

## **SECTION 32 80 00 IRRIGATION SYSTEM**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. The CONTRACTOR must provide a landscape irrigation system and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The system will be manually operated (or) electric solenoid controlled underground irrigation system.
- C. The WORK includes:
  - 1. Well pumps and appurtenances.
  - 2. Water storage tank and appurtenances.
  - 3. Piping, fittings, and miscellaneous accessories.
  - 4. Valves, sprinkler heads, and controllers.
  - 5. Geo-composite drain.
  - 6. Auxiliary house architecture.
  - 7. Testing, adjusting, and balancing.

#### **1.02 RELATED REQUIREMENTS**

- A. DIVISION 26 – ELECTRICAL
- B. DIVISION 33 – UTILITIES

#### **1.03 REFERENCE STANDARDS**

- A. Vietnamese Standards.
  - 1. Technology standards
    - a. Vietnam standard TCVN 4419:1987: Exploration for construction - Basic principles.
    - b. Vietnam standard TCVN 9432:2012: Investigation, evaluation and exploration of minerals.
    - c. Vietnam standard Circular No. 08/2015/TT-BTNMT dated February 26, 2015 of the Ministry of Natural Resources and Environment regulating experimental water pumping techniques in investigation and assessment of underground water resources.
    - d. Vietnam standard QCVN 09-MT:2015/BTNMT: National technical regulation on ground water quality and Circular No. 66/2015/TT-BTNMT dated December 21, 2015 of the Ministry of Natural Resources and Environment promulgating national technical regulations on environment.
    - e. Vietnam standard TCVN 6663-1:2011: Water quality – Sampling.
    - f. Vietnam standard Relevant current standards and regulations.
    - g. Vietnam standard check valve, connection according to ISO 5996, BS 5159 or equivalent.
    - h. Vietnam general standards ISO, DIN, BS, AWWA and other equivalent standards.
    - i. Standard steel pipes and fittings: ATSM A53, PN10 or equivalent.
    - j. Vietnam standards on water supply and drainage systems in houses and works.
    - k. Vietnam Construction Regulations - volume II published in 1997.
    - l. Vietnam standard TCXDVN 33:2006: Water supply – Distribution system and facilities – Design standard.
    - m. Vietnam standard QCVN 07-9:2016/BXD: National Technical Regulation - Technical Infrastructure Works - Solid Waste Treatment and Public Toilet.

- n. Vietnam standard QCVN 07-2:2016/BXD: National Technical Regulation - Technical Infrastructure - Works Sewerage.
  - o. Vietnam standard TCVN 3989:2012: System of documents for building design - Water supply and drainage - External network - Working drawings.
  - p. Vietnam standard TCVN 8423:2010: Hydraulic structure – Irrigation and drainage pumping station – Requirement for hydraulic design.
2. Architectural part standards – design standards
- a. Design standards
  - b. Vietnam Construction Code.
  - c. National technical regulation on construction planning – according to Decision No. 04/2008/QĐ-BXD.
  - d. Vietnam standard QCVN 10:2014/BXD: National Technical Regulation on Construction for Disabled Access to Buildings and Facilities.
  - e. Vietnam standard QCVN 09:2013/BXD: National Technical Regulation on Energy Efficiency Buildings.
  - f. Vietnam standard QCVN 07-4:2016/BXD: National Technical Regulation - Technical Infrastructure Works - Transportation Infrastructure.
  - g. Vietnam standard QCVN 06:2010/BXD: Vietnam Building Code on Fire Safety of Buildings.
  - h. Vietnam standard QCVN 05:2008/BXD: Vietnam Building Code - Dwellings and Public Buildings - Occupational Health and Safety.
  - i. Vietnam standard QCVN 03:2012/BXD: National Technical Regulation on Rules of Classifications and Grading of Civil and Industrial Buildings and Urban Infrastructures.
  - j. Vietnam standard QCVN 01:2008/BXD: Vietnam Building Code - Regional and Urban Planning and Rural Residential Planning.
  - k. Vietnam standard TCVN 4451:2012: Dwellings – Basic principles for design.
  - l. Vietnam standard TCVN 4319:2012: Public Buildings – Basic rules for design.
  - m. Vietnam standard TCXDVN 276:2003: Public Building. Basic rules for design.
  - n. Vietnam standard TCVN 3905:1984: Dwellings and public buildings - Geometrical parameters.
  - o. Vietnam standard TCXD 13:1991: Grades for dwellings and civil works - General principles.
  - p. Vietnam standard TCXD 150:1986: Sound isolation for dwellings - Design standard.
  - q. Vietnam standard TCXDVN 175:2005: Maximum permitted noise levels for public buildings – Design standard.
  - r. Vietnam standard TCVN 5568:2012: Dimensional coordination to modules in building – Basic principles.
  - s. Vietnam standard TCVN 2622:1995: Fire prevention and protection for buildings and structures - Design requirements.
  - t. Vietnam standard TCXDVN 264:2002: Buildings and facilities – Basic rules of accessible design and construction for people with disabilities.
3. Architectural part standards – Construction and acceptance standards
- a. TCVN 4447:2012: Earth works - Construction, check and acceptance.
  - b. Vietnam standard TCXDVN:170: 2007: Steel structures – Fabrication, assembly, check and acceptance – Technical requirements.
  - c. Vietnam standard TCVN 4453:1995: Monolithic concrete and reinforced concrete structures - Codes for construction, check and acceptance.
  - d. Vietnam standard TCXDVN 305:2004: Mass concrete

- e. Vietnam standard TCVN 9340:2012: Ready-mixed concrete - Specification and acceptance.
  - f. Vietnam standard TCVN 5593:2012: Building engineering - Permissible tolerances in geometry.
  - g. Vietnam standard TCVN 8828 : 2011: Concrete - Requirements for natural moist curing.
  - h. Vietnam standard TCVN 9377-2:2012: Finish works in construction - Execution and acceptance.
  - i. Vietnam standard TCVN 4085:2011: Masonry structures - Code for construction and acceptance
  - j. Vietnam standard TCVN 8652:2012: Wall emulsion paints.
4. Architectural part standards – Material standards
- a. Vietnam standard TCVN 7570:2006: Aggregates for concrete and mortar.
  - b. Vietnam standard TCVN 4506 : 2012: Water for concrete and mortar.
  - c. Vietnam standard TCVN 7570:2006: Aggregates for concrete and mortar.
  - d. Vietnam standard TCVN 9205 : 2012: Crushed sand for concrete and mortar.
  - e. Vietnam standard TCVN 7132 : 2002: Ceramic floor and wall tiles.
  - f. Vietnam standard TCVN 4314 : 2003: Mortar for masonry.
  - g. Vietnam standard TCVN 9366-2:2012: Doors and windows- Part 2: Metallic doors and windows.
  - h. Vietnam standard TCVN 7455:2013: Glass in building.
  - i. Vietnam standard TCVN 9258:2012: Heat protection for residential buildings.
  - j. Vietnam standard ISO 4427:2007: Plastic piping systems.
5. Architectural part standards – Experimental standards
- a. Vietnam standard TCXDVN 336:2005: Adhesives for tiles – specification and testing methods.

**B. American Standards.**

1. American Society for Testing and Materials (ASTM) Publications:
  - a. ASTM D 2241-89 Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)
  - b. ASTM D 2466-90a Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
  - c. ASTM D 2564-91 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
  - d. ASTM D 2855 Standard Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
2. National Electric Code
3. Local Plumbing Code
4. Standard Plumbing Procedure

**1.04 SUBMITTALS**

- A. Submit submittals in accordance with SECTION 01 33 00 – SUBMITTAL PROCEDURES.
- B. Product Data: Submit for ENGINEER/CONSTRUCTION MANAGER approval:
1. Shop Drawings showing complete layout of pumps, piping and installation details
  2. Complete materials list.
  3. Information on controller.
  4. Manufacturer's installation instructions which, when approved, shall become the basis for inspection and acceptance or rejection of installed work.

- C. Certificate of Compliance: Indicating that all installed materials comply with the specified requirements.
- D. Record Irrigation Drawings: The CONTRACTOR is responsible to prepare two (2) copies of record drawings on blue-line prints which shall show all deviations from the bid documents made during construction. The drawings shall indicate and show approved substitutions of size, material and manufacturer's name and catalog number. The drawings shall be delivered to the ENGINEER/CONSTRUCTION MANAGER prior to final acceptance of work.
- E. Sand Backfill: Provide sample of sand to be used in trench backfill for approval. Sand shall be clean and free flowing, free of rock, clay clods and other deleterious material.

#### **1.05 QUALITY CONTROL AND ASSURANCE**

- A. The CONTRACTOR shall be specialized in commercial landscape irrigation installation and shall be approved by the OWNER's designated representative.
- B. Installer Qualifications: Project foreman shall have a minimum of three years of experience in the installation of irrigation systems. Foreman shall be always present during the installation of the irrigation system.
- C. Irrigation work shall comply with all local Plumbing and Electrical Codes in Vietnam.
- D. All work shall be supervised on the site by a Licensed Irrigator in Vietnam.
- E. Plastic pipe shall be certified by Manufacturer to have passed or be able to pass Anhydrous Acetone Immersion Test.
- F. Do not allow irrigation system work to be covered up or enclosed until all work has been inspected, tested, and approved by ENGINEER/CONSTRUCTION MANAGER.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials in manufacturer's original, unopened packaging with all factory-applied tags, labels, and other identifying information intact, legible, and accurately representing material on approved submittals. Transport plastic pipe on a vehicle long enough to allow pipe to lay flat without bending.
- B. Storage:
  1. Store all materials under weather-proof cover, off the ground and away from other construction activities.
  2. Do not store material in a manner that would create a humidity chamber. Provide for free movement of air under protective cover and between components of the fencing.
  3. Do not install items that become cracked, broken, or otherwise damaged or non-functional. In the event of damage, repair or replace at no additional cost to Owner.
- C. Handling: Handle material in manner that is in compliance with manufacturer's recommendations.
- D. Extra Materials:
  1. Furnish extra components:
    - a. Two sprinkler heads of each type and size. CONTRACTOR must furnish extra if required by the OWNER.
    - b. Two valve box keys. CONTRACTOR must furnish extra if required by the OWNER.
    - c. Two wrenches for each type head core and for removing and installing each type head. CONTRACTOR must furnish extra if required by the OWNER.

## **1.07 WARRANTY**

- A. Provide 2 year manufacturer warranty for materials: equipment and piping and 5-year warranty for installation.
- B. General Warranty: The special warranties specified in this Section must not deprive the OWNER of other rights or remedies that OWNER may otherwise have under the Contract Documents and must be in addition to and run concurrent with other warranties made by CONTRACTOR under the Contract Documents.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Minimum product standards are specified below.

### **2.02 PIPES AND FITTINGS**

- A. Pipe sizes as shown on the drawings. Pipe materials include HDPE, stainless steel, and as shown on the drawings.
- B. Fittings must be the same size as the piping served.
- C. Pipes and fittings must meet performance requirements for pressure applications and per design standards.

### **2.03 VALVES**

- A. Wire and Splices: As per design standards.
- B. Electric Controller and Valves: Not needed for this project.
- C. All valves shall be enclosed in a valve box. This valve box shall be properly supported and of sufficient construction that tractors and mowers crossing over the box will not push the box down and crush the pipe, valve, or box. All valve boxes and related equipment shall include purple non-potable covers and related markings.
- D. Manual Control Valves: All manual valves shall be as shown in the Plans or approved equal.
- E. Valve parameter
  - 1. Maximum working pressure: 10 Bar.
  - 2. Maximum working temperature: -150° C/+1300° C.
  - 3. Valve body material: cast iron.

### **2.04 SPRINKLER HEADS**

- A. Sprinkler heads guaranteed to indefinitely withstand corrosive action of soils and water used with purple designation for non-potable.
- B. Sprinkler heads shall be designed to provide uniform coverage over entire area of spray at available water pressure.
- C. Rotary type sprinkler head: Pop-up type with screens; fully adjustable for flow and pressure; size as needed; with letter or symbol designating degree of arc and arrow indicating center of spray pattern.

- D. Spray Type Sprinkler Head: Pop-up head with full circle, half circle, third circle, quarter circle, and square pattern.
- E. Sprinkler head specifications:
  1. Flow = 0,5 - 1,0 (m<sup>3</sup>/h).
  2. Working pressure: 2,0 - 5,0 bar.
  3. Irrigation radius: 11 - 12 m.
  4. Adjust angle: rotate 360 degrees.

**2.05 WELL PUMPS AND TANK**

- A. Reinforced concrete tanks, concrete structural materials according to standards TCVN 4453:1995, TCXDVN 170:2007, and some related TCVN, TCXDVN.
- B. Water supply pump
  1. Furnish pumps of standard dimensions, built to limit gauges or formed to templates, such that parts will be interchangeable between like units.
  2. Components of each pump system provided under the pump Sections must be entirely compatible. Each unit of pumping equipment must incorporate basic mechanisms, couplings, electric motors, variable speed controls, necessary mountings, and appurtenances.
  3. Operating Conditions:

Flow	28 m <sup>3</sup> /h
Pressure head	28 m H <sub>2</sub> O
Maximum working pressure	25 Bar
Maximum working temperature	-15°C/+120°C
Efficiency	≥ 75%
Impeller Pump	304 stainless steel (minimum)
pump housing	Stainless Steel
Pump shaft	Stainless Steel
Pump base	Cast iron

- C. Bore wells
  1. Furnish pumps of standard dimensions, built to limit gauges or formed to templates, such that parts will be interchangeable between like units.
  2. Components of each pump system provided under the pump Sections must be entirely compatible. Each unit of pumping equipment must incorporate basic mechanisms, couplings, electric motors, variable speed controls, necessary mountings, and appurtenances.
  3. Operating Conditions:

## 2.06 AUXILIARY HOUSE ARCHITECTURE

Flow	10-15 m <sup>3</sup> /h
Pressure head	35-40 mH <sub>2</sub> O
Maximum working pressure	25 Bar
Maximum working temperature	-15°C/+120°C
Efficiency	≥ 75%
Impeller Pump	304 stainless steel minimum
pump housing	Stainless Steel
Pump shaft	Stainless Steel
Pump base	Stainless Steel

### A. Walls:

1. Take the solid or hollow grade 75 brick (190x85x50) as the standard. In practice, it can be replaced with a popular local brick, but must have the same size and effect. Walls are built and plastered with XM sand grade 75. Specifications for wall construction are according to TCVN 4085:2011.
2. Finishing wall surfaces: Walls are painted with 3 layers according to TCVN standards TCVN 8652:2012.

### B. Doors:

1. The entire door system has been classified according to symbols and introduced on the construction site drawings.
2. The outside glass door system is a high-quality door, according to TCVN 9366-2:2012, ensuring safety in the event of an incident. Has solidity and durability in the environmental conditions of the area. The way of structure and connection must ensure tight seal, withstand wind and rain and no water leads into the room.
3. High quality aluminum frame glass wall system, glass according to TCVN 7455-2013 standard, ensuring safety in case of incidents. Has solidity and durability in the environmental conditions of the area. The way of structure and connection must ensure tight seal, withstand wind and rain and no water leads into the room. Single layer white glass (tempered glass) - 10-19 mm thick glass, Double layer white box glass in which the outer layer is 8.38 mm thick laminated glass, the inner layer is 8mm thick, between 2 layers of inert gas-injected glass ensure sound insulation and insulation.

### C. Floor - floor - roof:

1. The entire foundation, floor, roof and ceiling have been classified according to symbols and introduced on the construction site drawings.
2. Floor – floor: Most of the floor structure is reinforced concrete. The finished surface layer is 50mm from the reinforced concrete floor structure (except for XM screed). Thus, the thickness of 50mm to perform (depending on different locations and types) includes tasks such as: leveling, slope creation, waterproofing, bonding glue and surface finishing materials.
3. Ceramic: according to TVCN 7132:2002.
4. Roof: Three layers of heat-resistant corrugated iron roof, 0.5mm thick corrugated iron layer, insulating pu layer, alufin film according to TCVN 9258:2012. Truss system made

of galvanized box steel with anti-rust paint treatment with welds.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. This part shall include the placing of all specified materials at the locations and elevations as shown in the Plans.
- B. The work performed here shall conform in every respect to the Contract Documents, the applicable local requirements, the applicable local ordinances and sanitary codes.
- C. Coordinate work with site landscape grading and delivery of plant life.

#### **3.02 SYSTEM DESIGN**

- A. Design Pressures: Water Supply pressures as required to irrigate the area as indicated on the Drawings.
- B. Design location of heads as necessary and evenly spread around the land for irrigation. Make adjustments as necessary to avoid obstructions.
- C. Piping, heads, valves, or other elements of the system must be installed in the planting area. If installed under paved areas running parallel or adjacent to planting areas, they must be provided with pipe sleeves as needed.
- D. Piping Layout: Piping layout has been designed to irrigate the area as shown on the Drawings. Route piping around any existing trees and shrubs in such manner as to avoid damage to plantings. The CONTRACTOR shall notify the ENGINEER/CONSTRUCTION MANAGER in writing of a planned change in trench routing from that shown on the design drawing.
- E. Storage tanks, auxiliary houses: calculated according to relevant construction standards to ensure safety in bearing, and aesthetics.
- F. CONTRACTOR's Responsibility: The CONTRACTOR shall not willfully install the irrigation system as shown on the design drawings when it is obvious in the field that obstructions, grade differences or discrepancies in equipment usage, static water pressure, or area dimensions exist that might not have been considered in the engineering. Such obstructions or differences shall be brought to the attention of the ENGINEER/CONSTRUCTION MANAGER in writing before work commences. In the event this notification is not performed, the CONTRACTOR shall assume full responsibility for any revision necessary.

#### **3.03 PREPARATION**

- A. Prior to start of irrigation work inspect site to verify that the system may be installed as indicated in design drawings. Do not begin work until unsuitable conditions have been corrected.
- B. Verify location of existing underground utilities prior to start of trenching.
- C. Field verify all dimensions and site pressure.
- D. Existing Utilities: If applicable:
  - 1. Locations and elevations of various utilities included with the scope of this work have been obtained from the most reliable sources available and should serve as a general guide without guarantee to accuracy. The CONTRACTOR shall examine the site and verify to his own satisfaction the locations and elevation of all utilities and availability of utilities and services required. The CONTRACTOR shall inform himself as to their relation to the work and the submission of bids shall be deemed as evidence thereof.

The CONTRACTOR shall repair, at his own expense, and to the satisfaction of the OWNER's designated representative, damage to any utility shown on or not shown on the plans, including civil plans for the project.

2. Should utilities not shown on the plans be found during excavations, CONTRACTOR should promptly notify designated representative for instructions as to further action.
3. CONTRACTOR shall make necessary adjustments in the layout as may be required to connect existing stubouts, conduit locations, etc., should such stubouts or locations not be located exactly as shown, and as may be required to work around existing work at no increase in cost to the OWNER. All such work will be recorded on as-built drawings and turned over to the OWNER's designated representative prior to final payment.

### **3.04 PIPING SYSTEM**

- A. Trenching:
  1. All lateral piping shall be buried a minimum of 300 mm below finished grade, or as shown on the drawings. All main piping must be installed with a minimum of 450 mm of cover, or as shown on the drawings.
  2. Trench to accommodate grade changes.
  3. Maintain trenches free of debris, material, or obstructions that may damage pipe.
  4. Do not leave trenches open overnight.
- B. Carefully inspect all pipe and fittings prior to installation. Remove all dirt, burrs and reaming.
- C. Lay pipe on solid subbase with markings up, uniformly sloped, as indicated.
- D. All piping passing under paving or other slabs more than 1,8 m wide shall be installed in PVC sleeves.
- E. Make all piping joints with specified solvent cement. Joints shall set a minimum of 15 minutes prior to handling or moving, and 24 hours prior to filling with water.
- F. Centerload piping with a small amount of backfill to prevent arching and whipping under pressure.
- G. Bed piping and backfill trenches with sand after all inspections and corrections have been made and the piping installation has been accepted by the ENGINEER/CONSTRUCTION MANAGER. Sand used as backfill shall be clean and free of rock, clay, and other deleterious material. CONTRACTOR shall provide a sample of sand for approval prior to delivery and placement.
- H. PVC pipe shall not be installed when there is water in the trench, nor shall PVC pipe be laid when temperature of 40 degrees or below or when rain is eminent. PVC pipe will expand and contract as the temperature changes. Therefore, pipe shall be snaked from side to side of trench bottom to allow for expansion and contracting.

### **3.05 EQUIPMENT**

- A. Well Pumps, Tank, Piping, Valves and Appurtenances: Before construction and installation, the CONTRACTOR must read the manufacturer's manual and submit the appropriate construction methods approved by the investor.
- B. Install pipe, valves, controls, and heads in accordance with manufacturer's instructions.
- C. Connect pumps to piping.
- D. Set outlets and box covers at finish grade elevations.

- E. Circuit Valves: Install in valve box, arranged for easy adjustment and removal, buried deep enough that valve box lid will not protrude above grade.
- F. Sprinkler Heads: Install in accordance with manufacturer written instructions.
  - 1. Impact Heads: Heads shall be installed as per the Plans.
  - 2. Thrust Blocking: All main line piping shall be installed with concrete thrust blocking. For thrust blocking of main line piping see Plans.

**3.06 TESTING, ADJUSTING, AND BALANCING:**

- A. Notify ENGINEER/CONSTRUCTION MANAGER a minimum of 48 hours prior to start of testing.
- B. Flushing:
  - 1. Prior to backfilling, with all control valves in place but before lateral pipes are connected, completely flush and test the main line and repair all leaks.
  - 2. Flush out each section of lateral pipe before sprinkler heads are attached.
- C. Testing: Furnish all required personnel and equipment to accomplish testing as follows:
  - 1. Thoroughly bleed line of all air and debris. Fill and maintain line full of water for a minimum period of 24 hours immediately prior to the test.
  - 2. After valves are installed, test all live water lines for leaks at a pressure of 999,7 kPa for a continuous period of 2 hours, with all couplings exposed and with all pipe sections center loaded.
  - 3. For Well Pumps: Before construction and installation, the CONTRACTOR must read the manufacturer's manual and submit the appropriate construction methods approved by the investor.
  - 4. Correct all leaks and retest until system is accepted by the ENGINEER/CONSTRUCTION MANAGER.
- D. Thoroughly clean, adjust, and balance all systems.
  - 1. Final Adjustment:
    - a. After installation has been completed, make final adjustment of sprinkler system preparatory to the ENGINEER/CONSTRUCTION MANAGER's designated representative's final inspection.
    - b. Completely flush system to remove debris from lines by removing nozzle from heads on ends of lines and turning on system.
    - c. Check sprinklers for proper operation and proper alignment for direction of throw.
    - d. Check nozzling for proper coverage. Prevailing wind conditions may indicate that arc of angle of spray should be other than as shown on drawings. In this case, change nozzles to provide correct coverage and furnish record data to ENGINEER/CONSTRUCTION MANAGER with each change.
    - e. The CONTRACTOR shall furnish all water necessary for testing, flushing and jetting unless noted otherwise.
- E. Demonstrate complete system to ENGINEER/CONSTRUCTION MANAGER:
  - 1. Show that all remote control valves are properly balanced and that all heads are properly adjusted for radius and arc coverage.
  - 2. Instruct and train OWNER's maintenance personnel in the operation, maintenance and monitoring of the irrigation system. Include contents of the OWNER's Manual.
  - 3. Provide flow analysis for one program cycle to be used as a reference for water usage. Utilizing flow information, create a predicted water use budget which conforms with site requirements and local water use restrictions.
  - 4. Guarantee and Maintenance:
    - a. The CONTRACTOR shall guarantee material and workmanship for one year after installation including repair and replacement of defective materials, workmanship and repair of backfill settlement. CONTRACTOR shall provide maintenance for one year after installation.

- b. Maintenance shall include, but not necessarily be limited to, the following:
  - (i) Adjustment of sprinkler height and plumb to compensate for settling.
  - (ii) Adjustment of head coverage as necessary.
  - (iii) Unstopping heads plugged by foreign material.
  - (iv) Adjustment of controller as necessary to insure proper performance.
  - (v) Cleaning to insure heads pop-up and pop-down properly.
  - (vi) All maintenance necessary to keep the system in good operating order.
  - (vii) Provide follow up water use analysis with OWNER's personnel to determine compliance with original water use budget.

END OF  
SECTION