10.01 SCOPE OF WORK

The work covered by this section of the specifications consists in furnishing all labor, equipment and material necessary to perform the installation of a Type I water supply well per these specifications, and most current Michigan Safe Drinking Water Act, 1976 PA 399, as amended, and the Administrative Rules promulgated thereunder (SDWA) and the Michigan Water Well Construction and Pump Installation Code, Part 127, of 1978 PA 368, as amended, and the Administrative Rules promulgated thereunder (Well Construction Code).

10.02 CONSTRUCTION OF NEW WELL

A. Construct _____ new ____ well(s) capable of producing _____ gallons per minute at above ground discharge head of _____ feet. The well(s) shall be constructed where shown on the plans. This shall be well number(s) _____. The well construction shall strictly adhere to the requirements of the Michigan Department of Environmental Quality for public water systems and shall be performed by a state certified well driller.

The well pump assembly proposed by the well driller to be installed shall first be approved by the Design Engineer (with concurrence of the Township Engineer). Contractor shall submit performance curves and other related technical information per specifications Section 1.10.

B. Well Casing

The well casing(s) shall consist of steel with a minimum inside diameter of _____ inches and shall meet the requirements set forth in the most current Safe Drinking Water Act (P.A. 399) and the Well Construction Code. Pipe shall meet the standard thickness requirements according to the Great Lakes Upper Mississippi River Board of State Public Health and Environmental Managers Recommended Standards for Water Works as amended (Ten States Standards). The casing must meet the requirements of NSF International (NSF) Standard 61 and shall be new and watertight throughout its length and shall have welded or threaded joints in accordance with all applicable codes and standards.

C. Pitless Adapter

The pitless adapter(s) shall be new, shop fabricated from the point of connection with the well casing to the unit cap or cover, constructed of materials and weight equivalent and compatible with the casing, be of watertight construction, frost proof, threaded or welded to the casing and utilize a contamination-proof entrance connection for electrical supply and

conform to SDWA and the Well Construction Code. For well casings up to and including 12-inches in diameter, the pitless adapter shall possess an inside diameter equal to the inside diameter of the well casing. The pitless adapter shall be as manufactured by Baker, or approved equal.

D. Well construction shall be performed in accordance with the Michigan Water Well Construction and Pump Installation code utilizing rotary boring or other approved method. The required open annular space outside of the outer casing shall be completely sealed with a neat cement grout or by an equivalent method.

E. Grouting shall be neat cement weighing at least 15 pounds per gallon and shall be placed under pressure starting at the bottom of the casing. Grouting shall conform to the Department of Environmental Quality (DEQ) Water Division's (WD) Policy and Procedure DWRP-03-016, "Grouting of Community Water Supply Wells" and the Well Construction Code. Grouting shall be a continuous operation stopping only after the grout material flows from the ground at the top of the casing.

F. Well Screen: The well screen shall be new, stainless steel as manufactured by Johnson Screen or approved equal. The slot size and configuration shall be determined by a recognized well screen manufacturer from soil samples extracted during the well drilling operation. The screen manufacturer shall submit his recommendations to the Design Engineer for approval.

G. Disinfection: After the well has been completely constructed, it shall be thoroughly cleaned of all foreign substances, including tools, timbers, rope, debris of any kind, cement, oil, grease, joint dope and scum. The casing pipe shall be thoroughly swabbed using alkalis, if necessary, to remove oil, grease or joint dope. The well shall then be disinfected with a chlorine solution, and conform to the American Water Works Association (AWWA) Standard C645-97 and the Well Construction Code.

The chlorine solution used for disinfecting the well shall be of such volume and strength and shall be so applied that a concentration of at least 50 ppm of chlorine shall be obtained in all parts of the well. Chlorine solution shall be prepared and applied in accordance with the directions of, and to the satisfaction of the Township Engineer, but for at least two (2) hours.

In the event that the test pump is installed after the well has been disinfected, all exterior parts of the test pump coming in contact with the water shall be disinfected with chlorine solution.

After the contact period, the well shall be flushed until the chlorine residual is eliminated. Chlorinated water shall be disposed of in a manner that will not damage vegetation, wildlife, or aquatic life. Under no circumstances shall chlorinated water be discharged into a natural waterway.

After flushing of the chlorine from the well is complete, the well shall be allowed to stand for 24 hours. Samples will then be drawn from the well sample tap for bacteriological analysis. The well shall be allowed to stand for an additional 24 hours at which time a second sample shall be analyzed. Bacteriological analysis shall be performed by a state approved drinking water testing laboratory. Two consecutive negative (clean) samples are required for acceptance.

H. Samples and Records: The Contractor shall keep an accurate record of the location of the top and bottom of each stratum penetrated. An accurate copy of the "Driller's Log" shall be submitted to the Township Engineer.

10.03 WELL TEST PUMPING FOR NEW WELL

A. Well Development: The test well shall be thoroughly developed to remove all appreciable amounts of loose material from the formation. Development shall be done by the use of a close fitting surge block mounted on a drilling tool or pipe heavy enough to cause the surge block to sink rapidly. This assembly shall be operated in an up-and-down drilling motion by means of the well drilling machine at the rate of 30 to 40 strokes per minute. The material pulled into the well shall be bailed out periodically. The development operation shall continue until only a negligible amount of sand is pulled into the well.

The Contractor shall establish, by trial, the maximum pumping rate possible at or below the required maximum value, which can be maintained throughout test period without breaking suction.

B. Test Pumping: Each proposed production well shall be test pumped separately for a period as outlined in 10.03C of these specifications. Test pumping shall conform to the DEQ WD's Policy and Procedure DWRP-03-003, Rev. #1 – 06/2002, "Aquifer Test Requirements for Public Water Supply Wells." The test pump measurements shall be taken and recorded per 10.03G of these specifications. The test pump shall be capable of producing at least the maximum gallon-per-minute rate specified. The pump test must start at a full condition of rest in the system; to achieve this it is advisable not to pump for one day prior to the test. The withdrawal rate should be held constant throughout the test.

C. Duration of Pump Test: The duration of the pump test shall be twenty-four hours at a continuous and unvarying rate of flow unless otherwise specified. The pump test shall be monitored by the Contractor with reports filed with the Design Engineer and Township Engineer.

D. Water Disposal: If the production formation has 10 feet of clay cover, there is no concern regarding water entering the well. If less than 10 feet, the waste water should be carried to the nearest body of open water, or to a distance of 350 feet from the well making use of any slope which will carry the water further from the well or its observation points. In all cases, water shall be disposed of in a manner so as to guard against damage to property.

E. Determination of Flow: The rate of flow during the test shall be measured by the use of a circular orifice weir. A glass tube will be used to determine the head in the discharge pipe.

Other methods for measuring the rate of flow can be used only on approval of the Township Engineer.

F. Procedure in Determining the Water Level in the Well: A water sensing electrode-type of water level indicator shall be used for this purpose.

G. Test Pump Measurement Intervals: During the pump test referenced in 10.03B and 10.03C of these specifications, simultaneous readings of the pump rate and drawdown measurements in the observation wells and production well, to the nearest 0.01 feet, shall be made and recorded at the following intervals:

ELAPSED TIME	FREQUENCY OF MEASUREMENT
0 to 10 minutes	1 per minute
10 to 20 minutes	Every 2 minutes
20 to 60 minutes	Every 5 minutes
60 to 180 minutes	Every 15 minutes
180 to 360 minutes	Every 30 minutes
360 to completion	Every 60 minutes

(Elapsed time shall be from the beginning of the test pumping)

During the recovery period, which shall be 1/3 as long as the pumping test period, water level reading shall be taken in each observation well and the production well according to the schedule above.

H. Remarks:

1. If there is a nearby lake or stream, hourly readings of its level should be made throughout the test.

2. Breakdowns – Water Table Conditions: If a breakdown occurs during the first hour of pumping, rest one hour before starting again. Continue to take water levels during down period. Breakdown during second hour: 5 minutes may be tolerated – third hour: 10 minutes – fourth hour: 15 minutes. Add 5 minutes for each hour of pumpage thereafter for a maximum of 30 minutes. For more than 30 minutes, start over.

3. Breakdowns – Artesian Conditions: Not over 5 minutes permissible during first 3 hours, nor more than 10 minutes for remainder of test.

I. Observation Well: At least two (2) observation wells are required per P.A.399 requirements. A production well may be used as one of the observation wells during the pump testing of another well as approved by the Township Engineer. Sections 10.03F and 10.03G shall apply to the observation wells.

J. Water Samples: A one (1) gallon water sample shall be collected at six (6) hour intervals during the end of the pumping test (well efficiency test). These samples must be analyzed for organic and inorganic chemicals, including Phase II/V compounds (nitrates, nitrites, certain metals, organic chemicals, and radiochemicals), per MDEQ WD's requirements. The Contractor shall have a complete chemical analysis run on the last sample taken by a laboratory acceptable to both the Township Engineer and the Contractor. The remainder of the samples shall be retained by the Contractor for safekeeping.

10.04 NEW PUMP FOR EXISTING WELL

A. The pump in the existing _____ inch well shall be removed and a new well pump shall be installed. The new well pump shall be capable of producing ____ gallons per minute at above ground discharge head of _____ feet. Depth of pump setting shall be at least _____ feet as shown on the attached drawing.

B. Well driller shall submit data, performance curves, etc. on pump assembly he intends to install to the Design Engineer prior to proceeding.

The Design Engineer shall issue a set of this information to the Township Engineer for his review and approval.

C. Turbine pumps shall be utilized for wells with proposed production rates greater than 1,000 GPM. No submersible turbine pumps will be allowed for this condition.

10.05 TURNOVER PACKAGE FOR WELLS

Upon completion of production well test pumping, the Contractor shall submit to the Design Engineer the following items:

A. Water Well and Pump Record (Driller's Log) for each well.

B. Copies of shop drawings, including pump characteristic curves, for the production pump installed in each well.

C. Copies of the measurements recorded, to the nearest 0.01 feet, taken during the test pumping and recovery of each well (in tabular form).

D. Copies of the complete chemical analysis for each water sample tested.

E. Within thirty (30) days of receiving the Contractor's information, the Design Engineer shall submit to the Township Engineer for review the following information in a bound format:

1. Well Logs for the production well(s).

2. A drawdown vs. time plot of the test pumping data for each production well on semi-log paper including recovery.

3. A summary of aquifer analysis results based on the information from each observation well obtained during the pump test for each production well. This summary shall include computations for coefficient of storage along with the average of these for each production well.

4. A plot of the system head curve and pump curve for each production well.

5. A location map showing each production well and the well cross section based on the well driller's log.

6. Water quality analysis results from the requirements of Section 10.03J of these specifications.

7. An overall water system map for the piping system utilizing the production wells.