested modifications;

c. Plan of action is not acceptable.

Under (a), the Contractor shall proceed with the plan of action. The Contractor shall bear all costs of surveys associated with detecting the problem, implementing his plan of action, and tests to confirm the plan of action was carried to successful completion and to obtain approval of the Consultant.

Under (b), the Contractor shall re-submit his plan of action with necessary backup and justification for a revised plan of action. The Consultant shall notify the Contractor that the revised plan of action is (a) acceptable or (c) not acceptable.

If the plan of action is not acceptable to the Consultant and the Contractor elects to pursue the unacceptable plan of action, then two options exist for the Consultant.

OPTION 1: If the unacceptable plan of action jeopardizes the well construction, completion, or operation in the Consultant's opinion, and the Contractor elects to implement the unacceptable plan of action, the Consultant may declare the well abandoned by the Contractor. A determination shall be made by the Consultant whether to abandon the well or attempt to correct the existing well. The Contractor shall bear all costs of rig time, etc., from original verbal notification and all cost of either abandoning the well or taking steps to complete a successful well.

OPTION 2: If the unacceptable plan of action does not jeopardize the well construction, completion, or operation in the Consultant's opinion, the Contractor may, at his own risk, proceed with his plan of action. The Contractor shall bear all costs associated with his plan of action including testing,

All holes for the injection well and the monitor well shall be round, straight, and true to line. No dog-legs or departures from a straight line shall be permitted which will interfere or prevent casings from being set to their required depths. The maximum allowable inclination from the vertical at any portion of a hole or survey point shall be one (1) degree; the maximum allowable difference between any two successive survey points shall be 0.5 degree (30 minutes). Any deviation greater than one (1) degree or difference greater than 0.5 degree (30 minutes) between two surveys shall be corrected by the Contractor at his own expense.

Should the inclination surveys or the results of the drilling of any of the pilot and/or reamed holes indicate that conditions have been or are being created that would prevent the casings from being set to their prescribed depths and properly cemented or prevent the well from being properly and successfully completed, the Contractor shall take steps to straighten the hole or correct the drift or deviation at his own expense so that casing can be installed to the prescribed depths and allow for proper cementing.

Unless he can demonstrate competence in the use of the surveying equipment, the Contractor shall utilize the services of a qualified technician employed by the survey equipment manufacturer to instruct in the performance of the survey and in the maintenance of the equipment. The technician shall remain on the job until the drilling crews are proficient in the use of the equipment, as judged by the Consultant. The equipment shall be kept on the job at all times. The costs for surveys described in this section, including those required to diagnose a problem and demonstrate the effectiveness of any remedial work, or demonstrate that no problem has occurred shall be the responsibility of the Contractor.

remedies, surveys, and programs to solve the problem. When completed, the Contractor shall notify the Consultant that the problem has been solved. The Contractor shall bear all costs of testing, surveys, and work deemed necessary by the Consultant to confirm that the problem has been solved. If the Consultant is satisfied that the problem has been solved by the Contractor, then the Contractor shall proceed with the construction of the well, bearing all costs of the plan of action and the Consultant's program to confirm successful completion.

2.05 STRAIGHT HOLE REQUIREMENTS: Priority requirements of these Specifications is the drilling of straight holes, positive documentable proof that all pilot holes have been wiped out or covered by the reaming operations, and setting the casing to the required depths. The Contractor will be required to perform the schedule of surveys as specified in this section. To insure that the casing and tubing can be set to the required depths and properly cemented, all of the holes shall be drilled so that they are straight. Hole straightness, which will permit setting of the casing to the required depths and providing sufficient annular space for proper cementing, and providing positive documentable assurance that the pilot hole has been wiped out by the reaming operations, shall not be sacrificed for drilling speed or any other reason.

During all drilling in the injection well, the Contractor shall perform inclination surveys at intervals of 60 feet as the drilling and reaming progresses. These surveys shall be performed using a wire-line instrument equipped with an inclination unit having a range of from 0 to 1.5 degrees of inclination from the vertical and the survey record shall be capable of being read to the nearest 10 minute of angle.

The following are the minimum survey requirements:

Injection Well

1. Nominal 60-inch-diameter hole from land surface to 170 feet

   A. Inclination survey at 60-foot intervals during drilling

2. Nominal 52-inch-diameter hole from 170 feet to 1000 feet

   A. Inclination survey at 60-foot intervals during drilling

3. 12-1/4-inch-diameter pilot hole from 1000 feet to 2300 feet

   A. Inclination survey at 60-foot intervals during drilling

4. Nominal 44-inch-diameter hole from 1000 feet to 2300 feet

   A. Inclination surveys at 60-foot intervals during reaming.

5. 12-1/4-inch-diameter pilot hole from 2300 feet to 3000 feet

   A. Inclination surveys at 60-foot intervals during drilling

6. Nominal 34-inch-diameter hole from 2300 feet to 3000 feet

   A. Inclination surveys at 60-foot intervals during reaming.

Monitor Well

1. Nominal 36-inch-diameter hole from land surface to 170 feet.

A. Inclination surveys at 60-foot intervals during drilling.

2. Nominal 24-inch-diameter hole from 170 feet to 1100 feet.

A. Inclination surveys at 60-foot intervals during drilling.

3. Nominal 16-inch-diameter hole from 1100 feet to 1500 feet.

A. Inclination surveys at 60-foot intervals during drilling.

During the drilling operations, the Contractor shall submit the record of each inclination survey to the Consultant on the site. The Consultant shall analyze the data and shall notify the Contractor of the survey results within three hours. In the event other duties delay the Consultant from interpreting the data, the Contractor should have a qualified crew member proficient in the interpretation of the raw data. The Contractor may continue drilling during this three-hour period. In the event the survey data indicates hole drift or departure in excess of the specified limits, the Contractor shall take the following steps:

1. Run additional surveys to demonstrate that the hole is within the specified limits.

2. If instrument is indicating that the hole is not meeting the specified limits, then the Contractor shall re-ream the hole and repeat the survey. This process will be repeated or other actions taken by the Contractor to meet the specified limits.

3. If the Contractor feels that the instrument is in error, it will be his responsibility to obtain a new instrument to confirm the survey data. If a new instrument requires

24 hours or less to be shipped to the site, the Contractor may, with the Consultant's approval, continue the drilling operation. However, this does not relieve the Contractor of his responsibility of maintaining the hole within the specified limits. The Contractor shall bear all of the costs of repeated surveys, re-reaming the hole, or other steps required to meet the specified limits. No standby time will be paid for time spent during these procedures.

2.06 FORMATION SAMPLES: Two sets of formation samples shall be collected from each well at intervals of 10 feet and at every formation change and drilling break. The samples shall be preserved in cloth sample sacks to be furnished by the Contractor. The sample containers shall be plainly marked with the well identification and shall show the depth below the ground surface from which they were taken. The Contractor shall collect the samples, deliver them to the Consultant's field office, and provide facilities for storage while the samples remain on site, in a manner acceptable to the Consultant. Upon completion of drilling and upon authorization by the Consultant, the Contractor shall forward one set of samples to the Florida Bureau of Geology in Tallahassee along with any appropriate well completion reports. If sample storage becomes a problem on the site, samples may be forwarded to the Florida Bureau of Geology as work progresses following accepted procedures and with the approval of the Consultant.

2.07 CEMENTING PROCEDURES: Cementing will be completed by an approved company, expert in well cementing such as Halliburton Services unless the Contractor can demonstrate that he has the equipment and expertise to perform these operations. Cementing will be accomplished in stages by means of a collarless tremie pipe. After each stage of cementing and before the next stage, the Contractor shall conduct a temperature log and

tag the top of the cement with a collarless tremie pipe. This method of cementing applies to all cementing procedures in all casings.

Cementing procedures shall be continuous for each stage after cementing begins. If loss of circulation or no return of cement is encountered, the Consultant shall be notified immediately of what remedial measures are underway to re-establish the circulation and complete the cementing program according to well design and specifications.

During the cementing of all strings of casing the Contractor will be responsible for having a sample from each cement stage collected (both dry and mixed). Mixed-cement samples shall include at least three, 2-inch cubes of each blend from each cement stage. The cost of the collection of these samples should be included in the lump-sum price; they should be submitted to the Consultant as soon as they are available. The top 100 feet of annulus in the injection well, between the 34-inch-diameter casing and the 24-inch-diameter injection casing shall not be cemented until after the completion of the cement bond log. If good bonding between casing, cement, and formation is not obtained, remedial work shall be done to the satisfaction of the Consultant. In addition, the Consultant may require temperature or cement bond logs to substantiate the effectiveness of any remedial grout work done. These operations shall be performed at the Contractor's expense.

During all stages of cementing, the Contractor will use a pre-flush or spacer. The Contractor shall submit the technical specifications of the pre-flush to the Consultant for approval before cementing begins. In addition, written cementing procedures shall be submitted to the Consultant prior to commencement of cementing operations for each stage of each casing string.

When the casings are being set and cemented in place, it is the Contractor's responsibility to insure that these operations are conducted in such a manner that the casing collapse and burst strengths (with safety factor) are not exceeded and the casings are not caused to fail. Cement shall be pumped or placed so that excessive pressures will not result and affect the bond.

PART 3 - GEOPHYSICAL LOGGING AND TESTING

3.01 GEOPHYSICAL LOGGING: The Contractor shall employ the services of an approved company to obtain geophysical logs of the injection well and the monitor well. The Contractor shall prepare and condition the hole to insure it is open and can be logged with a minimum of delay. The following logs shall be run in the injection well at the stages listed and their cost shall be included. No payment will be made for logs which are unusable or inaccurate due to poor performance of the logging equipment.

Following the completion of each of the stages of the 12-1/4-inch-diameter pilot hole below the 44-inch-diameter casing in the injection well to a total depth of approximately 3000 feet below land surface, and in the nominal 24-inch-diameter open hole below the final casing, the following geophysical logs will be performed:

Dual-Induction
Borehole-compensated sonic - VDL
X-Y Caliper
Gamma ray
Temperature

Following the completion of cementing the 24-inch-diameter casing in place:

The Contractor shall furnish 20 field copies of the various logs to the Consultant and shall provide a written evaluation of their quality as well. Twenty copies of the finished logs shall be provided to the Consultant as soon as possible after the logging along with copies of the original films or mylars of the logs.

3.02 CORES: Cores shall be taken during the drilling of the 12-1/4-inch-diameter pilot hole in the injection well. Four-inch-diameter cores, at least 10 feet long, shall be collected at depths designated by the Consultant. (A minimum 10-foot barrel is to be as manufactured by the Christensen Diamond Products Company or approved equal.) The collecting of cores will be observed by technicians from the manufacturer of the coring tool unless the Contractor can demonstrate previous experience.

Coring points will be determined from information derived during drilling operations and as directed by the Consultant. All cores will be stored in wooden boxes with lids, marked with the appropriate well designation, and the depth from which they are taken. Tops and bottoms of the cores are to be marked. After collection, boxing, and labeling, each core will be furnished to the Consultant. The Consultant will then select a maximum of three representative sections of each core on which the Contractor will have laboratory analyses performed in order to determine vertical and horizontal permeability, porosity, specific gravity, elastic modulus and compressive strength. The Contractor shall submit the name of the laboratory for approval to the Consultant before analyses. The cost of the five cores and fifteen analyses is to be included in the lump-sum price for the Injection Well. A credit or deduct for more or less than the specified number of cores will be taken into account in the unit price schedule of the contract.

3.03 TELEVISION SURVEY: Following completion of the nominal 24-inch-diameter open hole in the injection well, the Contractor shall have a

Cement bond

Following the completion of the injection testing and TV Survey:

Temperature

The Contractor also will perform caliper logs on all boreholes before the installation of all casings.

The Contractor will perform temperature logs after each stage of cementing on all casings.

In the dual-zone monitor well, following the completion of each of the stages of the 12-1/4-inch-diameter pilot hole below the 24-inch-diameter casing to a total depth of approximately 1500 feet below land surface, and in the nominal 6-inch-diameter open hole below the final casing, the following geophysical logs will be performed:

Caliper

Gamma Ray

Following the completion of cementing the 16-inch-diameter casing in place:

Cement bond

Following the completion of cementing the 6-inch-diameter casing in place:

Cement bond

television survey performed on the entire well from the top of the 24-inch-diameter injection casing to the bottom of the hole, by a qualified service company using equipment capable of surveying and recording to the required depth. The Contractor may use his own equipment providing it is capable of surveying as required and the Contractor shall furnish proof of the capability of the equipment. The television camera shall be centralized within the borehole. Twenty copies of the complete survey shall be provided by the Contractor for distribution. It is the Contractor's responsibility to make all arrangements and scheduling for the television survey.

It is the Contractor's responsibility to insure that the borehole fluid is of sufficient clarity (as determined by the Consultant) to allow a television survey to be conducted. The Contractor shall pump into the injection well a quantity of clear water not less than three volumes of the entire borehole.

While pumping in the water and during the television survey, the well may be under artesian pressure and may flow. The Contractor shall be required to provide and use a stripper head assembly and any other equipment necessary to keep any flow under control at all times.

Costs for pumping clear water into the borehole to achieve the desired level of clarity; for the television surveys and tapes (including time spent waiting for the television equipment); and for rig and crew labor for all activities associated with preparing for, performing, and dismantling equipment related to the television survey as shall be included in the lump-sum price of the injection well.

3.05 STRADDLE-PACKER TESTS: Upon the completion of the geophysical logs in the 12-1/4-inch-diameter pilot holes, the Contractor shall perform five straddle-packer tests in the injection well as directed by the

Consultant. To perform the straddle-packer tests the Contractor shall employ the services of an approved company recognized as expert in this form of testing, such as, but not limited to, Baker Tools or TAM International. The open-hole straddle-packer tests shall be conducted such that the hydrologic properties of the formation can be determined and a representative water sample collected for analysis. The Consultant will select the depth intervals to be tested in conjunction with the service company representative based on evaluation of the geophysical logs and other available data.

The tests shall be performed using two inflatable packers with a section of perforated pipe between them installed in the borehole on drill pipe with the upper 250 feet consisting of casing or drill pipe with a six-inch-inside-diameter to facilitate the installation of a four-inch-diameter submersible pump which shall be set at an elevation of approximately 250 feet below land surface. The submersible pump shall have the capability of pumping at rates between 5 and 100 gpm. An in-line propeller type flow meter capable of recording total flow and discharge will be used. The internal surfaces of drill pipe, casings, and other fittings used for the packer tests shall be free of rust, scale, and other material that could be dislodged and interfere with a test. Should a test fail because of the presence of any of these materials in the tools or pipe, the Contractor will not be reimbursed for the test and he will be required to clean the pipe, re-set it and the packer, and re-run the test successfully as part of the Contract requirements at his own cost.

After successfully inflating and setting the packers and before the Contractor conducts a four-hour pumping test and a three-hour recovery test for each straddle-packer test, he shall develop each zone so that it is free of any drilling mud/fluids (and producing representatives formation water) and allow the water level in the pipes to return to

static conditions, to the satisfaction of the Consultant. It is anticipated that rates of between 5 and 100 gpm will be obtained during the pumping test. The water produced during the pumping test shall be confined to the closed-circulation system. The Contractor will be responsible for providing all necessary pumps, prime movers, pipelines, meters, and gauges necessary for testing and will provide access for water-level measurements using an M-scope, tape, or electronic probe.

Just prior to completion of each pumping test, the Contractor shall have a State-certified laboratory collect a water sample from the discharge and have the following analyses performed by a State-certified laboratory acceptable to the Consultant.

Total Dissolved Solids
Chloride
Conductivity
Sulfate

The Contractor shall include the cost of five straddle-packer tests and five sets of water-quality analyses in the lump-sum price for each injection well. If more or less tests are performed, a credit or charge will be provided for in the Contract.

3.06 INJECTION TEST: After the completion of the injection well, an injection test shall be run for a 24-hour period. The injection test will be performed at a rate of 10,360 gpm. Fresh water for the injection test will be obtained from the canal adjacent to the site. The Contractor shall provide a layout drawing of his piping for approval by the Consultant. Just prior to the last trip out of the hole on the injection well, the Contractor shall collect a five gallon sample from the discharge of the circulation system and deliver it to the Florida Bureau of Geology in Tallahassee, Florida. Prior to conducting the TV

Survey and injection test, the Contractor shall have a water sample collected from the injection well. Before collecting the water sample, the blow out preventer shall be installed and the return line from the closed circulation system will be shut, forcing the injection zone to develop when pumping begins. A volume equal to at least 3 times the volume of the drill pipe must be removed. The Contractor shall then have a water sample collected from the well and have it analyzed for the primary and secondary drinking water standards and for EPA (Environmental Protection Agency) Test Method 608, 624, and 625 constituents. The laboratory will follow all quality assurance guidelines set forth by the State of Florida. Additionally, the following constituents will be included:

Specific Gravity	Alkalinity
Water Temperature	Total Phosphorus, as P
pH	Total Nitrogen
Turbidity	Nitrate
Color	Nitrite
Sulfate	Organic Nitrogen
Iron	Ammonia
Total Dissolved Solids	Conductivity
Total Hardness	Calcium
Hydroxide	Magnesium
Hydrogen Sulfide	Carbon Dioxide
Non-carbonate Hardness	Carbonate
Bicarbonate	Potassium
Sodium	Chloride
Soluble Orthophosphate	COD (Chemical Organic Carbon)
Ammonium	TOC (Total Organic Carbon)
Antimony	Acidity
Total Suspended Solids	Total Kjeldahl Nitrogen, as N
Dissolved Oxygen	Bromide

The Contractor shall be responsible for providing all necessary pipelines, meters and gauges necessary for the testing and should include these in the lump-sum price of the injection well.

The Contractor shall furnish and install an in-line propeller type flow meter capable of recording instantaneous flow rates and of totalizing flow in the pipeline . The flow meter shall have an accuracy of five percent at the tested rate. The flow meter shall be sufficiently removed from obstructions in the pipeline, valves, elbows, reductions, to allow the meter to perform within specifications. Manufacturers specifications shall be submitted to the Consultant prior to installation for approval.

To the extent possible, the speed of the pump and motor shall remain constant throughout the test. The pumping rate shall be controlled and adjustable by means of a gate valve in the pipeline. The valve shall be installed between the injection pump and the flow meter. The pumping rate shall not be adjusted by changing the speed of the motor or pump, except when absolutely necessary and with the permission of the Consultant.

During the injection test, bottom-hole pressure and temperature shall be monitored, and recorded at land surface in each injection well. The Contractor shall employ the services of a company specializing in furnishing and operating the equipment used in collecting this information. An approved pressure gauge and recording system capable of accurately measuring and detecting pressure changes of as little as 0.01 psi (pounds per square inch) such as the Baker Tools RES-300 or Geophysical Research Corp. EPG-520 system will be used. The data recording system shall record in real time and continuous delta time. No

interruptions of data recording will be permitted if delta time will re-zero after interruption for equipment service or any other reason. The Contractor shall provide the Consultant with technical data on the pressure-measuring and recording system for approval before the injection tests. The system will be installed in the injection well at the top of the injection zone at a depth determined by the Consultant. Access to the monitor well during the test also will be required to allow water levels to be measured. The separate dual-zone monitor well shall be completed prior to the injection test.

The pressure-recording system will be operated for a period of 24 hours prior to the start of the injection test (to collect information on natural bottom-hole pressure fluctuations), during the injection test, and for a 12-hour period after the injection test. The Consultant shall be furnished a copy of all of the basic data recorded as part of the injection tests in hard copy and in ASCE Format on 3-1/2-inch disk. During the injection test, well head pressure gauges must be in good working order and they must be accessible. The Contractor shall submit verification of pressure-gauge calibration to the Consultant prior to commencement of the injection test.

The costs for these services shall be included in the lump-sum price of the injection well. For time spent more or less, the Contractor shall be paid or credit given on the basis of an hourly charge to be listed in the Contract.

3.07 MONITOR-WELL WATER-QUALITY ANALYSES: After disinfection, the monitor zones will be developed by pumping or other approved means until conductivity and chloride measurements of the discharged water from each zone have stabilized as determined by the Consultant, to ensure that representative formation water samples can be collected. Upon stabilization, the casings will be pumped until 10 times the calculated

casing volume has been displaced. If the casings are not open to the formations or are incapable of yielding a representative water sample from the monitor zones, the Contractor shall employ such procedures as are necessary to open up the casing so that representative water samples may be collected. These procedures shall be conducted at no additional cost to the Owner and shall be approved in writing by the Consultant prior to implementation. No standby time will be paid for the time spent during these procedures.

After the monitor casings have been demonstrated to be functioning and have been disinfected, they shall be pumped to remove any fluid that may have been introduced into the disinfection. Upon concurrence of the Consultant that representative water is being produced from each monitor zone, the Contractor shall have a State-certified laboratory collect a sample from each tube in the presence of the Consultant's representative and have the following analyses performed on each monitor zone by a State-certified laboratory approved by the Consultant.

The samples collected from the monitor zones shall be analyzed for all constituents listed in Chapter 17-22.104 FAC, as primary and secondary drinking water standards, including analysis for microbiological, radionuclides, BOD and constituents listed under EPA Methods 608, 624, and 625 in Chapter 17-22.105 FAC. The laboratory will follow all quality assurance guidelines set forth by the State of Florida. The constituents are as follows:

Specific Gravity
Water Temperature
Arsenic
Barium
Cadmium
Chromium

1,2-Dichloropropane
Trihalomethane
Trichloroethylene
Tetrachloroethylene
Tetrachloromethane
Vinyl Chloride

Lead
Mercury
Nitrate (as N)
Selenium
Silver
Sodium
Fluoride
Endrin
Lindane
Methoxychlor
BOD
Toxaphene
2,4-Dichlorophenoxyacetic Acid
2,4,5-TP (Silvex)
Turbidity
Total fecal Coliform
Radium 226
Radium 228
Gross Alpha
Beta Particles
Photonradioactivity
Trichlorofluoromethane
Acenaphthene
Acenaphthylene
Anthracene
Aldrin
Benzo(a)anthracene
Benzo(b)Fluoranthene
Benzo(k)Fluoranthene
Benzo(a)pyrene
Benzo(ghi)perylene
Benzyl butyl phthalate
1,1,1-Trichloroethane
1,2-Dichloroethane
Benzene
Ethylene Dibromide
Chloride
Color
Copper
Corrosivity
Foaming agents
Iron
N-Nitrososodimethylamine
Manganese
Odor
pH (in field)
Sulfate
TDS
Zinc
Bromodichloromethane
Bromoform
Chlorobenzene
Chloroethane
2-Chloroethylvinyl ether
Chloroform
Dibromochloromethane
1,2 Dichlorobenzene
1,3 Dichlorobenzene
1,4 Dichlorobenzene
1,1 Dichloroethane
1,1 Dichloroethene
trans-1,2-Dichloroethene
cis-1,3 Dichloropropene
trans-1,3 Dichloropropene

α -BHC
β -BHC
Bis(2-chloroethyl)ether
Bis(2-chloroethoxy)methane
Bis(2-ethylhexyl)phthalate
Bis(2-chloroisopropyl)ether
4-Bromophenyl phenyl ether
Chlordane
2-Chloronaphthalene
4-Chlorophenyl phenyl ether
Chrysene
4,4-DDD
4,4-DDE
4,4 DDT
Dibenzo(a,h)anthracene
Di-n-butylphthalate
3,3 Dichlorobenzidine
Dieldrin
Diethyl phthalate
Dimethyl phthalate
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octylphthalate
Endosulfan sulfate
Endrin aldehyde
Fluoranthene
Fluorene
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Hexachlorobutadiene
Hexachloroethane

Ethyl Benzene
Methylene Chloride
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Nitrobenzene
N-Nitrosodi-n-propylamine
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
Phenanthrene
Pyrene
1,2,4 Trichlorobenzene
4-Chloro-3-methylphenol
2-Chlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2-methyl-4,6-dinitrophenol
2-nitrophenol
4-nitrophenol
Pentachlorophenol
Phenol
2,4,6-Trichlorophenol
Benzidine

Indeno(1,2,3-cd)pyrene	γ -BHC
Isophorone	Endosulfan I
Naphthalene	Endosulfan II
Hexachlorocyclopentadiene	Bromomethane
N-Nitrosodiphenylamine	Chloromethane
Hydrogen Sulfide	Alkalinity
Soluble Orthophosphate	COD (Chemical Oxygen Demand)
Ammonium	Fluoride
Organic Nitrogen	TOC (Total Organic Carbon)
Antimony	Acidity
Magnesium	Specific Gravity
Calcium	Total Suspended Solids
Potassium	Total Kjeldahl Nitrogen, as N
Bicarbonate	Dissolved Oxygen
Bromide	Total Phosphorus, as P
Strontium	Borate

The Contractor shall include the cost for the collection and chemical analyses for one set of samples from the shallow monitor zone and one set from the deep monitor zone in the lump-sum price of the monitor well.

3.08 RADIOACTIVE TRACER SURVEY: Upon completion of the injection test and TV survey, a radioactive tracer survey shall be performed in the injection well. The Contractor shall employ the services of a company specializing in furnishing and operating the equipment used in collecting this information. The tests shall be conducted as directed by the Consultant, according to the following procedure outline. The costs for these services shall be included in the lump-sum price for the injection well.

The geophysical tool supplied for the radioactive-tracer survey must be capable of ejecting the radioactive tracer and simultaneously monitoring

the gamma-ray detectors. Film documentation of the radioactive tracer injection time must be provided and the tracer injection time must be calibrated to ± 1 millisecond. No time lag between ejection and monitoring is permitted. A casing collar locator (CCL) shall be positioned below the tool to precisely locate the bottom of the casing. The tool shall be configured such that one gamma-ray detector shall be located above the ejector chamber and two detectors shall be located below the ejector.

The RATS (radioactive-tracer survey) testing will be conducted following the injection test according to the following procedure:

1. Fresh water from the adjacent canal will be used for the 24-hour injection test immediately prior to RATS testing so a sufficient fresh-water "bubble" will be established.

2. The combination gamma-ray/casing collar locator/temperature/radioactive slug ejector tool will be used to log in the hole, recording temperature from surface to a depth approximately 10 feet below the casing.

3. A background gamma-ray log will be conducted in the interval beginning at total depth of the temperature log to approximately 1500 feet above the casing seat (bottom of casing). A casing collar locator log will be used.

4. The tracer ejector should be positioned within 1 foot below the bottom of the casing, with one gamma-ray detector above the ejector (GRT), and two gamma-ray detectors below the ejector [(GRM) and (GRB)].

5. Time-drive monitoring will begin without pumping, and a slug of tracer material will be ejected. The tracer material slug will be a volume of Iodine 131 equivalent to approximately 2.0 to 3.0 millicuries. This release may be confirmed by detectors GRM and GRB. Detector GRT, located inside the casing, above the ejector will monitor the fluid in the casing to confirm the absence of tracer material rising upward inside the casing.

6. Gamma-ray levels will be monitored for 60 minutes; if tracer material is detected by detector GRT, the combination logging tool will be raised to follow the tracer.

7. A gamma-ray log will be run to approximately 1000 feet above the casing seat (or to a depth above the top of the confining sequence - to be determined during the drilling of the injection well).

8. The tracer ejector should be positioned approximately 5 feet above the bottom of the casing, with one gamma-ray detector above the ejector (GRT), and two gamma-ray detectors below the ejector ((one inside the casing above the casing seat (GRM) and one outside the casing below the casing seat (GRB)).

9. A low injection rate will be established. The velocity will be approximately 0.1 foot per second, or approximately 130 gallons per minute.

10. Time-drive monitoring will begin and a slug of tracer material (similar to that used in item 5) will be ejected. This release will be confirmed by detectors GRM and GRB.

11. Gamma-ray levels will be monitored for 30 minutes.

12. A gamma-ray log will be run to the same depth determined in Item 7.

13. The combination logging tool will be re-positioned as described in Item 8.

14. A high injection rate (approximately 10,360 gal/min) then will be established.

15. Time-drive monitoring will begin; a slug of tracer material will be ejected (similar to that used in item 5); and the release of the tracer material will be confirmed by detectors GRM and GRB.

16. Gamma-ray levels will be monitored for five minutes.

17. A gamma-ray log will be run to the same depth determined in Item 7.

18. Repeat as necessary.

19. Pumping shall cease.

20. Repeat Items 4, 5 and 6. A larger volume of radioactive material (approximately 4.0 to 5.0 millicuries) will be released.

21. A gamma-ray log will be run up to approximately 1500 feet.

3.09 ADDITIONAL TESTING BY OUTSIDE AGENCIES OR SERVICES: The Consultant and/or the Owner may issue written authorization for additional testing and for logging to be performed by outside agencies, the Consultant's staff, or competent testing firms. The Contractor shall be given due notification of the test program and the firm or agency performing the test. The Contractor shall be compensated for standby time during any such well testing or logging.

In the event a tool owned by the outside firm or agency is lost in the well and cannot be retrieved, the Contractor shall be compensated for

correcting the situation (if necessary). The Contractor shall be reimbursed for all costs incurred for rental of extra tools and equipment needed for these measures. The Contractor shall furnish the Owner with copies of invoices for all extra tools and equipment used during these operations.

The Contractor shall be responsible for and shall receive no additional compensation for cleaning the well of debris or loose wall material which is dislodged during the test. The condition of the well is the Contractor's responsibility and no compensation shall be made for maintaining a clean hole.

3.10 PRESSURE TESTING: Pressure tests will be conducted following the cement-bond logs in both injection and monitor wells. The tests will be performed in the 24-inch-diameter casing in the injection well, and in both the 16-inch-diameter and 6-inch-diameter casings in the monitor well. Pressure testing shall be conducted according to the same procedure in each of the three casings. This procedure is as follows:

> The casing shall be filled with water and placed under a minimum of 150 psi (pounds per square inch) and a maximum of 225 psi pressure. No pressure change is allowed in sixty minutes. If a pressure change occurs, the test shall be repeated under controlled conditions to the satisfaction of the Consultant and the regulatory agencies. If the pressure changes or if there is some other indication of leakage, the Contractor shall take steps to locate the leak and make repairs in a manner satisfactory to the Consultant. Pressure testing shall be witnessed and certified in writing by the Consultant.

The Contractor shall submit verification of pressure-gauge calibration to the Consultant prior to commencement of each pressure test. The cost of

the pressure tests of the injection well shall be included in the lump-sum price of the injection well. The cost of pressure testing the monitor well shall be included in the lump-sum price of the monitor well.

PART 4 - MATERIALS SPECIFICATIONS

Injection Wells

4.01 CASING: All well casing and tubing shall be new. The Contractor may propose to the Consultant the use of well casing of a higher grade. The casing shall have minimum standards in the following specifications. Before casings are installed in the well, the Contractor shall supply the Consultant with mill certificates.

4.011 PIT CASING: The Contractor shall install a pit casing with an inside-diameter sufficient to accommodate a 60-inch-diameter drilling bit. The material, length, and method of installation shall be at the Contractor's option subject to approval by the Consultant. The cost of the pit casing shall be included in the lump-sum price of the injection well.

4.012 CONDUCTOR CASING: The conductor casing shall be new, unused, steel, random length, 52-inch-diameter, 0.375-inch wall-thickness, and shall conform to API 5L Grade B, ASTM A53 Grade B or Spiral Weld A139 Grade B standards. The casing shall be plain end and beveled for welding and shall be joined together by certified welders. The Contractor must provide the Consultant proof of welders' certifications before any welding may be started. The Contractor shall include the cost for 170 feet of conductor casing in the lump-sum price of the injection well.

4.013 SURFACE CASING: The surface casing shall be new, unused steel, random length, 44-inch-diameter, 0.375-inch wall-thickness, and shall

conform to either API 5L Grade B, ASTM A53 Grade B or Spiral Weld A139 Grade B standards. The casing shall be plain end and beveled for welding and shall be joined together by certified welders. The Contractor shall include the cost for 1000 feet of surface casing in the lump-sum price of the injection well.

4.014 INTERMEDIATE CASING: The intermediate casing shall be new, unused steel, random length, 34-inch-diameter, 0.375-inch wall-thickness, and shall conform to either API 5L Grade B, ASTM A53 Grade B or Spiral Weld A139 Grade B standards. The casing shall be plain end and beveled for welding and shall be joined together by certified welders. The Contractor shall included the cost of 2300 feet of intermediate casing in the lump-sum price of the injection well.

4.015 INJECTION CASING: The injection casing shall be new, unused seamless steel, random length, 24-inch-diameter, 0.500-inch wall-thickness, and shall conform to either API 5L Grade B or ASTM A53 Grade B standards. The casing shall be threaded and coupled. Prior to installation of the final casing into the well, it shall be sand blasted to remove any traces of mill varnish from its exterior surface. The Contractor shall have sand blasting done at such a time as to allow the appropriate amount of rust (to facilitate proper cement bond) to have formed before installation of casing. The Contractor shall include the cost of 3000 feet of injection casing in the lump-sum price of the injection well.

4.016 CENTRALIZERS: In the injection well, all casings shall be fitted with Halliburton-type centralizers with steel straps at 0, 90, 180, and 270 degrees around the casing at each position. The centralizers shall be located as follows:

Conductor Casing:

1. One at 20 feet above the bottom end of the casing
2. Two at 40-foot intervals above the bottom centralizer
3. One at 20 feet below land surface

All other casings and tubings:

1. One at 20 feet above the bottom end of the casing
2. Three at 40-foot intervals above the bottom centralizer and at approximate intervals of 200 feet thereafter
3. The topmost centralizer to be at a depth of 20 feet below land surface

All centralizers shall be in a precise vertical alignment, one above the other, to allow for the placement of tremie pipes in the annuli. The cost of all centralizers shall be included in the lump-sum price of the injection well.

4.017 CEMENT: Sulfate-resistant cement shall be used for all cementing of casings and hole plugging. ASTM Type II, or API Class B, can be used with additives and lost-circulation materials (Flocele and/or gilsonite) as necessary and approved by the Consultant. Gel may be used in concentrations up to a maximum of 12 percent. Neat cement only shall be emplaced in the bottom 100 feet of the intermediate and bottom 200 feet of the surface and final casing in the injection well. However, lost-circulation material such as Flocele and gilsonite may be used as needed. At the Contractor's option, all conductor casing may be cemented with neat cement. All cement blends shall be approved by the Consultant in advance of placement. Prior to commencement of cementing operations, the Contractor shall submit a written procedure for cementing each stage of each casing string. Mixed cement shall include cement and all additives and lost circulation material approved by the Consultant. The

Contractor shall include the cost of 45,000 cubic feet of mixed cement in the lump-sum price of the injection well.

4.018 WELL HEAD COMPLETION: The Contractor shall finish the injection well head with a 24-inch gate valve. The 24-inch gate valve shall be a resilient seated gate valve. The resilient seated gate valve shall conform to AWWA-C-504-80. The valve shall provide bidirectional bubble-type sealing at 150-psi differential pressure. The Contractor shall include the cost of these items in his lump-sum price for the injection well.

4.02 MONITOR-WELL MATERIALS

4.021 CASING: All monitor-well casing and tubing shall be new. The Contractor may propose to the Consultant the use of well casing of a higher grade. The casings shall have minimum standards in the following specifications. Before casings are installed in the well, the Contractor shall supply the Consultant with mill certificates.

4.022 PIT CASING: The Contractor shall install a pit casing with an inside diameter sufficient to accommodate a 36-inch-diameter drilling bit. The material, length, and method of installation shall be at the Contractor's option subject to approval by the Consultant. The cost of the pit casing shall be included in the lump-sum price of the monitor well.

4.023 CONDUCTOR CASING: The conductor casing shall be new, unused, steel, random length, 24-inch-diameter, 0.375-inch-wall thickness, and shall conform to API 5L Grade B, ASTM A53 Grade B or Spiral Weld A139 Grade B standards. The casing shall be plain end and beveled for welding and shall be joined together by certified welders. The Contractor must provide the Consultant proof of welders' certifications before any

welding may be started. The Contractor shall include the cost of 170 feet of conductor casing in the lump-sum price of the monitor well.

4.024 SURFACE CASING: The surface casing shall be new, unused steel, random length, 16-inch-diameter, 0.375-inch-wall thickness, and shall conform to either API 5L Grade B, ASTM A54 Grade B or Spiral Weld A139 Grade B standards. The casing shall be plain end and beveled for welding and shall be joined together by certified welders. The Contractor shall include the cost for 1100 feet of surface casing in the lump-sum price of the monitor well.

4.025 MONITOR CASING: The monitor casing shall be new, unused 6-5/8-inch-diameter, 0.562-inch-wall-thickness steel casing. The monitor casing may be welded at the Contractor's discretion. The Contractor shall include the cost of 1500 feet of monitor casing in the lump-sum price for the monitor well.

4.026 CENTRALIZERS: In the monitor well, all casings shall be fitted with Halliburton-type centralizers with steel straps at 0, 90, 180, and 270 degrees around the casing at each position. The centralizers shall be located as follows:

Conductor Casing:

1. One at 20 feet above the bottom end of the casing
2. Two at 40-foot intervals above the bottom centralizer
3. One at 20 feet below land surface

All other casings and tubings:

1. One at 20 feet above the bottom end of the casing

2. Three at 40-foot intervals above the bottom centralizer and at approximate intervals of 200 feet thereafter

3. The topmost centralizer to be at a depth of 20 feet below land surface

All centralizers shall be in a precise vertical alignment, one above the other, to allow for the placement of tremie pipes in the annuli. The cost of all centralizers shall be included in the lump-sum price of the monitor well.

4.027 CEMENT: Sulfate-resistant cement shall be used for the cementing of all casings and hole plugging. ASTM Type II, or API Class B, can be used with additives and lost-circulation materials (Flocele and/or gilsonite) as necessary and approved by the Consultant. Gel may be used in concentrations up to a maximum of 12 percent. Neat cement only shall be emplaced in the bottom 200 feet of the surface and final casings. However, lost-circulation material such as Flocele and gilsonite may be used as needed. At the Contractor's option, the conductor casing may be cemented with neat cement. All cement blends shall be approved by the Consultant in advance of placement. Prior to commencement of cementing operations, the Contractor shall submit a written procedure for cementing each stage of each casing string. Mixed cement shall include cement and all additives and lost circulation materials approved by the Consultant. The Contractor shall include the cost of 6,000 cubic feet of mixed cement in the lump-sum price of the monitor well.

4.028 COATING: Prior to installation of the 6-5/8-inch-diameter casing for the lower monitor zone, the entire casing string shall be coated with an epoxy-phenolic compound such as Matcote Epoxy-Phenolic System 1-850 (Intergard THA 855/THA 724) as manufactured by International Paint, 6001

Antoine, Houston, Texas. The coating on the monitor casing shall have a minimum thickness of 6.0 mils when dry. The Contractor shall exercise care while making up the tubing and replace any coating that may be damaged during this operation. After all applications of the coating, the Contractor shall have the coating holiday checked and certified as to its integrity before the casing is installed in the well.

The costs of all coating for the 6-5/8-inch-diameter casing shall be included in the lump-sum price of the monitor well.

4.030 DISINFECTION: Following approval by the Consultant of the tests indicating that the monitor casings are open and in contact with the formation, the Contractor shall disinfect the monitor tubes in accordance with Section 1-7 of the AWWA Standard for Deep Wells. The Contractor shall submit to the Consultant for approval his written procedure for disinfection prior to its implementation. The Contractor shall notify the Consultant in writing at least 24 hours in advance of the implementation of the approved disinfection procedures. The Contractor shall include all costs for disinfection in the lump-sum price of the monitor well.

4.031 WELL HEAD COMPLETION: The Contractor shall finish both the shallow monitor well-head and deep monitor well-head with two-inch-diameter PVC ball valves, as shown on the Contract Drawings. The valves shall be as specified by Plastic Piping Systems Inc., or equal. Both valves shall be constructed of PVC material, operate under a working pressure of 150 psi, shall have union ends and be fitted with end connectors.

The interior face of the valve shall be a flush port valve and have a flush diameter when open equal to the inside diameter of 2-inch-diameter Schedule 80 PVC pipe. The Contractor shall include the cost of these specified items, in the lump sum price for the dual-zone monitor well.

CONTRACT DRAWINGS

CONTRACT DRAWINGS

1. Plant Site Plan

2. Proposed Construction Details of Injection Well #2 and the Dual-Zone Monitor Well

3. Typical Drill Pad Construction Details

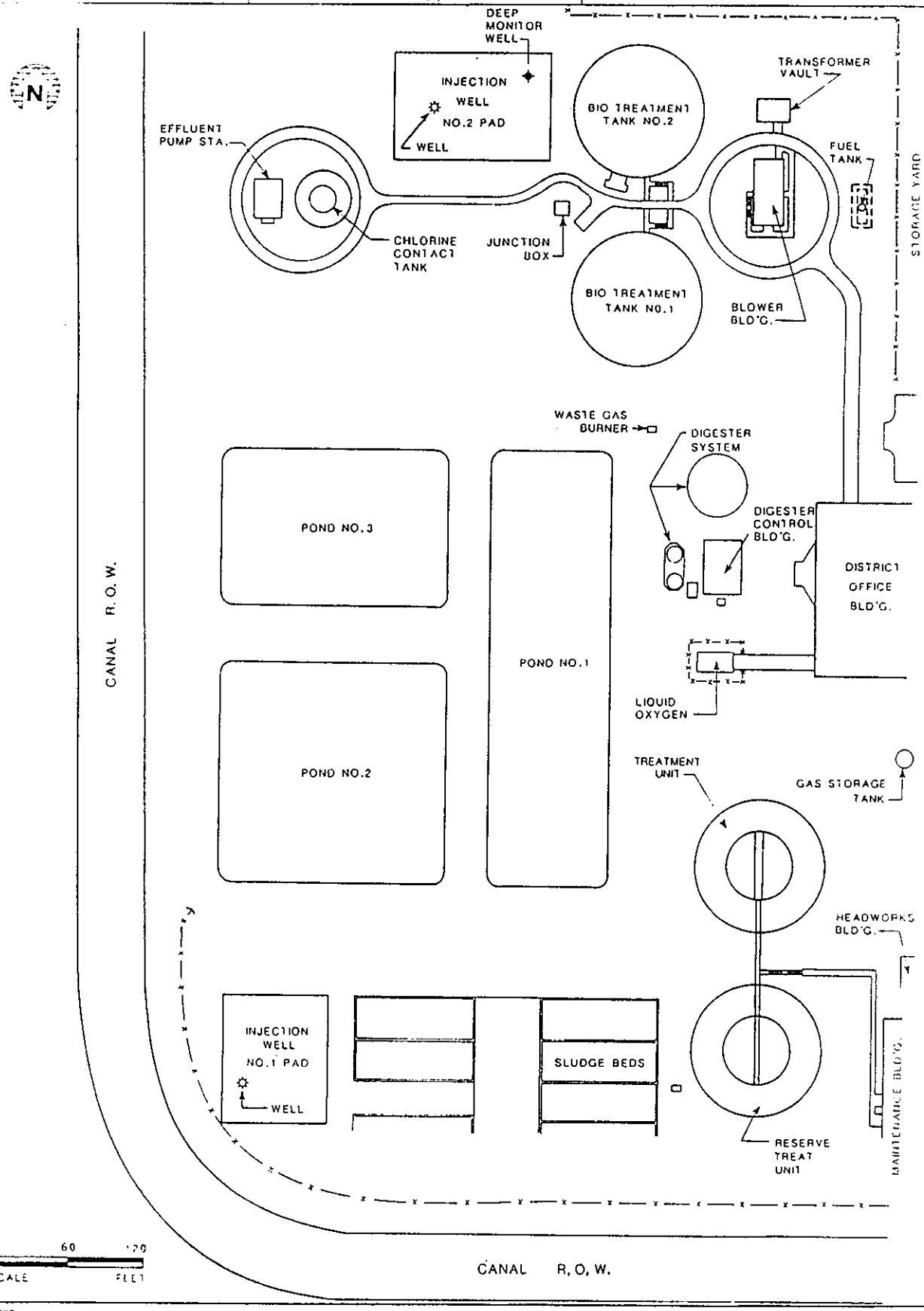
4. Injection Well Drilling Pad Water-Table Monitoring Well Construction Details

5. Dual-Zone Monitor-Well, Well-Head Construction Details

GERAGHTY & MILLER, INC.
Ground-Water Services

COMPILED BY:	J. McGRATH	DATE:	SCALE:
PREPARED BY:	J. POLLACK	DEC.88	SHOWN
PROJECT MGR.:	H. MADEKSHO	FILE NO:	PF0234IW01

PREPARED FOR:
GEE & JENSON
CORAL SPRINGS IMPROVEMENT DISTRICT



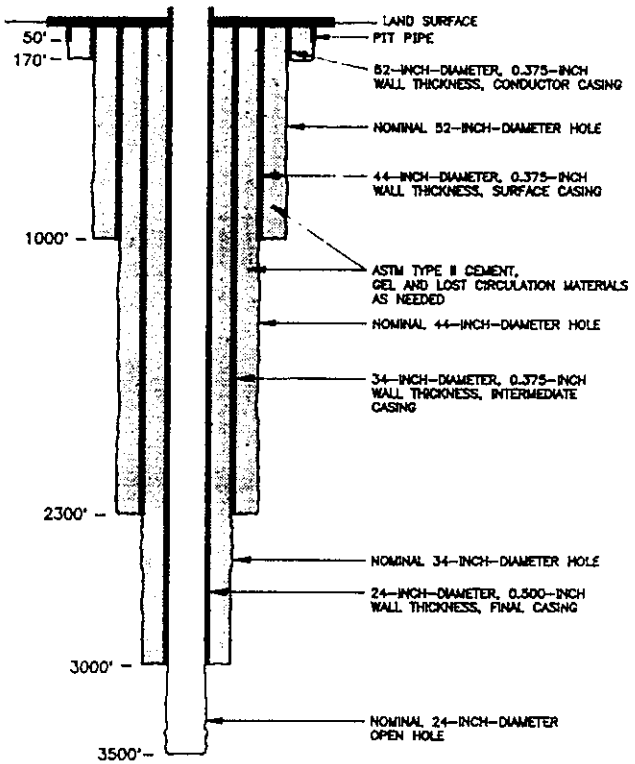
SUBJECT:

PLANT SITE PLAN

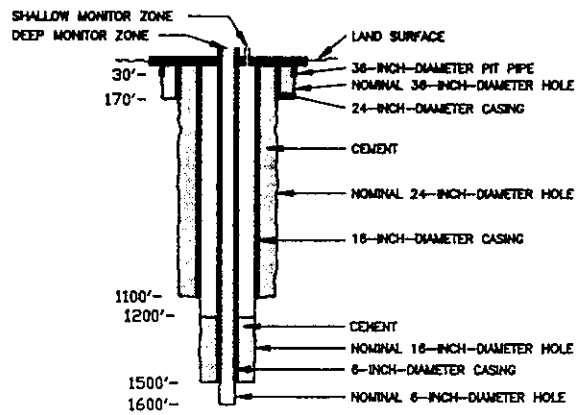
FIGURE:
1

GERAGHTY & MILLER, INC. *Ground-Water Services*	COMPILED BY: J. McGRATH	DATE: DEC 88	SCALE: NONE	PREPARED FOR: GEE & JENSON
	PREPARED BY: B. OLIVA	FILE NO: PF0234IW01		Coral Springs Improvement District
	PROJECT MGR.: J. WHEATLEY			

CSID
PROPOSED 24" IW-2



CSID
PROPOSED DUAL-ZONE MONITOR WELL



INJECTION WELL CASING SCHEDULE

CONDUCTOR CASING: 52-INCH-DIAMETER, 0.375-INCH-WALL THICKNESS, MAY BE SPIRAL WOUND, ERW, OR DSAW PIPE, WELDED JOINTS.

SURFACE CASING: 44-INCH-DIAMETER, 0.375-INCH-WALL THICKNESS, MAY BE SPIRAL WOUND, ERW, OR DSAW PIPE, WELDED JOINTS.

INTERMEDIATE CASING: 34-INCH-DIAMETER, 0.375-INCH-WALL THICKNESS, MAY BE SPIRAL WOUND, ERW, OR DSAW PIPE, WELDED JOINTS.

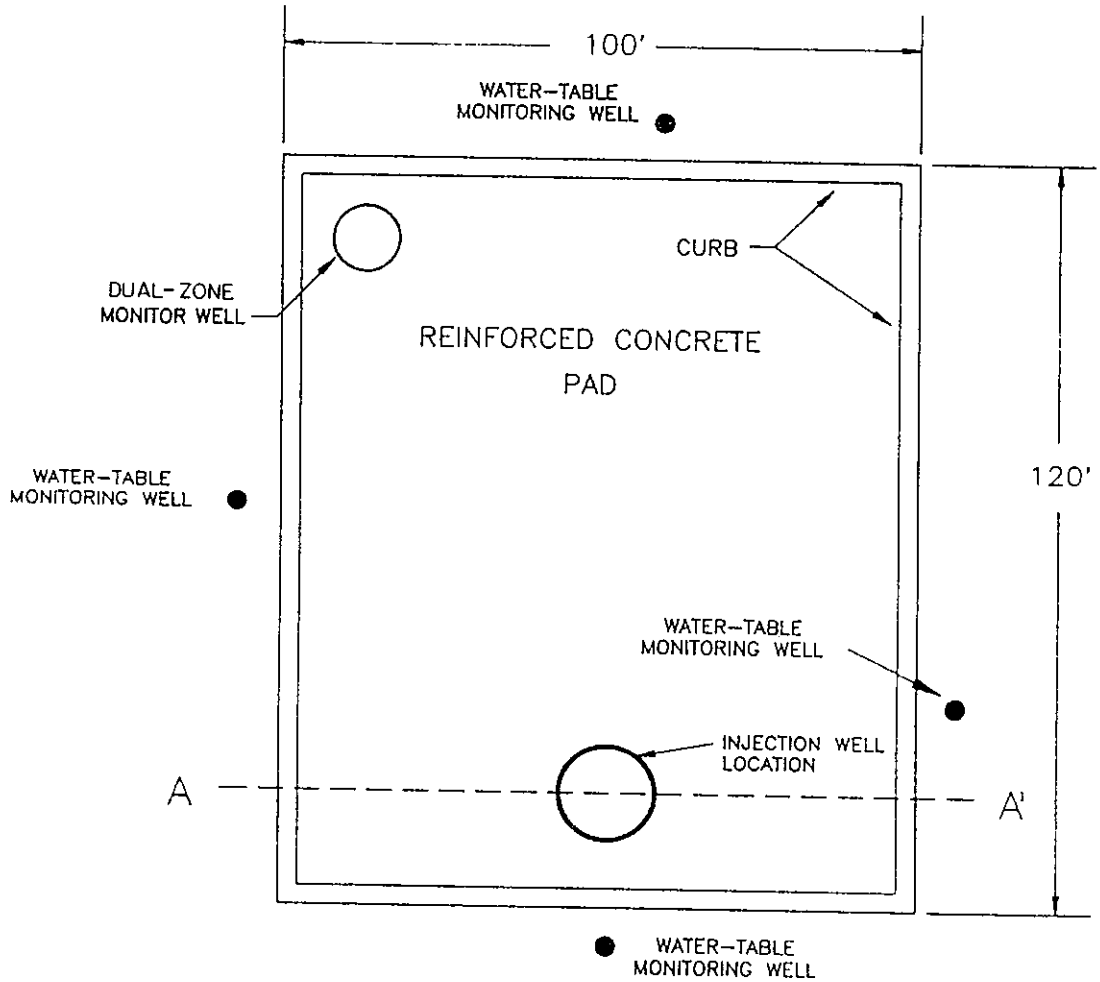
FINAL CASING: 24-INCH-DIAMETER, 0.500-INCH-WALL THICKNESS, SEAMLESS, WELDED JOINTS.

SUBJECT:

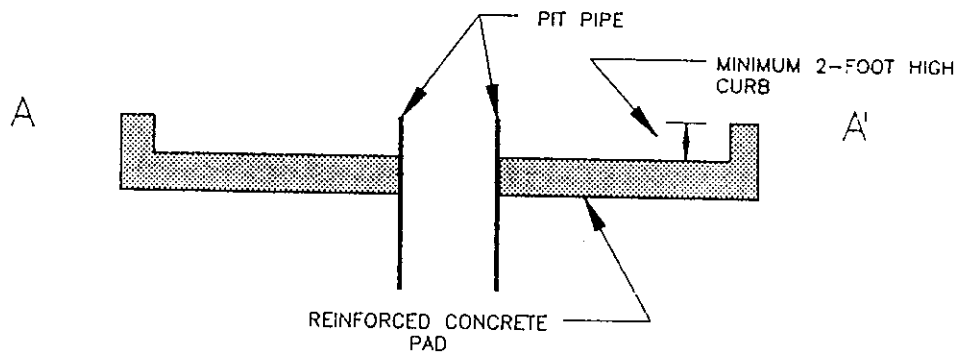
PROPOSED CONSTRUCTION DETAILS OF INJECTION WELL #2 AND THE DUAL-ZONE MONITOR WELL

FIGURE: 2

GERAGHTY & MILLER, INC. *Ground-Water Services*	COMPILED BY: J. McGRATH	DATE: DEC 88	SCALE: NONE	PREPARED FOR: GEE & JENSON
	PREPARED BY: B. OLIVA	FILE NO: PF0234IW01		CORAL SPRINGS IMPROVEMENT DISTRICT
	PROJECT MGR.: H. MADEKSHO			



PLAN VIEW



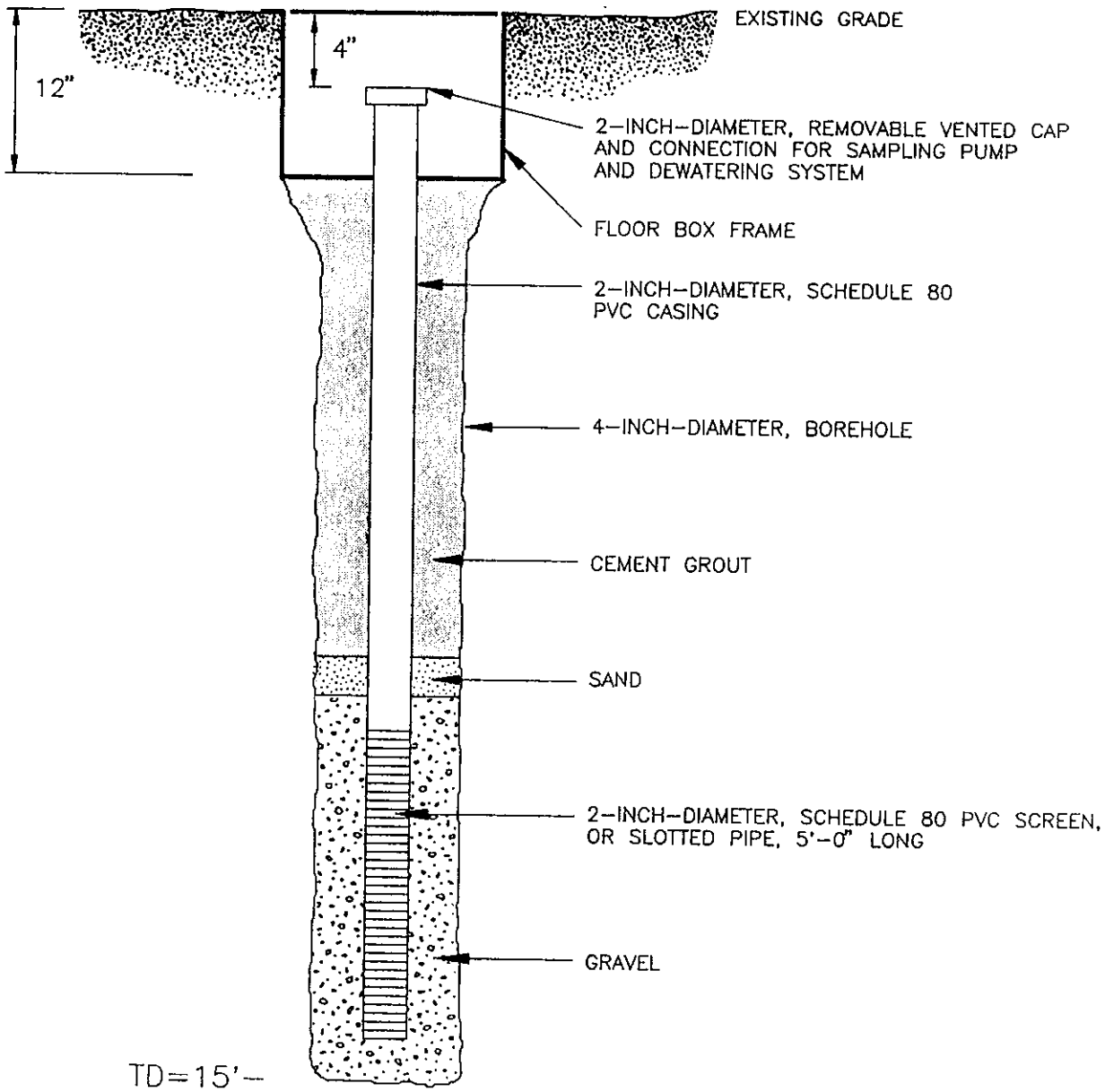
CROSS SECTION

SUBJECT:

TYPICAL DRILL PAD CONSTRUCTION DETAILS

FIGURE 3

GERAGHTY & MILLER, INC. *Ground-Water Services*	COMPILED BY: J. McGRATH	DATE: DEC 88	SCALE: NONE	PREPARED FOR: GEE & JENSON
	PREPARED BY: B. OLIVA	FILE NO: PF0234IW01		CORAL SPRINGS IMPROVEMENT DISTRICT
	PROJECT MGR.: H. MADEKSHO			



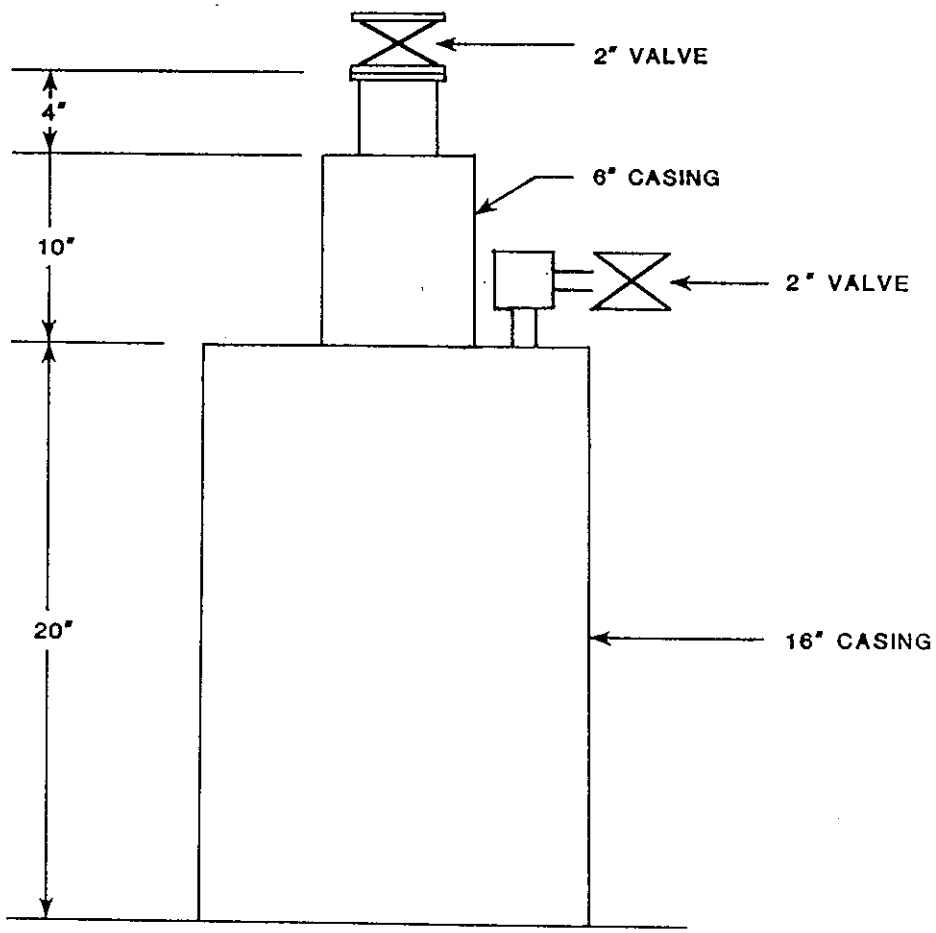
NOTE: NOT TO SCALE

SUBJECT:

INJECTION WELL DRILLING PAD WATER–TABLE MONITORING WELL CONSTRUCTION DETAILS

FIGURE 4

GERAGHTY & MILLER, INC. *Ground-Water Services*	COMPILED BY: J. McGRATH	DATE: DEC.88	SCALE: NONE	PREPARED FOR: GEE & JENSON
	PREPARED BY: J. POLLACK	FILE NO: PF0234IW01		CORAL SPRINGS IMPROVEMENT DISTRICT
	PROJECT MGR.: H. MADEKSHO			



SUBJECT:

DUAL-ZONE MONITOR WELL, WELL-HEAD COMPLETION DETAILS

FIGURE: 5

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA
DISTRICT
3301 GUN CLUB ROAD
P.O. BOX 3858
WEST PALM BEACH, FLORIDA 33402

APPLICATION TO CONSTRUCT/OPERATE/ABANDON CLASS I, III, OR V INJECTION WELL SYSTEMS

PART I. Directions

A. All applicable items must be completed in full in order to avoid delay in processing this application. Where attached sheets or other technical documentation are utilized in lieu of the blank space provided, indicate appropriate cross-reference in the space and provide copies to the department in accordance with (C) below. Where certain items do not appear applicable to the project, indicate N/A in the appropriate spaces. When this form is used in conjunction with DER Form 17-1.205(1), duplicative information requests need to be completed only once.

B. All information is to be typed or printed in ink.

C. Four (4) copies of this application and four (4) copies of supporting information such as plans, reports, drawings and other documents shall be submitted to the appropriate District/Subdistrict office. An engineering report is also required to be submitted to support this application pursuant to the applicable sections of Florida Administrative Code Rule 17-28. The attached lists* shall be used to determine completeness of supporting data submitted or previously received. A check for the application fee in accordance with Florida Administrative Code Rule 17-4.05 made payable to the Department shall accompany the application.

D. For projects involving construction, this application is to be accompanied by four (4) sets of engineering drawings, specifications and design data as prepared by a Professional Engineer registered in Florida, where required by Chapter 471, Florida Statutes.

E. Attach 8 1/2" x 11" USGS site location map indicating township, range and section and latitude/longitude for the project.

PART II. General Information

A. Applicant: Name Coral Springs Improvement District Title _____

Address 10300 N.W. 11th Manor

City Coral Springs, Florida Zip 33071

Telephone Number (305) 753-0380

B. Project Status: [X] New [ ] Existing

[ ] Modification (specify) _____

*"Engineering and Hydrogeologic Data Required for Support of Application to Construct, Operate and Abandon Class I, III, or V Injection Wells"

C. Well Type:

( ) Exploratory Well (x) Test/Injection Well

D. Type of Permit Application:

( ) Class I Exploratory Well Construction and Testing Permit

(x) Class I Test/Injection Well Construction and Testing Permit

( ) Class I Well Operating Permit

( ) Class I Well Plugging and Abandonment Permit

( ) Class III Well Construction/Operation/Plugging and Abandonment Permit

( ) Class V well Construction Permit

( ) Class V Well Operating Permit

( ) Class V Well Plugging and Abandonment Permit

E. Facility Identification:

Name: Coral Springs Improvement District

Facility Location: Street: 10300 NW 11th Manor

City: Coral Springs, Florida County: Broward

SIC Code: 4941

F. Proposed facility located on Indian Lands: Yes_____ No x

G. Well Identification:

Well No. 2 of 2 Wells
(total #)

Purpose (Proposed Use): Domestic Wastewater Effluent Disposal

Well Location: Latitude: 80° 15' 30" Longitude 26° 14' 30"

(attach separate sheet, if necessary, for multiple wells.)

Subpart B. General Projection Description:

(1) Describe the nature, extent and schedule of the injection well project. Refer to existing and/or future pollution control facilities, expected improvement in performance of the facilities and state whether the project will result in full compliance with the requirements of Chapter 403, Florida Statutes, and all rules and regulations of the Department. Attach additional sheet(s) if necessary or cross-reference the engineering report.

Coral Springs Improvement District Wastewater Treatment Plant Injection Well Construction And Testing Program Coral Springs Improvement District Wastewater Plant Injection Well Construction Technical Specifications

PART III Statement by Applicant and Engineer

A. Applicant

I, the owner/authorized representative* of Coral Springs Improvement District, certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. I understand that this certification also applies to all subsequent reports submitted pursuant to this permit. Where construction is involved, I agree to retain the design engineer, or other professional engineer registered in Florida, to provide inspection of construction in accordance with Florida Administrative Code Rule 17-28.34(1)(c).

Signed _____ Date 1-6-89

Gary L. Moyer, Superintendent — 753-3080

Name and Title (Please Type) — Telephone Number

*Attach a Letter of Authorization.

B. Professional Engineer Registered in Florida

This is to certify that the engineering features of this injection well have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that the well, when properly maintained and operated, will discharge the effluent in compliance with all applicable statutes of the State of Florida and the rules and regulations of the Department. It is also agreed that the undersigned will furnish the applicant a set of instructions for proper maintenance and operation of the well.

Signed: Peter L. Palmer

Peter L. Palmer
Name (Please Type)

Geraghty & Miller Engineers, Inc.
Company Name (Please Type)

P. O. Box 270573
Tampa, Florida 33688
Mailing Address (Please Type)

(Please Affix Seal)

FLORIDA REGISTRATION NUMBER 18324 Date: 1/3/89 Phone No. 813-968-2248

ENGINEERING AND HYDROLOGIC DATA REQUIRED FOR SUPPORT OF APPLICATION TO CONSTRUCT, OPERATE, AND ABANDON CLASS I, III, OR V INJECTION WELL SYSTEMS

The following information shall be provided for each type of permit application.

(A) CLASS I EXPLORATORY WELL CONSTRUCTION AND TESTING PERMIT

(1) Conceptual plan of the injection project. Include number of injection wells, proposed injection zone, nature and volume of injection fluid, and proposed monitoring program.

(2) Preliminary Area of Review Study. Include the proposed radius of the area of review with justification for that radius. Provide a map showing the location of the proposed injection well or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surfacebodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

(3) Proposed other uses of the exploratory well.

(4) Drilling and testing plan for the exploratory well. The drilling plan must specify the proposed drilling program, sampling, coring, and testing procedures.

(5) Abandonment Plan.

(B) CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT

(1) A map showing the location of the proposed injection wells or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

(2) A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone, confining zone, or proposed monitoring zone. Such data shall include a description of each well's type, construction, data drilled, location, depth, record of plugging and/or completion, and any additional information the Department may require.

(3) Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

(4) Maps and cross sections detailing the hydrology and geologic structures of the local area.

(5) Generalized maps and cross sections illustrating the regional geologic setting.

(6) Proposed operating data.

a. Average and maximum daily rate and volume of the fluid to be injected;
b. Average and maximum injection pressure; and,
c. Source and an anlysis of the chemical, physical, radiological and biological characteristics of injection fluids.

(7) Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

(8) Proposed stimulation program.

(9) Proposed injection procedure.

(10) Engineering drawings of the surface and subsurface construction details of the system.

(11) Contingency plans to cope with all shut-ins or well failures, so as to protect the quality of the waters of the State as defined in Florida Administrative Code Rule 17-3, including alternate or emergency discharge provisions.

(12) Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Florida Administrative Code Rule 17-28.25.

(13) For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Florida Administrative Code Rule 17-28.13(5).

(14) Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids from surficial aquifers, proposed blowout protection (if necessary), and a drilling, testing and coring program.

(15) A certification that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Florida Administrative Code Rule 17-28.27(9).

(C) **CLASS I INJECTION WELL OPERATING PERMIT**

(1) A report shall be submitted with each application for a Class I well operation permit, which shall include, but not be limited to, the following information:

a. Results of the information obtained under the construction permit described in (B)-CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT, including:

1. All available logging and testing program data and construction data on the well or well field;

2. A satisfactory demonstration of mechanical integrity for all new wells pursuant to Florida Administrative Code Rule 17-28.13(6)(b);

3. The actual operating data, including injection pressures versus pumping rates where feasible, or the anticipated maximum pressure and flow rate at which the permittee will operate, if approved by the Department;

4. The actual injection procedure;

5. The compatibility of injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone; and,

6. The status of corrective action on defective wells in the area of review.

b. Record drawings, based upon inspections by the engineer or persons under his direct supervision, with all deviations noted;

c. Certification of completion submitted by the engineer of record;

d. If requested by the Department, operation manual including emergency procedures;

e. Proposed monitoring program and data to be submitted;

f. Proof that the existence of the well has been recorded on the surveyor's plan at the county courthouse.

g. Proposed plugging and abandonment plan pursuant to Florida Administrative Code Rule 17-28.27(2).

(D) **CLASS I WELL PLUGGING AND ABANDONMENT PERMIT**

(1) The reasons for abandonment.

(2) A proposed plan for plugging and abandonment describing the preferred and alternate methods, and justification for use.

a. The type and number of plugs to be used;

b. The placement of each plug including the elevation of the top and bottom;

c. The type and grade and quantity of cement or any other approved plugging material to be used;

d. The method for placement of the plugs.

(3) The procedure to be used to meet the requirements of Rule 17-28.27.

(E) **CLASS III WELL CONSTRUCTION/OPERATION/PLUGGING AND ABANDONMENT PERMIT**

Construction Phase

(1) A map showing the location of the proposed injection wells or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

(2) A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone, confining zone, or proposed monitoring zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Department may required.

(3) Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

(4) Maps and cross sections detailing the hydrology and geologic structures of the local area.

(5) Generalized maps and cross sections illustrating the regional geologic setting.

(6) Proposed operating data:

a. Average and maximum daily rate and volume of the fluid to be injected;

b. Average and maximum injection pressure; and,

c. Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids, including any additives.

(7) Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

(8) Proposed stimulation program.

(9) Proposed injection procedure.

(10) Engineering drawings of the surface and subsurface construction details of the system.

(11) Contingency plans to cope with all shut-ins or well failures or catastrophic collapse, so as to protect the quality of the waters of the state as defined in Florida Administrative Code Rule 17-3, including alternate or emergency discharge provisions.

(12) Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Florida Administrative Code Rule 17-28.25.

(13) For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Florida Administrative Code Rule 17-28.13(5).

(14) Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids form surficial aquifers, and a drilling, testing and coring program.

(15) A certificate that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Florida Administrative Code Rule 17-28.27(9).

(16) Expected changes in pressure, native fluid displacement, direction of movement of injection fluid.

(17) A proposed monitoring plan, which includes a plan for detecting migration of fluids into underground sources of drinking water, a plan to detect water quality violation in the monitoring wells, and the proposed monitoring data to be submitted.

Operation Phase

(1) The following information shall be provided to the Department prior to granting approval for the operation of the well or well field:

a. All available logging and testing program data and construction data on the well or well field;

b. A satisfactory demonstration of mechanical integrity for all new wells pursuant to Florida Administrative Code Rule 17-28.13(6)(b);

c. The actual operating data, including injection pressure versus pumping rate where feasible, or the anticipated maximum pressure and flow rate at which the permittee will operate, if approved by the Department;

d. The results of the formation testing program;

e. The actual injection procedure;

f. The status of corrective action on defective wells in the area of review.

Plugging and Abandonment Phase

(1) The justification for abandonment.

(2) A proposed plan for plugging and abandonment describing the preferred and alternate methods.

a. The type and number of plugs to be used;

b. The placement of each plug including the elevation of the top and bottom;

c. The type and grade and quantity of cement or any other approved plugging material to be used;

d. The method for placement of the plugs.

(3) The procedure to be used to meet the requirements of Florida Administrative Code Rule 17-28.27.

(F) CLASS V WELL CONSTRUCTION PERMIT. (This form should be used for Class V wells instead of Form 17-1.209(1) when there is a need for a Technial Advisory Committee and an engineering report.)

(1) Type and number of proposed Class V Wells:

Wells Receiving Domestic Waste _____ Salt-water Intrusion Barrier Wells _____

Cooling Water Return Flow Wells, Open-looped System _____ Subsidence Control Wells _____

Sand Backfill Wells _____

Experimental Technology Wells _____

Radioactive Waste Disposal Wells* _____

Other non-hazardous Industrial or Commercial Disposal Wells (explain) _____

Wells used to inject spent brine after halogen recovery _____

Borehole Slurry Mining Wells _____

Other (explain) _____

*Provided the concentrations of the waste do not exceed drinking water standards contained in Chapter 17-22, F.A.C.

(2) Project Description:

a. Description and use of proposed injection system;

b. Nature and volume of injected fluid (The Department may require an analysis (including bacteriological analysis) in accordance with Florida Administrative Code Rule 17-4.27(2)(c));

c. Proposed pretreatment.

(3) Water well contractor's name, title, state license number, address, phone number and signature.

(4) Well Design and Construction Details. (For multi-casing configurations or unusual construction provisions, an elevation drawing of the proposed well should be attached.)

a. Proposed total depth;

b. Proposed depth and type of casing(s);

c. Diameter of well;

d. Cement type, depth, thickness;

e. Injection pumps (if applicable):_____gpm @____psi
Controls:_____
_____
_____

(5) Water Supply Wells - When required by Florida Administrative Code Rule 17-4.27, attach a map section showing the locations of all water supply wells within a one (1) mile radius of the proposed well. The well depths and casing depths should be included. When required by Rule 17-4.27(2)(g), results of bacteriological examinations of water from all water supply wells within one (1) mile and drilled to approximate depth of proposed well should be attached.

(6) Area of Review (may be required at Department's discretion).

Include the proposed radius of the area of review with justification for that radius. Provide a map showing the location of the proposed injection well or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and

subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

(G) **CLASS V WELL OPERATION PERMIT** (Final report of the construction that includes the following information may be submitted with the application to operate.)

(1) Permit Number of Class V Construction Permit: _____

(2) Owner's Name: _____

(3) Type of Well: _____

(4) Construction and Testing Summary:

a. Actual Dimensions:

Diameter _____ inches; Well Depth _____ feet; Casing Depth _____ feet.

_____ _____ _____

_____ _____ _____

b. Results of Initial Testing.

(5) Proposed Operating Data:

a. Injection Rate (GPM);

b. Description of injected waste;

c. Injection pressure and pump controls.

(6) Proposed Monitoring Plan (If any):

a. Number of monitoring wells;

b. Depth(s);

c. Parameters;

d. Frequency of sampling;

e. Instrumentation (if applicable) Flow _____

Pressure _____

(H) **CLASS V WELL PLUGGING AND ABANDONMENT PERMIT**

(1) Permit number of Class V construction or operating permit.

(2) Type of well.

(3) Proposed plugging procedures, plans and specifications.

(4) Reasons for abandonment.