COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the matter of:

APPLICATION OF THE LEVEE ROAD WATER ASSOCIATION FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT AN IMPROVEMENT PROJECT PURSUANT TO KRS 278.020	)))))	**Case No.** 2005-00535

APPLICATION

The Levee Road Water Association (the "Association"), by counsel, pursuant to KRS 278.020, petitions the Commission for a certificate of public convenience and necessity to construct a waterworks improvement project. The following information is filed in accordance with the Commission's regulations:

1. The Association's office address is P.O. Box 770, 4969 Levee Road, Mt. Sterling, Kentucky 40353. Its principal officers are listed in its 2004 Annual Report, which is filed with the Commission;

2. The Association is a Corporation organized under KRS Chapter 273 and has presented its articles of incorporation, including amendments, herewith as **Exhibit A**;

3. A description of the Association's water system and its property stated at original cost by accounts is contained in its Annual Report, which is incorporated by reference pursuant to 807 KAR 5:001 Section (5) (5). All required normal financial schedules and other data are in the Annual Report;

4. The water system improvements project consists of the construction and installation of approximately 8,120 feet of 6" waterline, 100 feet of 8" waterline, a 122,000 gallon storage tank, and a new telemetry system;

5. The project is in the public interest and is necessary in order to enhance service to approximately 800 households with potable water;

6. The total project cost is approximately $461,300 as set forth in the Final Pre-Bid Engineering Cost Estimate attached hereto as **Exhibit B**;

7. The Association has, or will have, obtained all easements and properties as required for the Project;

8 This service will not compete with any other utility in the area;

9. Based on these facts, the Association believes that it is in the public interest that this certificate of public convenience and necessity be granted;

10. The following information is provided in response to 807 KAR 5:001 Section (8)(3);

a. Articles of Incorporation – A certified copy is attached as **Exhibit A**

11. The following information is supplied to 807 KAR Section (9)(2);

a. Facts relied upon to show that the Project is in the public interest: The project will enhance water service to approximately 800 households by providing increased storage capacity and increased operational capability.

b. No new franchises are required. Copies of the necessary permits are attached hereto as **Exhibit C**;

c. Plans showing the details of the proposed construction and technical specifications are submitted herewith (3 sets);

d. Three (3) maps of suitable scale showing location of the proposed facilities are filed with this Application and attached hereto as **Exhibit D.**

e. The construction costs will be fully funded by a "Tobacco Settlement Grant" (TSG) in the aggregate amount of $461,300. These funds do not have any "Federal" involvement;

f. The estimated cost of operation of the new portions of the system after construction is completed is attached hereto as **Exhibit E.**

WHEREFORE, the Applicant, Levee Road Water Association, requests that the Public Service Commission of Kentucky grant to the Applicant a Certificate of Public Convenience and Necessity permitting the Applicant to construct the water system improvement project.

Levee Road Water Association

By: Jimmy Linkous
Chairman

Chenault Law

By: Myra D. Chenault
Chenault Law
127 W High St
Mt. Sterling, KY 40353
(859) 499-3610

COMMONWEALTH OF KENTUCKY)
) SS
COUNTY OF MONTGOMERY)

The undersigned, Mr. Jimmy Linkous, being duly sworn, deposes and states that he is the Chairman of the Levee Road Water Association, Applicant; that he has read the foregoing Application and has noted the contents thereof; that the same is true of his own knowledge, except as to matters which are therein stated on information or belief, and as to those matters, he believes same to be true.

IN TESTIMONY WHEREOF, witness the signature of the undersigned on this 7th day of Dec. 2005.

Jimmy Linkous
Jimmy Linkous
Levee Road Water Association

Subscribed and sworn to before me by Jimmy Linkous, Chairman of the Levee Road Water Association, on this 7th day of Dec., 2005

My Commission expires 8/31/09.

Paula M. Adkins
Notary Public, in and for said County and State

EXHIBIT A

Articles of Incorporation of

AMENDED ARTICLES OF INCORPORATION OF LEVEE ROAD WATER ASSOCIATION, INC.

Whereas, Articles of Incorporation were filed and a corporate charter issued by the Secretary of State of Kentucky on 20 July, 1970, and Whereas, said original Articles have been found not to comply with certain formal requirements of the U. S. Farmers Home Administration, and Whereas, the original Articles, Article XIII, provide "These articles and by-laws may be repealed or amended by a vote of the majority of the directors present at any regular meeting of the corporation or at any special meeting of the corporation for the purpose .....", and Whereas, these proposed Amended Articles of Incorporation hereafter set forth comply with the requirements of Farmers Home Administration and with Article XIII of the original Articles of Incorporation, and Whereas, the Board of Directors of the corporation at a special meeting held for that purpose on the 14 day of December, 1970, met and all being present or having waived notice of the meeting, and a quorum being present, unanimously voted to amend the Articles of Incorporation to read as follows.

Now the following Amended Articles of Incorporation are hereby adopted by Levee Road Water Association, Inc.

ARTICLE I
NAME

The name of this corporation shall be Levee Road Water Association, Inc.

ARTICLE II

REGISTERED OFFICE AND AGENT

The registered office of the corporation shall be at R. R. 2, Mt. Sterling, County of Montgomery, State of Kentucky; the registered agent at such address is Leonard Barrow.

ARTICLE III

PURPOSE

The purpose of the said corporation shall be to establish, develop, and operate a complete water supply and distribution system by purchase, development, or otherwise to construct reservoirs or water towers, erect pumping machinery, lay water mains, pipes and hydrants; to furnish and sell water to members of the corporation, public bodies and local businesses, for fire protection, drinking and general farm domestic use and collect payment for rental or sale of same and doing all things necessary, convenient and incidental thereto, and a complete sanitary and/or storm sewer collection system and treatment facilities by purchase, development, or otherwise to construct mains, submains, and laterals, treatment plant, lagoons, to furnish sewer service to members of the corporation, public bodies and local businesses, for sanitary and health protection and collect service payment for rental of same and doing all things necessary, convenient and incidental thereto.

ARTICLE IV

SEAL

This corporation shall have a seal, which seal shall contain the corporate name, Kentucky, and the words "corporate seal".

ARTICLE V

POWERS

This corporation shall have all powers provided by law.

ARTICLE VI

MEMBERSHIP

Persons may become members of the corporation as provided in the By-Laws.

ARTICLE VII

DURATION

The corporation shall have perpetual duration.

ARTICLE VIII

BOARD OF DIRECTORS

1. The affairs of this corporation shall be managed by a Board of five (5) directors to be elected by and from the members thereof and shall serve for three years and until their successors are elected. The size of the Board may not be changed except by amendment to these articles. At the first annual election, one director shall be elected for a term of one year; two directors shall be elected for a term of two years; and two directors shall be elected for a term of three years. Thereafter directors shall be elected for terms of three years.

2. The Board of Directors shall fill vacancies occurring in its own membership by appointment of qualified members to hold office until the next annual meeting of the membership at which meeting a member shall be elected to fill the unexpired term.

3. A majority of the directors must be present at a meeting to conduct the business of the corporation.

4. Until the first annual election, the following persons shall be directors:

NAME	ADDRESS
Leonard Barrow,	R.R. 2, Mt. Sterling, Ky 40353
Leslie Wilson,	R.R. 2, Mt. Sterling, Ky. 40353
Thomas Tipton,	R.R. 2, Mt. Sterling, Ky. 40353
Jas. Griffen, Jr.,	R.R. 2, Mt. Sterling, Ky. 40353
Joseph F. Murphy	R.R. 2, Mt. Sterling, Ky. 40353

and the following persons shall be officers:

President	Leonard Barrow	R.R. 2, Mt. Sterling, Ky. 40353
Vice President	Leslie Wilson	R.R. 2, Mt. Sterling, Ky. 40353
Secretary	Joseph F. Murphy	R.R. 2, Mt. Sterling, Ky. 40353
Treasurer	Thomas Tipton	R.R. 2, Mt. Sterling, Ky. 40353

5. The Board of Directors shall have their annual meeting after the annual meeting of members hereinafter provided for, at a time and place to be designated by the President, and will elect from their own number a President, Vice-President, Secretary and Treasurer. However, the offices of Secretary and Treasurer may be combined into one office.

6. The Board of Directors shall have other meetings as provided by the By-Laws.

ARTICLE IX

MEETINGS

1. The annual meeting of the members of this corporation for the purpose of electing directors and transacting such other business as may properly come before it at such time, shall be held on the second Monday in November of each year at the time and place specified by the Board of Directors.

2. Special meetings of the members of this corporation may be called by the President at any time or place within the county upon giving to each of the members a notice in writing mailed to his postal address as it appears in the corporation records at least ten (10) days prior to such meeting; and such meeting shall be called by him at any time upon written demand of the majority of the directors, or of any ten (10) members, and in case of his neglect or refusal to call such meetings, such directors or members shall unite in calling such meetings, which shall be the same as though called by the President. If the purpose of the meeting is to amend the articles, then the notice of meetings signed by the Secretary shall set forth the proposed amendment in substance. Articles may be amended by a two-thirds vote of the members present at such a meeting or voting by proxy.

ARTICLE X

INCORPORATORS

The names and addresses of the incorporators are:

NAME	ADDRESS
Leonard Barrow,	R.R. 2, Mt. Sterling, Ky. 40353
Leslie Wilson,	R.R. 2, Mt. Sterling, Ky. 40353
Thomas Tipton,	R.R. 2, Mt. Sterling, Ky. 40353
Jas. Griffen, Jr.,	R.R. 2, Mt. Sterling, Ky. 40353
Joseph F. Murphy,	R.R. 2, Mt. Sterling, Ky. 40353

ARTICLE XI

BY-LAWS

The corporation may make and amend By-Laws at its pleasure through its Board of Directors.

IN WITNESS WHEREOF, we have hereunto subscribed our names this 14 day of December, 1970.

Articles of Incorporation of

ARTICLES OF INCORPORATION OF LEWIS ROAD WATER ASSOCIATION, INC., A NON-PROFIT CORPORATION

This corporation is organized as a non-profit non-stock corporation under the provisions of Chapter 273 of the Kentucky Revised Statutes.

ARTICLE I:

GENERAL PURPOSES

The purpose for which this corporation is formed is to construct, purchase, lease, or otherwise acquire, maintain, operate and sell water works for the purpose of supplying manufactories, corporations, and individually with water and water power for domestic or business use. Also to construct, purchase, lease, or otherwise acquire, maintain and sell all necessary power houses, water towers, water mains, and pipes convenient for carrying on the aforesaid line of business.

ARTICLE II:

NAME, LOCATION, PROCESS AGENT, DURATION, AND INITIAL GOVERNING BODY

Section 1. The name of this corporation is Lewis Road Water Association, Inc.

Section 2. The principal office of this corporation shall be located at c/o Leonard Barrow, R.R. 2, Mt. Sterling, Montgomery County, Kentucky, but the corporation may maintain offices and places of business at such other places within the state as the Board of Directors may determine.

Section 3: The registered agent of this corporation is Leonard Barrow, R. R. 2, Mt. Sterling, Kentucky 40353.

Section 4: Duration of the corporation shall be perpetual.

Section 5: The undersigned incorporators shall constitute the Board of Directors until their successors are elected and qualified.

ARTICLES III:

SEAL

Section 1. The seal of the corporation [illegible] be as prescribed by the [illegible] of Directors.

Articles of Incorporation of

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Section 2. The secretary of the corporation shall have custody of the seal.

Section 3. The seal may be used by causing it or a facsimile thereof to be impressed or affixed or reproduced or otherwise.

ARTICLE IV:

FISCAL YEAR

The fiscal year of the corporation shall begin the first day of January in each year.

ARTICLE V:

MEMBERSHIP

Section 1. The holders of membership certificates of this corporation are its members. Any bona fide occupant of a dwelling, farm, or other property, including schools, churches, community and eleemosynary organizations, and where otherwise necessary by contract with said organization, corporation, etc., having reasonable accessibility to the source of and who is in need of having water supplied for domestic, livestock, and other purposes from the water system operated by the corporation and who receives the approval of the Board of Directors may be admitted to membership upon subscribing for or otherwise acquiring a membership certificate and by signing such agreements for the purchase of water as may be provided and required by the corporation; provided that no person otherwise eligible shall be permitted to subscribe for or acquire a membership of the corporation if the capacity of the corporation's water system is exhausted by the needs of its existing members. The membership fee shall be as prescribed by the Board of Directors.

Section 2. In case of the death of a member or if a member ceases to be eligible to hold membership as provided in Section 1, or willfully fails to comply with these Articles or by-laws and rules and requirements, or willfully obstructs the purposes and pro-

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activities of the corporation, the corporation, through the Board of Directors, may elect to purchase his membership certificate and terminate his membership upon tender to him or his heirs or legal representatives the membership fee less any indebtedness then due from him to the corporation. Any member whose membership is so terminated for cause other than that of ceasing to be eligible may appeal from the action of the Board of Directors to a vote of the members at the next regular meeting of the members or a special meeting of the members called for such purpose.

ARTICLE VI:

MEMBERSHIP CERTIFICATES

Section 1. This corporation shall not have capital stock, but its capital shall be represented by membership certificates.

Section 2. The membership certificates shall be issued to each holder or fully paid membership and shall be numbered consecutively, in accordance with the order of issue. Each membership certificate shall bear on its face the following statements:

A. This membership certificate, No. _____, is issued and accepted in accordance with and subject to the conditions and restrictions stipulated in the articles of incorporation and by-laws and amendments to the same of the Levee Road Water Association, Inc.

B. Transfers of membership certificates shall be made only upon the books of the corporation, only to persons eligible to become members, only with the approval of the Board of Directors and only when the member transferring is free from indebtedness to the corporation.

C. No member of this corporation shall be entitled to more than one vote at meetings of the members or to hold more than one of the membership certificates of the corporation. Every member upon becoming a member of this corporat

agrees to sign such agreement for the purchase of water from the corporation as may from time to time be provided and required by the corporation.

Section 3. All transfer of membership certificates shall be made upon the books of the corporation upon the surrender of the certificates covering the same by the holders thereof or by their legal representative but only with the approval of the Board of Directors and only to persons eligible to become members and only when the transferring member is free from indebtedness to the corporation.

Section 4. Each member agrees to sign such water user's agreements as the corporation shall from time to time provide and require.

ARTICLE VI

MEETINGS OF [illegible]

Section 1. Any meeting of the [illegible] of this corporation shall be held at a place prescribed by the [illegible] of Directors on the third Monday in January of each year, if not a legal holiday, or if a legal holiday, on the next business day following.

Section 2. Notice of meetings of members of the corporation may be given by a notice mailed to each member of record, directed to the address shown on the [illegible] of the corporation, at least ten days prior to the meeting. Such [illegible] shall state the nature, time, place and purpose of the meeting, but no failure or irregularity of notice of any annual meeting [illegible] regularly held, shall affect any proceedings taken thereat.

Section 3. The members present at any [illegible] ing of the members shall constitute a quorum at any meeting of [illegible] corporation for the transaction of business. The voting powers of the members of this corporation shall be equal, each member shall have one vote only, and voting by proxy shall be allowed.

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Section 4. Directors of this corporation shall be elected at the annual meeting of the members.

Section 5. The order of business at the regular meetings and so far as possible at all other meetings shall be:

1. Calling to order and proof of quorum
2. Proof of notice of meeting
3. Reading and action on any unapproved minutes
4. Reports of officers and committees
5. Election of directors
6. Unfinished business
7. New business
8. Adjournment

ARTICLE VIII:

DIRECTORS AND OFFICERS

Section 1. The Board of Directors of this corporation shall consist of five members, all of whom shall be members of the corporation. The directors named in the Articles of Incorporation shall serve until the first annual meeting of the members and until their successors are elected and have qualified. At the first annual meeting of the members, one director shall be elected for a term of one year; two directors for a term of two years; and two directors for a term of three years. At each annual meeting thereafter, the members shall elect for a term of three years the number of directors whose terms of office have expired.

Section 2. The Board of Directors shall meet within ten days after the first election and within ten days after the annual election of directors and shall elect by ballot a president, and vice-president from among themselves, and a secretary-treasurer, each of whom shall hold office until the next annual meeting and until the election and qualification of his successor unless sooner removed by death, resignation, or for cause.

Articles of Incorporation of

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Section 3. Special meeting of the Board of Directors may be called at any time by the president, or any two directors, on not less than twenty-four hours notice previous to the meeting. Notice of special meeting of the Board of Directors shall be given as provided in Article VII, Section 2 of these articles. Any meetin at which all directors are present shall be legal without notice or waiver. Any director or officer may waive any notice required to be given under these articles. Presence of a director in person shall constitute waiver by him of notice of a director's meeting.

Section 4. If the office of any director becomes vacant by reason of death, resignation, retirement, disqualification or otherwise, except by removal from office, a majority of the remaining directors though not less than a quorum shall, by a majority vote, choose a successor who shall hold office until the next annual meeting of the members of the corporation, at which time the members shall elect a director for the unexpired term, or terms.

Section 5. A majority of the Board of Directors shall constitute a quorum at any meeting of the board.

Section 6. Compensation of officers may be fixed at any regular or special meeting of the members of the corporation.

Section 7. Officers and directors may be removed from office in the following manner: Any member, officer, or director may present charges against a director or officer by filing them in writing with the secretary of the corporation. If presented by a member, the charges must be accompanied by a petition signed by ten per cent of the members of the corporation. Such removal shall be voted at the next regular meeting or special meeting of the members and shall be effective if approved by a vote of a majority of the members. The director or officer against whom such charges have been presented shall be informed, in writing, of such charges

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five days prior to the meeting, and shall have the opportunity at such meeting to be heard in person or by counsel and to present witnesses; and the person or persons presenting such charges against him shall have the same opportunity. If the removal of a director is approved, such action shall also vacate any other office held by the removed director in the association. A vacancy in the board thus created shall immediately be filled by a vote of a majority of the members present, at such meeting. A vacancy in any office thus created shall be filled by the directors from among their number so constituted after the vacancy in the board has been filled.

ARTICLE IX

DUTIES OF DIRECTORS

Section 1. The Board of Directors, subject to the restriction of law, the Articles of Incorporation, or the by-laws shall exercise all of the powers of the corporation, and, without prejudice to or limitation upon their general powers, it is hereby expressly provided that the Board of Directors shall have, and hereby are given, full power and authority in respect to the matters and as hereinafter set forth:

A. To pass upon the qualifications of members, and to cause to be issued appropriate certificates of membership.

B. To select and appoint all officers, agents, or employees of the corporation or remove such agents or employees of the corporation for just cause, prescribe such duties and designate such powers as may not be inconsistent with the by-laws, fix their compensation and pay for faithful services.

C. To borrow from any source, money, goods, or services, and to make and issue notes and other negotiable and transferable instruments, mortgages, deeds of trust and trust agreements and to do every act and thing necessary to effectuate the same.

D. To prescribe, adopt, and amend, from time to time such equitable by-laws, uniform rules and regulations as, in their discretion, may be deemed essential or convenient for the conduct of the business and affairs of the corporation and the guidance and control of its officers and employees, and to prescribe adequate penalties for the breach thereof.

E. To order, at least once each year, an audit of the books and accounts of the corporation by a qualified auditor or accountant. The report prepared by such auditor or accountant shall be submitted to the members of the corporation at their annual meeting.

F. To fix the charges to be paid by each member for services rendered by the corporation to him, the time of payment and manner of collection.

G. To require all officers, agents, and employees charged with responsibility for the custody of any of the funds of the corporation to give adequate bonds, the cost thereof to be paid by the corporation, and it shall be mandatory upon the directors to so require.

H. To select one or more banks to act as depositories of the funds of the corporation and to determine the manner of receiving, depositing and disbursing of funds of the corporation and the form of checks and the person or persons by whom the same shall be signed, with the power to change such banks and the person or persons signing such checks and the form thereof at will.

ARTICLE X:

DUTIES OF OFFICERS

Section 1. Duties of the President: The President shall preside over all meetings of the corporation and the Board of

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of Directors, call special meetings of the Board of Directors, perform all acts and duties usually performed by an executive and presiding officer, and sign all membership certificates and such other papers of the corporation as he may be authorized or directed to sign by the Board of Directors, provided the Board of Directors may authorize any person to sign any or all checks, contracts and other instruments in writing on behalf of the corporation. The President shall perform such other duties as may be prescribed by the Board of Directors.

Section 2. Duties of the Vice-President: In the absence or disability of the President, the Vice-President shall perform the duties of the President; provided, however, that in case of death, resignation, or disability of the President, the Board of Directors may declare the office vacant, and elect his successor.

Section 3. Duties of the Secretary-Treasurer: The Secretary Treasurer shall keep a complete record of all meetings of the corporation and of the Board of Directors and shall have general charge and supervision of the books and records of the corporation. He shall sign all membership certificates with the president and such other papers pertaining to the corporation as he may be authorized or directed to do so by the Board of Directors. He shall provide a fidelity bond in an amount to cover an amount equal to the largest sum of money in his possession as Secretary-Treasurer at any one time. He shall serve all notices required by law and these by-laws and shall make a full report of all matters and business pertaining to his office to the members at the annual meeting. He shall keep the corporate seal and membership certificate records of the corporation, complete and countersign all certificates issued and affix said corporate seal to all papers requiring same. He shall keep a proper membership certificate record, showing the name of each member of the corporation and date of issuance, surrender,

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cancellation or forfeiture. He shall make all reports required by law and shall perform such other duties as may be required by law and shall perform such other duties as may be required by him by the corporation or the Board of Directors. Upon the election of his successor, the Secretary-Treasurer shall turn over to him all books and other property belonging to the corporation that he may have in his possession. He shall also perform such duties with respect to the finances of the corporation as may be prescribed by the Board of Directors.

ARTICLE XI:

BENEFITS AND DUTIES OF MEMBERS

Section 1. The corporation will install, maintain, and operate a main distribution pipeline or lines from the source of the water supply and service lines from the main distribution pipeline or lines to the property line of each member of the corporation, at which points, designated as delivery points, meters to be purchased, installed owned and maintained by the corporation shall be placed. The cost of the service line or lines from the main distribution pipeline or lines of the corporation to the property line of each member shall be paid by the corporation. The corporation will also purchase and install a cut-off valve in each service line from its main distribution line or lines, such cut-off valve to be owned and maintained by the corporation and to be installed on some portion of the service line owned by the corporation. The corporation shall have the sole and exclusive right to use such cut-off valve to turn it on and off.

Section 2. Each member shall be entitled to not to exceed one service line from the corporation's water system, provided that the member shall be required to pay a fee prescribed by the

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Board of Directors for each service line in excess of one. No new service line or change in an existing service line may be made which will interfere with an existing service line or the delivery of water therein. Each service line shall connect with the corporation's water system at the nearest available place to the place of desired use by the member if the corporation's water system shall be of sufficient capacity to permit the delivery of water through a service line at that place without interfering with the delivery of water through a prior service line. If the corporation's water system shall be inadequate to permit the delivery of water through a service line installed at such place without interfering with the delivery of water through a prior service line, then such service line shall be installed at such place as may be designated by the corporation. Each member will be required to dig or have dug a ditch for the connection of the service line or lines from the property line of the member to his dwelling or other portion of his premises and will also be required to purchase and install the portion of the service line or lines from his property line to the place of use on his premises and to maintain such portion of such service line or lines which shall be owned by the member, at his own expense, provided that the corporation may, if the Board of Directors so determine, purchase the pipe for and install such portion of such service line or lines, the cost of which will, however, be paid by the individual members.

Section 3. Each member shall be entitled to purchase from the corporation pursuant to such agreements as may from time to time be provided and required by the corporation, such water for domestic, livestock and other purposes as a member may desire, subject, however, to the provisions of these by-laws and to such rules and regulations as may be prescribed by the Board of Directors, each member shall be entitled to have delivered to him through a single service line only such water as may be necessary to supply the needs of the persons residing in a single dwelling

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and of the livestock owned by such persons and for such other purposes as needed. The water delivered through each service line shall be metered and the charges for such water shall be determined separately, irrespective of the number of service lines owned by a member.

Section 4. In the event the total water supply shall be insufficient to meet all of the needs of the members or in the event there is a shortage of water, the corporation may pro-rate the water available among the various members on such basis as is deemed equitable by the Board of Directors, and may also, prescribe a schedule of hours covering use of water by particular members and require adherence thereto or prohibit the use of water for other purposes; provided that if at any time the total water supply shall be insufficient to meet all of the needs of all of the members for domestic, livestock, and other purposes, the corporation must first satisfy all of the needs of all of the members for domestic purposes before supply any water for other purposes.

Section 5. The Board of Directors shall have the right in any calender year to determine the flat minimum monthly rate to be charged each member for a specified quantity of water, such flat minimum monthly rate to be payable irrespective of whether any water is used by a member during any month, and the amount of additional charges, if any, for additional water which may be supplied the members, shall fix the date for the payment of such charges, and shall notify each member of the amount of such charges and the dates for the payment thereof, a member to be entitled to the delivery of water shall pay such charges at the office of the corporation at or prior to the dates fixed by the Board of Directors. The failure to pay water charges duly imposed shall result in the automatic imposition of the following penalties:

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A. Non-payment within ten days from the due date will be subject to a penalty of ten per cent of the delinquent account.

B. Non-payment within thirty days from the due date will result in the water being shut off from the member's property.

C. Non-payment for sixty days after original due date will allow the corporation, in addition to all other rights and remedies to purchase the member's membership certificate and terminate his membership, and, in such event the member shall not be entitled to receive, nor the corporation obligated to supply, any water.

D. In the event it becomes necessary for the corporation to shut off the water from a member's property, a fee prescribed by the Board of Directors will be charged for the reconnection of the service.

Section 6. The Board of Directors shall be authorized to require each member to enter into water use agreements which shall embody the principles set forth in the foregoing sections of this article.

Section 7. Membership may be cancelled and/or water service discontinued by the corporation for any violation of any rule, regulation, or condition of service and especially for any of the following reasons:

A. Misrepresentation in application as to the property or fixtures to be supplied or use to be made of water.

B. Resale or giving away of water.

C. Waste or misuse of water due to improper or imperfect service pipes and/or fixtures or failure to keep the same in a suitable state of repair.

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D. Tampering with meter, meter seal, service, or valves or permitting such tampering by others.

E. Connections, cross-connections, or permitting the same, of any separate water supply to the premises which receives water from the corporation.

ARTICLE XII:

DISTRIBUTION OF [illegible] FUNDS

Section 1. It is not anticipated that there will be any net income. If there should be any, then at the end of any fiscal year, after paying the expenses of the corporation for operation and otherwise, and after setting aside reserve, for depreciation of all buildings, equipment, and office fixtures, and such other reserves as the Board of Directors may deem proper and after providing for payments on interest and principal of obligations and amortized debts of the corporation, and after providing for the purchase of proper supplies and equipment, the net earning shall be accumulated in a surplus fund for the purpose of replacing, enlarging, extending and repairing the system and property of the corporation and for such other purposes as the Board of Directors may determine to be for the best interests of the corporation. The said surplus fund or any portion thereof may from time to time at the discretion of the Board of Directors be applied to said debt of said corporation.

Section 2. Any part or the whole of such net income may be credited at the discretion of the Board of Directors to the indebtedness of the corporation, should any exist, and upon payment of all debts of the corporation, any surplus so remaining to be placed in a reserve account until such time as the Board of Directors shall deem sufficient for the needs of said corporation. Thereafter the Board of Directors may reduce said water rates to meet the cost of operation only.

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ARTICLE XVII:

AMENDMENTS

These articles and the by-laws may be repealed or amended by a vote of a majority of the directors present at any regular meeting of the corporation, or at any special meeting of the corporation called for that purpose, except that the directors shall not have the power to change the [illegible] of the corporation so as to decrease its rights and powers under the laws of the state, or to waive any requirement of bond or other provision for the safety and security of the property and funds of the corporation or its members, or to deprive any member of rights and privileges then existing, or so to amend the articles or by-laws as to effect a fundamental change in the policies of the corporation. Notice of any amendments to be made at a special meeting of the directors must be given at least ten days before such meeting and must set forth the amendments to be considered.

Amendments to these articles must, and will have, prior approval of the lending institution, if an indebtedness is owed or outstanding, before they become effective.

IN WITNESS WHEREOF, we, the Incorporators, have at the organization meeting onthis 17 day of July, 1970, adopted the foregoing Articles of Incorporation.

Leonard Barrow, R. R. 2, Mt. Sterling, Ky 40353 — Leonard Barrow

Leslie Wilson, R.R. 2, Mt. Sterling, Ky 40353 — Leslie Wilson

Thomas Tipton, R.R. 2, Mt. Sterling, Ky 40353 — Thomas Tipton

Jas. Griffen, Jr., R.R. 2, Mt. Sterling, Ky 40353 — Jas. Griffen Jr.

Joseph F. Murphy, R.R. 2, Mt. Sterling, Ky 40353 — Joseph F. Murphy

Prepared by:

John M. Prewitt
Attorney at Law
Box 385,
Mt. Sterling, Ky.

Articles of Incorporation of

Prepared by:

John M. Prewitt
JOHN M. PREWITT
ATTORNEY AT LAW, BOX 385,
MT. STERLING, KY 40353

Leonard Barrow, Pres.
Joseph F. Murphy
Leslie Wilson
Thomas Tipton
James A. Griffen, Jr.

STATE OF KENTUCKY
SCT
COUNTY OF MONTGOMERY

The foregoing instrument was acknowledged before me this 14 day of December, 1970, by Leonard Barrow, Leslie Wilson, Thomas Tipton, Jas. Griffen, Jr. and Joseph F. Murphy.

John Marshall Prewitt
JOHN MARSHALL PREWITT
NOTARY PUBLIC,
KENTUCKY STATE-AT-LARGE

My commission expires Aug. 7, 1971.

Original Copy
Filed and Recorded

Leila F. Begley

Dec 21 1970

Secretary of State of Kentucky
Frankfort, Kentucky

By Leila F. Begley
Secretary of State

STATE OF KENTUCKY
SCT
MONTGOMERY COUNTY

I, Mrs. Bruce Patrick, clerk of Montgomery County Court aforesaid, do hereby certify that the foregoing Articles was on 24 day of Dec. 1970 lodged for record in my office, whereupon the same with this and the foregoing certificate have been duly recorded.

Witness my hand this 31 day of Dec. 1970

Mrs Bruce Patrick Clerk

EXHIBIT B

CAMP MCKEE WATER IMPROVEMENTS PROJECT
LEVEE ROAD WATER ASSOCIATION
PRE-BID FINAL COST ESTIMATE

11/08/2005

ITEM NO.	ITEM	UNIT		COST	TOTAL QUANTITY		TOTAL COST
1	6" PVC	L.F.	$	9.00	8120	$	73,080.00
2	8" P.E.	L.F.	$	14.00	100	$	1,400.00
3	3" PVC	L.F.	$	7.00	10	$	70.00
4	3/4" Service Tubing	L.F.	$	6.00	80	$	480.00
5	6" Valve & Box	Ea.	$	700.00	2	$	1,400.00
6	3" Valve & Box	Ea.	$	550.00	1	$	550.00
7	12" Open Cut Liner Pipe	L.F.	$	40.00	30	$	1,200.00
8	Type II Blow Off	Ea.	$	1,150.00	1	$	1,150.00
9	ARV	Ea.	$	350.00	2	$	700.00
10	Small River Test Station	Ea.	$	375.00	2	$	750.00
11	Tie #1	L.S.	$	3,000.00	1	$	3,000.00
12	Class II Stone	Ton	$	22.00	170	$	3,740.00
13	Class III Stone	Ton	$	23.00	45	$	1,035.00
14	Crushed Stone	Ton	$	19.00	900	$	17,100.00
15	General Conc.	CYD	$	130.00	15	$	1,950.00
16	Clear & Grub/New Road	L.F.	$	5.00	3020	$	15,100.00
17	Telemetry	L.S.	$	60,000.00	1	$	60,000.00
18	122K Storage Tank	L.S.	$	145,000.00	1	$	145,000.00
19	Tank Site Work	L.S.	$	30,000.00	1	$	30,000.00
20	PRV to Elec. Vlv.	L.S.	$	12,000.00	1	$	12,000.00
	SUBTOTAL FOR CONSTRUCTION					$	369,705.00
	ENGINEERING DESIGN					$	40,175.00
	ENGINEERING INSPECTION					$	30,470.00
	GEO-TECHNICAL INVESTIGATION					$	10,000.00
	LANDS & R/W					$	5,000.00
	CONTINGENCY					$	5,950.00
	TOTAL ESTIMATED PROJECT COST					**$**	**461,300.00**

EXHIBIT C

ERNIE FLETCHER
GOVERNOR

ENVIRONMENTAL AND PUBLIC PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER
14 REILLY ROAD
FRANKFORT, KENTUCKY 40601-1190
www.kentucky.gov

LAJUANA S. WILCHER
SECRETARY

June 8, 2005

Mr. Jimmy Linkous, President
Levee Road Water Association
P.O.BOX 770
Mt.Sterling, Kentucky 40353

Re: Levee Road Water Association
PWS— 34037
DW No.0870246-05-001
Camp Mckee Water Improvement Project
Activity ID: APE20050001
Montgomery County, Kentucky

Dear Mr.Linkous:

We have reviewed the plans and specifications for the above referenced project. The plans include the construction of approximately 8,120 feet of 6-inch, 10 feet of 3-inch PVC, 100 feet of 8-inch PE water lines and a 122,000 gallon ground storage tank. This is to advise that plans and specifications for the above referenced project are APPROVED with respect to sanitary features of design, as of this date with the requirements contained in the enclosed waterline extension construction permit.

If you have any questions regarding this decision, please contact Fred Sarabi, at (502) 564-2225, extension 564.

Sincerely,

for Donna S. Marlin, Manager
Drinking Water Branch
Division of Water

DSM/FFS
Enclosure

CC: H.A.Spalding Engineers, Inc.
Montgomery County Health Department.
Powell County Health Department.
Public Service Commission
Division of Plumbing.

Distribution-Major Construction

Levee Rd Water Association Inc

Subject Item Inventory

Activity ID No.: APE20050001

Subject Item Inventory:

ID	Designation	Description
AIOO34037		
PORT1	Water Line	8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC
STOR1	Ground Tank	122,000 Gallon Ground Storage Tank

Subject Item Groups:

ID	Description	Components
GACT1	8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC and 122,000 Gallon Ground Storage Tank	STOR1 122,000 Gallon Ground Storage Tank
		PORT1 8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC

KEY

ACTV = Activity
AREA = Area
EQPT = Equipment
PERS = Personnel
STOR = Storage
TRMT = Treatment
AIOO = Agency Interest
COMB = Combustion
MNPT = Monitoring Point
PORT = Transport
STRC = Structure

GACT1 (Camp McKee Water Improv.) 8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC and 122,000 Gallon Ground Storage Tank:

Monitoring Requirements:

Condition No.	Parameter	Condition
M-1	Coliform	The presence or absence of total Coliform monitored by sampling and analysis as needed shall be determined for the new or relocated water line(s). Take samples at connection points to existing lines, at 1 mile intervals, and at dead ends without omitting any branch of the new or relocated water line. Sample bottles shall be clearly identified as "special" construction tests. [401 KAR 8:100 Section 1(7), 401 KAR 8:150 Section 4, Recommended Standards for Water Works 8.5.6] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination.
M-2	Coliform	The presence or absence of total Coliform monitored by sampling and analysis as needed shall be determined for the new storage structure(s). With at least 1 sample taken at least 24 hours after the first construction complete sample(s), take 2 or more samples from the yard hydrant, the outlet piping from the storage structure, or a sample tap directly connected to the storage structure. Sample bottles shall be clearly identified as "special" construction tests. [Recommended Standards for Water Works 7.0.18, 401 KAR 8:150 Section 4] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination.

Submittal/Action Requirements:

Coliform:

Condition No.	Condition
S-1	Coliform For new construction projects, the distribution system, using the most expedient method, shall submit Coliform test results to the Cabinet: Due immediately following disinfection and flushing. [401 KAR 8:150 Section 4(2)]

Submittal/Action Requirements:

Condition No.	Condition
S-2	For proposed changes to the approved plan, submit information: Due prior to any modification to the Cabinet for approval. Changes to the approved plan shall not be implemented without the prior written approval of the Cabinet. [401 KAR 8:100 Section 1(8)]
S-3	The person who presented the plans shall submit the professional engineer's certification: Due when construction is complete to the Division of Water. The certification shall be signed by a registered professional engineer and state that the water project has been constructed and tested in accordance with the approved plans, specifications, and requirements. [401 KAR 8:100 Section 1(8)]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-1	Additional Limitations: Chlorinated water resulting from disinfection of project components shall be disposed in a manner which will not violate 401 KAR 5:031. [401 KAR 8:020 Section 2(20)]

Condition No.	Condition
T-2	This project has been permitted under the provisions of KRS Chapter 224 and regulations promulgated pursuant thereto. Issuance of this permit does not relieve the applicant from the responsibility of obtaining any other approvals, permits or licenses required by this Cabinet and other state, federal and local agencies. Further, this permit does not address the authority of the permittee to provide service to the area to be served. [401 KAR 8:100 Section 1(7)]
T-3	Unless construction of this project is begun within 1 year from the issuance date of this permit, the permit shall expire. If requested prior to the permit expiration, an official extension from the Division of Water may be granted. If this permit expires, the original plans and specifications may be resubmitted for a new comprehensive review. If you have any questions concerning this project, please contact the Drinking Water Branch at 502/564-3410. [401 KAR 8:100 Section 1(9)]

Narrative Requirements:

Condition No.	Condition
f-4	During construction, a set of approved plans and specification shall be available at the job site at all times. All work shall be performed in accordance with the approved plans and specifications. [401 KAR 8:100 Section 1(7)(a)]

PORT1 (Water Line) 8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC:

Limitation Requirements:

Condition No.	Parameter	Condition
L-1	Depth	A continuous and uniform bedding shall be provided in the trench for all buried pipe. Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. Stones found in the trench shall be removed for a Depth >= 6 in below the bottom of the pipe. [Recommended Standards for Water Works 8.5.2] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-2	Depth	All water lines shall be covered to a Depth >= 30 in to prevent freezing. [Recommended Standards for Water Works 8.5.3, 401 KAR 8:100 Section 1(7)] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-3	Diameter	All water lines shall have Diameter >= 3 in. [Recommended Standards for Water Works 8.1.4] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-4	Diameter	Water lines with Diameter < 6 in shall not have fire hydrants. [Recommended Standards for Water Works 8.1.5] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-5	Diameter	All new and existing water lines serving fire hydrants or where fire protection is provided shall have Diameter >= 6 in. [Recommended Standards for Water Works 8.1.2] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-6	Distance	Water lines shall have a sufficient quantity of valves so that inconvenience and sanitary hazards will be minimized during repairs. A valve spacing Distance <= 1.0 mi should be utilized. [Recommended Standards for Water Works 8.2] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-7	Distance	Hydrant drains shall not be connected to sanitary sewers or storm drains and shall be located a Distance > 10 ft from sanitary sewers and storm drains. [Recommended Standards for Water Works 8.3.4] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.

Limitation Requirements:

Condition No.	Parameter	Condition
-8	Distance	Except when not practical, water lines shall be laid a horizontal Distance >= 10 ft from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, water lines may be installed closer to a sewer provided that the water lines shall be laid in a separate trench or on an undisturbed shelf located on one side of the sewer at such an elevation that the bottom of the water line is at least 18 inches above the top of the sewer. [Recommended Standards for Water Works 8.6.2] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-9	Distance	When water lines and sewers cross, 1) water lines shall be laid such that either a) the the top of the water line is a vertical Distance >= 18 in below the bottom of the sewer line or b) the bottom of the water line is a vertical Distance >= 18 in above the top of the sewer line, 2) 1 full length of the water pipe shall be located so that both joints of the water pipe will be as far from the sewer as possible, and 3) special structural support for the water and sewer pipes may be required. [Recommended Standards for Water Works 8.6.3] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-10	Distance	The open end of an air relief pipe from automatic valves shall be extended a Distance >= 1.0 ft above grade and provided with a screened, downward-facing elbow. The pipe from a manually operated valve shall be extended to the top of the pit. Use of manual air relief valves is recommended wherever possible. [Recommended Standards for Water Works 8.4.2] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-11	Pressure	Pipes shall not be installed unless all points of the distribution system remain designed for ground level Pressure >= 20 psi under all conditions of flow. [Recommended Standards for Water Works 8.1.1] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-12	Pressure	Pressure >= 30 psi must be available on the discharge side of all meters. [401 KAR 8:100 Section 4(2)] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination.

Limitation Requirements:

Condition No.	Parameter	Condition
-13	Residual Disinfection	New or relocated water lines shall be thoroughly disinfected (in accordance with AWWA Standard C651) upon completion of construction and before being placed into service. To disinfect the new or relocated lines use chlorine or chlorine compounds in such amounts as to produce an initial disinfectant concentration of at least 50 ppm and a Residual Disinfection >= 25 ppm at the end of 24 hours. Follow the line disinfection with thorough flushing and place the lines into service if, and only if, Coliform monitoring applicable to the line does not show the presence of Coliform. If Coliform is detected, repeat flushing of the line and Coliform monitoring. If Coliform is still detected, repeat disinfection and flushing as if the line has never been disinfected. Continue the described process until monitoring does not show the presence of Coliform. [401 KAR 8:150 Section 4(1), Recommended Standards for Water Works 8.5.6] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-14	Velocity	Each blow-off, fire hydrant, or flush hydrant shall be sized so that Velocity >= 2.5 ft/sec can be achieved in the water main served by the blow-off or hydrant during flushing. [Recommended Standards for Water Works 8.1.6.b, 401 KAR 8:100 Section 1(7)] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.

Monitoring Requirements:

Condition .o.	Parameter	Condition
M-1	leaks	The presence or absence of leaks monitored by physical testing as needed shall be determined in all types of installed pipe. Pressure testing and leakage testing shall be in accordance with the latest edition of AWWA Standard C600. [Recommended Standards for Water Works 8.5.5] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination.

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-1	Additional Limitations: Water line installation shall be in accordance with AWWA standards or manufacturer recommendations. [Recommended Standards for Water Works 8.5.1]
T-2	Additional Limitations: Pipes, fittings, valves and fire hydrants shall conform to the latest standards issued by the AWWA or NSF (if such standards exist). PVC and PE piping used must be certified to ANSI/NSF Standard 61. [Recommended Standards for Water Works 8.0.1]
T-3	Additional Limitations: At high points in water lines, where air can accumulate, provisions shall be made to remove the air by means of hydrants or air relief valves. Automatic air relief valves shall not be used in situations where manhole or chamber flooding may occur. [Recommended Standards for Water Works 8.4.1]
T-4	Additional Limitations: All tees, bends, plugs and hydrants shall be provided with reaction blocking, tie rods or joints designed to prevent movement. [Recommended Standards for Water Works 8.5.4]
T-5	Additional Limitations: A fire hydrant or blow-off shall be required at the end of each dead end line. [Recommended Standards for Water Works 8.1.6]
T-6	Additional Limitations: For each fire or flush hydrant, auxiliary valves shall be installed in the hydrant lead pipe. [Recommended Standards for Water Works 8.3.3]
T-7	Additional Limitations: No flushing device, blow-off, or air relief valve shall be directly connected to any sewer. Chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances shall not be directly connected to any storm drain or sanitary sewer. Such chambers, pits or manholes shall be drained to absorptions pits underground or to the surface of the ground where they are not subject to flooding by surface water. [Recommended Standards for Water Works 8.1.6, Recommended Standards for Water Works 8.4.3]
T-8	Additional Limitations: If water lines are installed or replaced in areas of organic contamination or in areas within 200 ft of underground or petroleum storage tanks, ductile iron or other nonpermeable materials shall be used in all portions of the water line installation or replacement. [401 KAR 8:100 Section 1(5)(d)6, Recommended Standards for Water Works 8.0.2]
T-9	Additional Limitations: No water pipe shall pass through or come in contact with any part of a sewer manhole. [Recommended Standards for Water Works 8.6.6]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-10	Additional Limitations: If a fire sprinkler system is to be installed, a double check detector assembly approved for backflow prevention shall be utilized. The double check detector assembly of the system shall be accessible for testing. [401 KAR 8:100 Section 1(7)]
T-11	Additional Limitations: If water lines cross a stream or wetland, the provisions in the attached Water Quality Certification shall apply. If you have any questions please contact the Water Quality Certification Supervisor of the Water Quality Branch at (502) 564-2225. [401 KAR 8:100 Section 1(7)]

Subfluvial Pipe Crossings:

Condition No.	Condition
T-12	Subfluvial Pipe Crossings: For subfluvial pipe crossings, a floodplain construction permit will not be required pursuant to KRS 151.250 if the following requirements of 401 KAR 4:050 Section 2 are met. 1) No material may be placed in the stream or in the flood plain of the stream to form construction pads, coffer dams, access roads, etc. during construction of pipe crossings. 2) Crossing trenches shall be backfilled as closely as possible to the original contour. 3) All excess material resulting from construction displacement in a crossing trench shall be disposed of outside the flood plain. 4) For erodible channels, there shall be at least 30 inches of backfill on top of all pipe or conduit points in the crossing. 5) For nonerodible channels, pipes or conduits in the crossing shall be encased on all sides by at least 6 inches of concrete with all pipe or conduit points in the crossing at least 6 inches below the original contour of the channel. [401 KAR 8:100 Section 1(7)]
T-13	Subfluvial Pipe Crossings: For subfluvial pipe crossings greater than 15 feet in width, 1) the pipe shall be of special construction, having flexible, restrained, or welded watertight joints, and 2) valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair. Valves shall a) be easily accessible, b) not be subject to flooding, and c) if closest to the supply source, be in a manhole with permanent taps made on each side of the valve to allow insertion of a small meter to determine leakage and for sampling purposes. [Recommended Standards for Water Works 8.7.2]

STOR1 (Ground Tank) 122,000 Gallon Ground Storage Tank:

Limitation Requirements:

Condition No.	Parameter	Condition
L-1	Depth	High and low level Depth >= 30 ft apart should not be allowed in storage structures providing pressure to a distribution system. [Recommended Standards for Water Works 7.3.2] This requirement is applicable during the following months: All Year. Statistical basis: Maximum.
L-2	Depth	Water Depth >= 50 percent of the total water depth should be above grade. [Recommended Standards for Water Works 7.0.2.b] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-3	Distance	Sewers, drains, standing water and similar sources of possible contamination shall be a Distance >= 50 ft from ground-level storage structures. The only exception allowed is for gravity sewers. Gravity sewers are allowed within 50 ft of ground-level storage structures only if they are a) greater than 20 ft from all ground-level storage structures and b) constructed of water main pipe pressure tested in place to 50 psi without leakage. [Recommended Standards for Water Works 7.0.2.b] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-4	Distance	To prevent excessive erosion of storage structure foundations, the overflow and main drain shall either a) discharge to concrete or other stable surfaces (splash pads) which extend a Distance >= 10 ft away from the base of the storage structure or b) discharge directly into a crushed stone pit that is at least 2' x 2' x 2' which is a Distance >= 10 ft away from the base of the storage structure. [401 KAR 8:100 Section 1(7)] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-5	Height	Tanks shall have an overflow which is a) brought down to a Height >= 12 and <= 24 in above the ground surface, b) of sufficient diameter to permit waste of water in excess of the filling rate, c) open downward, d) screened with twenty-four mesh noncorrodible screen installed within the pipe at a location least susceptible to damage by vandalism, and e) located on the outside of the tank so that any discharge is visible. [Recommended Standards for Water Works 7.0.7] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.

Limitation Requirements:

Condition No.	Parameter	Condition
-6	Height	Tanks shall have manholes that are a) framed a Height >= 4 in above the surface of the roof at the opening and b) fitted with a solid watertight cover which overlaps the framed opening and extends down around the frame at least 2 inches. Manholes should be hinged at one side and shall have a locking device. [Recommended Standards for Water Works 7.0.8] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-1	Additional Limitations: The materials and designs used for storage structures shall provide stability and durability as well as protection for the quality of the stored water. Steel structures shall follow the AWWA standards wherever they are applicable. Other materials of construction are acceptable when properly designed to meet the requirements in this permit. [Recommended Standards for Water Works 7.0]
T-2	Additional Limitations: The safety of employees must be considered in the design of any storage structure. The design of storage structures shall a) meet or exceed the minimum requirements of pertinent safety laws and regulations in the areas where the structures are constructed, b) include ladders, ladder guards and balcony railings (where applicable), c) locate entrance hatches in safe places, and d) consider confined space entry requirements. [Recommended Standards for Water Works 7.0.12]
T-3	Additional Limitations: Storage structures shall be designed with reasonably convenient access to the interior for cleaning and maintenance. Where space permits, at least 2 manholes shall be provided above the waterline at each water compartment. [Recommended Standards for Water Works 7.0.8]
T-4	Additional Limitations: Fencing, locks on access manholes, and other necessary precautions shall be provided to prevent trespassing, vandalism, and sabotage. [Recommended Standards for Water Works 7.0.4]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-5	Additional Limitations: All storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing. [Recommended Standards for Water Works 7.0.13]
T-6	Additional Limitations: Tanks shall be constructed with no openings except properly constructed vents, manholes, overflows, risers, drains, pump mountings, control ports, and piping for inflow and outflow. For steel tanks, any pipes running through the roof or sidewall must be welded or properly gasketed. For concrete tanks, any pipes running through the roof or sidewall shall be connected to standard wall castings which were poured in place during the forming of the concrete and which should have seepage rings imbedded in the concrete. [Recommended Standards for Water Works 7.0.10]
T-7	Additional Limitations: All finished water storage structures shall have suitable watertight roofs and sidewalls which exclude birds, animals, insects, and excessive dust. [Recommended Standards for Water Works 7.0.3, Recommended Standards for Water Works 7.0.10]
T-8	Additional Limitations: The roof of each storage structure shall be well drained. Downspout pipes shall not enter or pass through storage structures. Parapets or similar structures which would tend to hold water and snow on a storage structure roof shall not be approved unless adequate waterproofing and drainage are provided. [Recommended Standards for Water Works 7.0.11]
T-9	Additional Limitations: Storage structures shall be designed so they can be isolated from the distribution system and drained for cleaning or maintenance without necessitating loss of pressure in the distribution system. [Recommended Standards for Water Works 7.3.2, Recommended Standards for Water Works 7.0.5]
T-10	Additional Limitations: Storage structure drains shall discharge to the ground surface at a drainage structure inlet or splash plate. [Recommended Standards for Water Works 7.3.2, Recommended Standards for Water Works 7.0.7]
T-11	Additional Limitations: No drain on a storage structure may have a direct connection to a sewer or storm drain. [Recommended Standards for Water Works 7.0.5, Recommended Standards for Water Works 7.0.7, Recommended Standards for Water Works 7.3.2]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-12	Additional Limitations: Main drains from storage structures shall have a twenty-four mesh noncorrodible screen installed within the drain pipe at a location least susceptible to damage by vandalism. [401 KAR 8:100 Section 1(7)]
T-13	Additional Limitations: Storage structures shall be designed to facilitate turn over of water. [401 KAR 8:100 Section 1(7), Recommended Standards for Water Works 7.0.6]
T-14	Additional Limitations: Ground level storage tanks and standpipes shall be equipped with separate inlet/outlet pipes installed on opposite sides of the tank. A check valve shall be installed in the outlet pipe to insure turnover of the water. The inlet pipe a) shall be installed near the overflow elevation and b) shall not interfere with the overflow discharge. [401 KAR 8:100 Section 1(7)]
T-15	Additional Limitations: Storage structures shall have sufficient capacity, as determined from engineering studies, to meet domestic demands. Additionally, if fire protection is provided, capacity shall also be sufficient to meet fire flow demands. [401 KAR 8:100 Section 1(7), Recommended Standards for Water Works 7.0.1]
T-16	Additional Limitations: The bottom of the structure shall be above a) the maximum flood level and b) the groundwater level. [Recommended Standards for Water Works 7.0.2]
T-17	Additional Limitations: Storage structure discharge pipes shall be located in a manner that will prevent the flow of sediment into the distribution system. Additionally, removable silt stops should be provided. [Recommended Standards for Water Works 7.0.15]
T-18	Additional Limitations: Appropriate sampling tap(s) shall be provided to facilitate collection of water samples for both bacteriologic and chemical analyses. [Recommended Standards for Water Works 7.0.19]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-19	Additional Limitations: Storage structures shall be vented. Overflows shall not be considered as vents. Open construction between the sidewall and roof is not permitted. Vents shall a) prevent the entrance of rainwater, b) exclude birds and animals, and c) exclude insects and dust (as much as compatible with effective venting). Vents may use four-mesh noncorrodible screen. [Recommended Standards for Water Works 7.0.9]
T-20	Additional Limitations: Adequate controls shall be provided to maintain levels in storage structures. The level controls shall be acceptable to the Division of Water. Level indicating devices should be provided at a central location. Overflow and low-level warnings or alarms should be located at places in the community where they will be under responsible surveillance 24 hrs a day. [401 KAR 8:100 Section 1(7), Recommended Standards for Water Works 7.3.3]
T-21	Additional Limitations: If storage structures have a catwalk over the water, the catwalk floor shall be solid with raised edges so that shoe scrapings and dirt will not fall into the water. [Recommended Standards for Water Works 7.0.14]
T-22	Additional Limitations: The area around the storage structure shall be graded in a manner that will prevent surface water from standing within 50 ft of the storage structure. [Recommended Standards for Water Works 7.0.16]
T-23	Additional Limitations: Proper protection shall be given to metal surfaces by a) paints or other protective coatings and/or b) cathodic protective devices. [Recommended Standards for Water Works 7.0.17]
T-24	Additional Limitations: If cathodic protection is utilized, a) competent technical personnel should design and install the protection and b) a maintenance contract should be provided. [Recommended Standards for Water Works 7.0.17]
T-25	Additional Limitations: If the interior of the storage structure is coated or lined, the coating or lining shall be of a type approved by the Division of Water for use in contact with potable water. [401 KAR 8:020 Section 2(19)]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-26	Additional Limitations: Paints and coatings a) shall meet NSF standard 61, b) shall be acceptable to the Division of Water, c) shall be properly applied and cured, and d) shall not transfer any substance to the water which will be toxic or cause tastes or odors (following curing). Wax coatings shall not be used in any storage structure and must be completely removed before using other paints or coatings in an existing storage structure. [401 KAR 8:100 Section 1(7), Recommended Standards for Water Works 7.0.17]
T-27	Additional Limitations: New water storage structures shall be thoroughly disinfected (in accordance with AWWA Standard C652) upon completion of construction and before being placed into service. To disinfect newstorage structures 1) remove all scaffolding, planks, tools, rags, and other items that are not part of the structural or operational facilities of the storage structure, 2) clean thoroughly by sweeping, scrubbing, using high-pressure water jets, or some equivalently effective means, and 3) use chlorine or chlorine compounds as subsequently described. Finalize disinfection by a) chlorination method 1, described in detail at AWWA Standard C652 Section 4.3.1, b) chlorination method 2, described in detail at AWWA Standard C652 Section 4.3.2, or c) chlorination method 3, described in detail at AWWA Standard C652 Section 4.3.3. See the following conditions for abreviated descriptions of the methods. Following the finalization of disinfection, place storage structures into service if, and only if, Coliform monitoring applicable to the storage structure does not show the presence of Coliform. If Coliform is detected, flush the tank and repeat Coliform monitoring. If Coliform is still detected, repeat disinfection and flushing as if the tank has never been disinfected. Continue the described process until monitoring does not show the presence of Coliform. [Recommended Standards for Water Works 7.0.18]

Narrative Requirements:

Condition No.	Condition
T-28	If applicable, chlorination method 1 generally requires a) filling a storage structure to the overflow level with water providing a free chlorine Residual Disinfection >= 10 ppm and b) i) completely draining the storage facility and refilling or b) ii) otherwise reducing (in accordance with method 1) the free chlorine residual to a level appropriate for distribution. [Recommended Standards for Water Works 7.0.18]
T-29	If applicable, chlorination method 2 generally requires a) scrubbing or spraying the water-contact surfaces of a storage structure with a water solution having an available chlorine concentration = 200 ppm and b) purging of the strong chlorine solution and filling to the overflow level. [Recommended Standards for Water Works 7.0.18]
T-30	If applicable, chlorination method 3 generally requires a) filling a storage structure to approximately 5% of the total storage volume with water having an available chlorine concentration of 50 ppm, b) continued filling of the storage structure to the overflow level with normal potable water, and c) purging the storage structure so that various disinfection by-products do not reach water consumers. [Recommended Standards for Water Works 7.0.18, 401 KAR 8:100 Section 1(7)]

ERNIE FLETCHER
GOVERNOR

ENVIRONMENTAL AND PUBLIC PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER
14 REILLY ROAD
FRANKFORT, KENTUCKY 40601-1190
www.kentucky.gov

LAJUANA S. WILCHER
SECRETARY

June 8, 2005

Mr. Jimmy Linkous, President
Levee Road Water Association
P.O.BOX 770
Mt.Sterling, Kentucky 40353

Re: Levee Road Water Association
PWS— 34037
DW No.0870246-05-001
Camp Mckee Water Improvement Project
Activity ID: APE20050001
Montgomery County, Kentucky

Dear Mr.Linkous:

We have reviewed the plans and specifications for the above referenced project. The plans include the construction of approximately 8,120 feet of 6-inch, 10 feet of 3-inch PVC, 100 feet of 8-inch PE water lines and a 122,000 gallon ground storage tank. This is to advise that plans and specifications for the above referenced project are APPROVED with respect to sanitary features of design, as of this date with the requirements contained in the enclosed waterline extension construction permit.

If you have any questions regarding this decision, please contact Fred Sarabi, at (502) 564-2225, extension 564.

Sincerely,

for Donna S. Marlin, Manager
Drinking Water Branch
Division of Water

DSM/FFS
Enclosure

CC: H.A.Spalding Engineers, Inc.
Montgomery County Health Department.
Powell County Health Department.
Public Service Commission
Division of Plumbing.

Distribution-Major Construction

Levee Rd Water Association Inc

Subject Item Inventory

Activity ID No.: APE20050001

Subject Item Inventory:

ID	Designation	Description
AIOO34037		
PORT1	Water Line	8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC
STOR1	Ground Tank	122,000 Gallon Ground Storage Tank

Subject Item Groups:

ID	Description	Components
GACT1	8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC and 122,000 Gallon Ground Storage Tank	STOR1 122,000 Gallon Ground Storage Tank
		PORT1 8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC

KEY

ACTV = Activity
AREA = Area
QPT = Equipment
PERS = Personnel
STOR = Storage
TRMT = Treatment
AIOO = Agency Interest
COMB = Combustion
MNPT = Monitoring Point
PORT = Transport
STRC = Structure

GACT1 (Camp McKee Water Improv.) 8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC and 122,000 Gallon Ground Storage Tank:

Monitoring Requirements:

Condition No.	Parameter	Condition
M-1	Coliform	The presence or absence of total Coliform monitored by sampling and analysis as needed shall be determined for the new or relocated water line(s). Take samples at connection points to existing lines, at 1 mile intervals, and at dead ends without omitting any branch of the new or relocated water line. Sample bottles shall be clearly identified as "special" construction tests. [401 KAR 8:100 Section 1(7), 401 KAR 8:150 Section 4, Recommended Standards for Water Works 8.5.6] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination.
M-2	Coliform	The presence or absence of total Coliform monitored by sampling and analysis as needed shall be determined for the new storage structure(s). With at least 1 sample taken at least 24 hours after the first construction complete sample(s), take 2 or more samples from the yard hydrant, the outlet piping from the storage structure, or a sample tap directly connected to the storage structure. Sample bottles shall be clearly identified as "special" construction tests. [Recommended Standards for Water Works 7.0.18, 401 KAR 8:150 Section 4] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination.

Submittal/Action Requirements:

Coliform:

Condition No.	Condition
S-1	Coliform For new construction projects, the distribution system, using the most expedient method, shall submit Coliform test results to the Cabinet: Due immediately following disinfection and flushing. [401 KAR 8:150 Section 4(2)]

Submittal/Action Requirements:

Condition No.	Condition
S-2	For proposed changes to the approved plan, submit information: Due prior to any modification to the Cabinet for approval. Changes to the approved plan shall not be implemented without the prior written approval of the Cabinet. [401 KAR 8:100 Section 1(8)]
S-3	The person who presented the plans shall submit the professional engineer's certification: Due when construction is complete to the Division of Water. The certification shall be signed by a registered professional engineer and state that the water project has been constructed and tested in accordance with the approved plans, specifications, and requirements. [401 KAR 8:100 Section 1(8)]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-1	Additional Limitations: Chlorinated water resulting from disinfection of project components shall be disposed in a manner which will not violate 401 KAR 5:031. [401 KAR 8:020 Section 2(20)]

Condition No.	Condition
T-2	This project has been permitted under the provisions of KRS Chapter 224 and regulations promulgated pursuant thereto. Issuance of this permit does not relieve the applicant from the responsibility of obtaining any other approvals, permits or licenses required by this Cabinet and other state, federal and local agencies. Further, this permit does not address the authority of the permittee to provide service to the area to be served. [401 KAR 8:100 Section 1(7)]
T-3	Unless construction of this project is begun within 1 year from the issuance date of this permit, the permit shall expire. If requested prior to the permit expiration, an official extension from the Division of Water may be granted. If this permit expires, the original plans and specifications may be resubmitted for a new comprehensive review. If you have any questions concerning this project, please contact the Drinking Water Branch at 502/564-3410. [401 KAR 8:100 Section 1(9)]

Narrative Requirements:

Condition No.	Condition
1-4	During construction, a set of approved plans and specification shall be available at the job site at all times. All work shall be performed in accordance with the approved plans and specifications. [401 KAR 8:100 Section 1(7)(a)]

PORT1 (Water Line) 8,120 feet of 6-inch PVC, 100 feet of 8-inch PE & 10 feet of 3-inch PVC:

Limitation Requirements:

Condition No.	Parameter	Condition
L-1	Depth	A continuous and uniform bedding shall be provided in the trench for all buried pipe. Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. Stones found in the trench shall be removed for a Depth >= 6 in below the bottom of the pipe. [Recommended Standards for Water Works 8.5.2] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-2	Depth	All water lines shall be covered to a Depth >= 30 in to prevent freezing. [Recommended Standards for Water Works 8.5.3, 401 KAR 8:100 Section 1(7)] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-3	Diameter	All water lines shall have Diameter >= 3 in. [Recommended Standards for Water Works 8.1.4] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-4	Diameter	Water lines with Diameter < 6 in shall not have fire hydrants. [Recommended Standards for Water Works 8.1.5] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-5	Diameter	All new and existing water lines serving fire hydrants or where fire protection is provided shall have Diameter >= 6 in. [Recommended Standards for Water Works 8.1.2] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-6	Distance	Water lines shall have a sufficient quantity of valves so that inconvenience and sanitary hazards will be minimized during repairs. A valve spacing Distance <= 1.0 mi should be utilized. [Recommended Standards for Water Works 8.2] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-7	Distance	Hydrant drains shall not be connected to sanitary sewers or storm drains and shall be located a Distance > 10 ft from sanitary sewers and storm drains. [Recommended Standards for Water Works 8.3.4] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.

Limitation Requirements:

Condition No.	Parameter	Condition
L-8	Distance	Except when not practical, water lines shall be laid a horizontal Distance >= 10 ft from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, water lines may be installed closer to a sewer provided that the water lines shall be laid in a separate trench or on an undisturbed shelf located on one side of the sewer at such an elevation that the bottom of the water line is at least 18 inches above the top of the sewer. [Recommended Standards for Water Works 8.6.2] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-9	Distance	When water lines and sewers cross, 1) water lines shall be laid such that either a) the the top of the water line is a vertical Distance >= 18 in below the bottom of the sewer line or b) the bottom of the water line is a vertical Distance >= 18 in above the top of the sewer line, 2) 1 full length of the water pipe shall be located so that both joints of the water pipe will be as far from the sewer as possible, and 3) special structural support for the water and sewer pipes may be required. [Recommended Standards for Water Works 8.6.3] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-10	Distance	The open end of an air relief pipe from automatic valves shall be extended a Distance >= 1.0 ft above grade and provided with a screened, downward-facing elbow. The pipe from a manually operated valve shall be extended to the top of the pit. Use of manual air relief valves is recommended wherever possible. [Recommended Standards for Water Works 8.4.2] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-11	Pressure	Pipes shall not be installed unless all points of the distribution system remain designed for ground level Pressure >= 20 psi under all conditions of flow. [Recommended Standards for Water Works 8.1.1] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-12	Pressure	Pressure >= 30 psi must be available on the discharge side of all meters. [401 KAR 8:100 Section 4(2)] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination.

Limitation Requirements:

Condition No.	Parameter	Condition
L-13	Residual Disinfection	New or relocated water lines shall be thoroughly disinfected (in accordance with AWWA Standard C651) upon completion of construction and before being placed into service. To disinfect the new or relocated lines use chlorine or chlorine compounds in such amounts as to produce an initial disinfectant concentration of at least 50 ppm and a Residual Disinfection >= 25 ppm at the end of 24 hours. Follow the line disinfection with thorough flushing and place the lines into service if, and only if, Coliform monitoring applicable to the line does not show the presence of Coliform. If Coliform is detected, repeat flushing of the line and Coliform monitoring. If Coliform is still detected, repeat disinfection and flushing as if the line has never been disinfected. Continue the described process until monitoring does not show the presence of Coliform. [401 KAR 8:150 Section 4(1), Recommended Standards for Water Works 8.5.6] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-14	Velocity	Each blow-off, fire hydrant, or flush hydrant shall be sized so that Velocity >= 2.5 ft/sec can be achieved in the water main served by the blow-off or hydrant during flushing. [Recommended Standards for Water Works 8.1.6.b, 401 KAR 8:100 Section 1(7)] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.

Monitoring Requirements:

Condition No.	Parameter	Condition
M-1	leaks	The presence or absence of leaks monitored by physical testing as needed shall be determined in all types of installed pipe. Pressure testing and leakage testing shall be in accordance with the latest edition of AWWA Standard C600. [Recommended Standards for Water Works 8.5.5] This requirement is applicable during the following months: All Year. Statistical basis: Instantaneous determination.

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-1	Additional Limitations: Water line installation shall be in accordance with AWWA standards or manufacturer recommendations. [Recommended Standards for Water Works 8.5.1]
T-2	Additional Limitations: Pipes, fittings, valves and fire hydrants shall conform to the latest standards issued by the AWWA or NSF (if such standards exist). PVC and PE piping used must be certified to ANSI/NSF Standard 61. [Recommended Standards for Water Works 8.0.1]
T-3	Additional Limitations: At high points in water lines, where air can accumulate, provisions shall be made to remove the air by means of hydrants or air relief valves. Automatic air relief valves shall not be used in situations where manhole or chamber flooding may occur. [Recommended Standards for Water Works 8.4.1]
T-4	Additional Limitations: All tees, bends, plugs and hydrants shall be provided with reaction blocking, tie rods or joints designed to prevent movement. [Recommended Standards for Water Works 8.5.4]
T-5	Additional Limitations: A fire hydrant or blow-off shall be required at the end of each dead end line. [Recommended Standards for Water Works 8.1.6]
T-6	Additional Limitations: For each fire or flush hydrant, auxiliary valves shall be installed in the hydrant lead pipe. [Recommended Standards for Water Works 8.3.3]
T-7	Additional Limitations: No flushing device, blow-off, or air relief valve shall be directly connected to any sewer. Chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances shall not be directly connected to any storm drain or sanitary sewer. Such chambers, pits or manholes shall be drained to absorptions pits underground or to the surface of the ground where they are not subject to flooding by surface water. [Recommended Standards for Water Works 8.1.6, Recommended Standards for Water Works 8.4.3]
T-8	Additional Limitations: If water lines are installed or replaced in areas of organic contamination or in areas within 200 ft of underground or petroleum storage tanks, ductile iron or other nonpermeable materials shall be used in all portions of the water line installation or replacement. [401 KAR 8:100 Section 1(5)(d)6, Recommended Standards for Water Works 8.0.2]
T-9	Additional Limitations: No water pipe shall pass through or come in contact with any part of a sewer manhole. [Recommended Standards for Water Works 8.6.6]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-10	Additional Limitations: If a fire sprinkler system is to be installed, a double check detector assembly approved for backflow prevention shall be utilized. The double check detector assembly of the system shall be accessible for testing. [401 KAR 8:100 Section 1(7)]
T-11	Additional Limitations: If water lines cross a stream or wetland, the provisions in the attached Water Quality Certification shall apply. If you have any questions please contact the Water Quality Certification Supervisor of the Water Quality Branch at (502) 564-2225. [401 KAR 8:100 Section 1(7)]

Subfluvial Pipe Crossings:

Condition No.	Condition
T-12	Subfluvial Pipe Crossings: For subfluvial pipe crossings, a floodplain construction permit will not be required pursuant to KRS 151.250 if the following requirements of 401 KAR 4:050 Section 2 are met. 1) No material may be placed in the stream or in the flood plain of the stream to form construction pads, coffer dams, access roads, etc. during construction of pipe crossings. 2) Crossing trenches shall be backfilled as closely as possible to the original contour. 3) All excess material resulting from construction displacement in a crossing trench shall be disposed of outside the flood plain. 4) For erodible channels, there shall be at least 30 inches of backfill on top of all pipe or conduit points in the crossing. 5) For nonerodible channels, pipes or conduits in the crossing shall be encased on all sides by at least 6 inches of concrete with all pipe or conduit points in the crossing at least 6 inches below the original contour of the channel. [401 KAR 8:100 Section 1(7)]
T-13	Subfluvial Pipe Crossings: For subfluvial pipe crossings greater than 15 feet in width, 1) the pipe shall be of special construction, having flexible, restrained, or welded watertight joints, and 2) valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair. Valves shall a) be easily accessible, b) not be subject to flooding, and c) if closest to the supply source, be in a manhole with permanent taps made on each side of the valve to allow insertion of a small meter to determine leakage and for sampling purposes. [Recommended Standards for Water Works 8.7.2]

STOR1 (Ground Tank) 122,000 Gallon Ground Storage Tank:

Limitation Requirements:

Condition No.	Parameter	Condition
L-1	Depth	High and low level Depth >= 30 ft apart should not be allowed in storage structures providing pressure to a distribution system. [Recommended Standards for Water Works 7.3.2] This requirement is applicable during the following months: All Year. Statistical basis: Maximum.
L-2	Depth	Water Depth >= 50 percent of the total water depth should be above grade. [Recommended Standards for Water Works 7.0.2.b] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.
L-3	Distance	Sewers, drains, standing water and similar sources of possible contamination shall be a Distance >= 50 ft from ground-level storage structures. The only exception allowed is for gravity sewers. Gravity sewers are allowed within 50 ft of ground-level storage structures only if they are a) greater than 20 ft from all ground-level storage structures and b) constructed of water main pipe pressure tested in place to 50 psi without leakage. [Recommended Standards for Water Works 7.0.2.b] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-4	Distance	To prevent excessive erosion of storage structure foundations, the overflow and main drain shall either a) discharge to concrete or other stable surfaces (splash pads) which extend a Distance >= 10 ft away from the base of the storage structure or b) discharge directly into a crushed stone pit that is at least 2' x 2' x 2' which is a Distance >= 10 ft away from the base of the storage structure. [401 KAR 8:100 Section 1(7)] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.
L-5	Height	Tanks shall have an overflow which is a) brought down to a Height >= 12 and <= 24 in above the ground surface, b) of sufficient diameter to permit waste of water in excess of the filling rate, c) open downward, d) screened with twenty-four mesh noncorrodible screen installed within the pipe at a location least susceptible to damage by vandalism, and e) located on the outside of the tank so that any discharge is visible. [Recommended Standards for Water Works 7.0.7] This requirement is applicable during the following months: All Year. Statistical basis: Not applicable.

Limitation Requirements:

Condition No.	Parameter	Condition
T-6	Height	Tanks shall have manholes that are a) framed a Height >= 4 in above the surface of the roof at the opening and b) fitted with a solid watertight cover which overlaps the framed opening and extends down around the frame at least 2 inches. Manholes should be hinged at one side and shall have a locking device. [Recommended Standards for Water Works 7.0.8] This requirement is applicable during the following months: All Year. Statistical basis: Minimum.

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-1	Additional Limitations: The materials and designs used for storage structures shall provide stability and durability as well as protection for the quality of the stored water. Steel structures shall follow the AWWA standards wherever they are applicable. Other materials of construction are acceptable when properly designed to meet the requirements in this permit. [Recommended Standards for Water Works 7.0]
-2	Additional Limitations: The safety of employees must be considered in the design of any storage structure. The design of storage structures shall a) meet or exceed the minimum requirements of pertinent safety laws and regulations in the areas where the structures are constructed, b) include ladders, ladder guards and balcony railings (where applicable), c) locate entrance hatches in safe places, and d) consider confined space entry requirements. [Recommended Standards for Water Works 7.0.12]
T-3	Additional Limitations: Storage structures shall be designed with reasonably convenient access to the interior for cleaning and maintenance. Where space permits, at least 2 manholes shall be provided above the waterline at each water compartment. [Recommended Standards for Water Works 7.0.8]
T-4	Additional Limitations: Fencing, locks on access manholes, and other necessary precautions shall be provided to prevent trespassing, vandalism, and sabotage. [Recommended Standards for Water Works 7.0.4]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-5	Additional Limitations: All storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing. [Recommended Standards for Water Works 7.0.13]
T-6	Additional Limitations: Tanks shall be constructed with no openings except properly constructed vents, manholes, overflows, risers, drains, pump mountings, control ports, and piping for inflow and outflow. For steel tanks, any pipes running through the roof or sidewall must be welded or properly gasketed. For concrete tanks, any pipes running through the roof or sidewall shall be connected to standard wall castings which were poured in place during the forming of the concrete and which should have seepage rings imbedded in the concrete. [Recommended Standards for Water Works 7.0.10]
T-7	Additional Limitations: All finished water storage structures shall have suitable watertight roofs and sidewalls which exclude birds, animals, insects, and excessive dust. [Recommended Standards for Water Works 7.0.3, Recommended Standards for Water Works 7.0.10]
T-8	Additional Limitations: The roof of each storage structure shall be well drained. Downspout pipes shall not enter or pass through storage structures. Parapets or similar structures which would tend to hold water and snow on a storage structure roof shall not be approved unless adequate waterproofing and drainage are provided. [Recommended Standards for Water Works 7.0.11]
T-9	Additional Limitations: Storage structures shall be designed so they can be isolated from the distribution system and drained for cleaning or maintenance without necessitating loss of pressure in the distribution system. [Recommended Standards for Water Works 7.3.2, Recommended Standards for Water Works 7.0.5]
T-10	Additional Limitations: Storage structure drains shall discharge to the ground surface at a drainage structure inlet or splash plate. [Recommended Standards for Water Works 7.3.2, Recommended Standards for Water Works 7.0.7]
T-11	Additional Limitations: No drain on a storage structure may have a direct connection to a sewer or storm drain. [Recommended Standards for Water Works 7.0.5, Recommended Standards for Water Works 7.0.7, Recommended Standards for Water Works 7.3.2]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-12	Additional Limitations: Main drains from storage structures shall have a twenty-four mesh noncorrodible screen installed within the drain pipe at a location least susceptible to damage by vandalism. [401 KAR 8:100 Section 1(7)]
T-13	Additional Limitations: Storage structures shall be designed to facilitate turn over of water. [401 KAR 8:100 Section 1(7), Recommended Standards for Water Works 7.0.6]
T-14	Additional Limitations: Ground level storage tanks and standpipes shall be equipped with separate inlet/outlet pipes installed on opposite sides of the tank. A check valve shall be installed in the outlet pipe to insure turnover of the water. The inlet pipe a) shall be installed near the overflow elevation and b) shall not interfere with the overflow discharge. [401 KAR 8:100 Section 1(7)]
T-15	Additional Limitations: Storage structures shall have sufficient capacity, as determined from engineering studies, to meet domestic demands. Additionally, if fire protection is provided, capacity shall also be sufficient to meet fire flow demands. [401 KAR 8:100 Section 1(7), Recommended Standards for Water Works 7.0.1]
T-16	Additional Limitations: The bottom of the structure shall be above a) the maximum flood level and b) the groundwater level. [Recommended Standards for Water Works 7.0.2]
T-17	Additional Limitations: Storage structure discharge pipes shall be located in a manner that will prevent the flow of sediment into the distribution system. Additionally, removable silt stops should be provided. [Recommended Standards for Water Works 7.0.15]
T-18	Additional Limitations: Appropriate sampling tap(s) shall be provided to facilitate collection of water samples for both bacteriologic and chemical analyses. [Recommended Standards for Water Works 7.0.19]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
T-19	Additional Limitations: Storage structures shall be vented. Overflows shall not be considered as vents. Open construction between the sidewall and roof is not permitted. Vents shall a) prevent the entrance of rainwater, b) exclude birds and animals, and c) exclude insects and dust (as much as compatible with effective venting). Vents may use four-mesh noncorrodible screen. [Recommended Standards for Water Works 7.0.9]
T-20	Additional Limitations: Adequate controls shall be provided to maintain levels in storage structures. The level controls shall be acceptable to the Division of Water. Level indicating devices should be provided at a central location. Overflow and low-level warnings or alarms should be located at places in the community where they will be under responsible surveillance 24 hrs a day. [401 KAR 8:100 Section 1(7), Recommended Standards for Water Works 7.3.3]
T-21	Additional Limitations: If storage structures have a catwalk over the water, the catwalk floor shall be solid with raised edges so that shoe scrapings and dirt will not fall into the water. [Recommended Standards for Water Works 7.0.14]
T-22	Additional Limitations: The area around the storage structure shall be graded in a manner that will prevent surface water from standing within 50 ft of the storage structure. [Recommended Standards for Water Works 7.0.16]
T-23	Additional Limitations: Proper protection shall be given to metal surfaces by a) paints or other protective coatings and/or b) cathodic protective devices. [Recommended Standards for Water Works 7.0.17]
T-24	Additional Limitations: If cathodic protection is utilized, a) competent technical personnel should design and install the protection and b) a maintenance contract should be provided. [Recommended Standards for Water Works 7.0.17]
T-25	Additional Limitations: If the interior of the storage structure is coated or lined, the coating or lining shall be of a type approved by the Division of Water for use in contact with potable water. [401 KAR 8:020 Section 2(19)]

Narrative Requirements:

Additional Limitations:

Condition No.	Condition
f-26	Additional Limitations: Paints and coatings a) shall meet NSF standard 61, b) shall be acceptable to the Division of Water, c) shall be properly applied and cured, and d) shall not transfer any substance to the water which will be toxic or cause tastes or odors (following curing). Wax coatings shall not be used in any storage structure and must be completely removed before using other paints or coatings in an existing storage structure. [401 KAR 8:100 Section 1(7), Recommended Standards for Water Works 7.0.17]
T-27	Additional Limitations: New water storage structures shall be thoroughly disinfected (in accordance with AWWA Standard C652) upon completion of construction and before being placed into service. To disinfect newstorage structures 1) remove all scaffolding, planks, tools, rags, and other items that are not part of the structural or operational facilities of the storage structure, 2) clean thoroughly by sweeping, scrubbing, using high-pressure water jets, or some equivalently effective means, and 3) use chlorine or chlorine compounds as subsequently described. Finalize disinfection by a) chlorination method 1, described in detail at AWWA Standard C652 Section 4.3.1, b) chlorination method 2, described in detail at AWWA Standard C652 Section 4.3.2, or c) chlorination method 3, described in detail at AWWA Standard C652 Section 4.3.3. See the following conditions for abreviated descriptions of the methods. Following the finalization of disinfection, place storage structures into service if, and only if, Coliform monitoring applicable to the storage structure does not show the presence of Coliform. If Coliform is detected, flush the tank and repeat Coliform monitoring. If Coliform is still detected, repeat disinfection and flushing as if the tank has never been disinfected. Continue the described process until monitoring does not show the presence of Coliform. [Recommended Standards for Water Works 7.0.18]

Narrative Requirements:

Condition No.	Condition
T-28	If applicable, chlorination method 1 generally requires a) filling a storage structure to the overflow level with water providing a free chlorine Residual Disinfection >= 10 ppm and b) i) completely draining the storage facility and refilling or b) ii) otherwise reducing (in accordance with method 1) the free chlorine residual to a level appropriate for distribution. [Recommended Standards for Water Works 7.0.18]
T-29	If applicable, chlorination method 2 generally requires a) scrubbing or spraying the water-contact surfaces of a storage structure with a water solution having an available chlorine concentration = 200 ppm and b) purging of the strong chlorine solution and filling to the overflow level. [Recommended Standards for Water Works 7.0.18]
T-30	If applicable, chlorination method 3 generally requires a) filling a storage structure to approximately 5% of the total storage volume with water having an available chlorine concentration of 50 ppm, b) continued filling of the storage structure to the overflow level with normal potable water, and c) purging the storage structure so that various disinfection by-products do not reach water consumers. [Recommended Standards for Water Works 7.0.18, 401 KAR 8:100 Section 1(7)]

KENTUCKY TRANSPORTATION CABINET
Department of Highways
Permits Branch

TC 99-1E
Rev. 10/01

Released Date _____ **ENCROACHMENT PERMIT** PERMIT NO. _____

APPLICANT IDENTIFICATION:
NAME: Levee Road Water Association
CONTACT PERSON: Ms. Brenda Murphy
ADDRESS: P.O. Box 770; 4969 Levee Rd.
CITY: Mt. Sterling
STATE: KY ZIP CODE: 40353
PHONE: area code(859) 498-6980

PROJECT IDENTIFICATION:
ACCESS CONTROL: ☒ By Permit ☐ Partial ☐ Full
COUNTY: Montgomery PRIORITY ROUTE NO: _____
MILEPOINT: _____ ☐ Left ☐ Right ☐ X-ing
PROJECT STATUS: ☐ Maint. ☐ Const. ☐ Design
PROJECT # STATE: _____
PROJECT # FEDERAL: _____
ROAD/STREET NAME: KY 11

TYPE OF ENCROACHMENT:
☐ COMMERCIAL ENTRANCE - BUSINESS _____
☐ PRIVATE ENTRANCE: ☐ Single Family ☐ Farm
☒ UTILITY: ☐ Overhead ☐ Underground
☐ GRADE: ☐ Fill ☐ Landscape on R/W
☐ AIRSPACE: ☐ Agreement ☐ Lease
☐ OTHER: (Specify)

ATTACHMENTS:
☐ Standard Drawings (List on TC 99-21 under Misc.)
☒ Applicant's Plans
☐ Highway Plan and Profile Sheets
☐ TC 99-3 (Ponding Encroachment Specs. and Conditions)
☐ TC 99-4 (Rest Area Usage Specs. and Conditions)
☐ TC 99-5 (Tree Cutting/Trimming Specs. and Conditions)
☐ TC 99-6 (Chemical Use of Specs. and Conditions)
☐ TC 99-10 (Typical Highway Boring Crossing Detail)
☐ TC 99-12 (Overhead Utility Encroachment Diagram)
☐ TC 99-13 (Surface Restoration Methods)
☐ TC 99-21 (Encroachment Permit General Notes and Specs.)
☐ TC 99-22 (Agreement for Services to be Performed)
☐ TC 99-23 (Mass Transit Shelter Specs. and Conditions)
☐ Other Attachments (Specify):

TYPE OF INDEMNITY: ☒ Bond ☐ Cash
☐ SELF-INSURED AMOUNT ENCUMBERED $ _____
☐ OTHER _____

NAME AND ADDRESS OF LOCAL INSURANCE AGENCY OR SELF-INSURED REPRESENTATIVE:
Bond to be paid by Contractor when selected.

IDEMNITY: The applicant, in order to secure this obligation, has deposited with the Transportation Cabinet as a guarantee of conformance with the Department's Encroachment Permit requirements, an indemnity in the amount of $ _____ as determined by the as determined by the Department. It shall be the responsibility of the applicant or permitee, his heirs and assignees to keep all indemnities in full force until construction or reconstruction has been completed and duly accepted by an authorized agent of the Transportation Cabinet, Department of Highways.

BRIEF DESCRIPTION OF WORK TO BE DONE.

See attached Plans & Technical Specs.

IMPORTANT (PLEASE READ): Applicant ☐ does ☒ does not intend to apply for excess R/W.

When the work is completed in accordance with the terms of this encroachment permit, your indemnity will be released. However, the permit is effective until revoked by the Transportation Cabinet and the terms on the permit accompanying permit documents and drawings remain in effect as long as the encroachment exists. FUTURE MAINTENANCE OF THE ENCROACHMENT IS THE RESPONSIBILITY OF THE PERMITEE. It is important that you understand the requirements of this encroachment permit application and accompanying documents. If you have not done so, it is suggested that you review these documents and place the permit package in a safe place for future reference.

A copy of this permit and all documents shall be given to your contractor and shall be readily available at the work site for the encroachment permit inspector to review at all times. Failure to meet this requirement may result in cancellation of this permit.

IN THE EVENT THIS APPLICATION IS APPROVED, THIS DOCUMENT SHALL CONSTITUTE A PERMIT FOR THE APPLICANT TO USE THE RIGHT-OF-WAY, BUT ONLY IN THE MANNER AUTHORIZED BY THIS DOCUMENT AND REGULATIONS OF THE DEPARTMENT AND THE DRAWINGS, PLANS, ATTACHMENTS, AND OTHER PERTINENT DATA ATTACHED HERETO AND MADE A PART HEREOF.

Permit No. _____

The permittee agrees to the following terms and conditions:

1. The permittee shall comply with and is bound by the requirements of the Department's Permits Manual as revised to and in effect on the date of the issuance of this permit which is made a part hereof by reference.

2. Permittee agrees that if the Department determines that vehicular capacity deficiencies or over capacity conditions develop as a result of the installation and use of this facility, the permittee shall adjust, relocate, or reconstruct the facilities and/or provide and bear the expenses for signs, auxiliary lanes, or other corrective measures reasonably deemed necessary by the Department and as set forth in the Department's Permit Manual within a reasonable length of time after receipt of written notice regarding such adjustments, relocation, additions, modifications, and/or corrective measures, such time to be specified in the notice. In cases where traffic signals are permitted or required, as determined by the Department, the costs for signal equipment and installation(s) shall be borne by the permittee and/or the Department in accordance with Department policy then in force as set forth in the Traffic Manual. Any modifications to the permittee's entrance necessary to accommodate signalization (including necessary easement(s) on private property) shall be the responsibility of the permittee, at no expense to the Department. (This applies only to Entrance Permits.)

3. The said encroachment will not infringe on the frontage rights of an abutting owner without written consent of the said owner as hereto: "I(we) consent to the granting of attached permit." _____

Date _____ (This does not apply to utilities which serve the general public.)

4. Any permit granted hereunder shall be with the full understanding that it shall not interfere with any similar rights or permits heretofore granted to any other party except as otherwise provided by law.

5. A plan prepared by H. A. SPALDING ENGINEERS, Inc. and dated 6/2005 is attached hereto and made a part hereof, which describes the facilities to be constructed by the permittee for which facilities this permit is granted. The permittee agrees as a condition to the issuance of the permit to construct and maintain such facilities in accordance with said plan, and the permittee shall not use the facilities authorized herein in any manner contrary to that prescribed by this permit and plan. Normal usage and routine maintenance only are authorized under this permit.

6. Permittee shall comply with the Manual on Uniform Traffic Control Devices as revised to and in effect on the date of the issuance of this permit which is made a part hereof by reference.

7. Permittee shall at all times from date when work is first commenced and until such time as all facilities are removed from the right-of-way premise, defend, protect, and save harmless the Department from all liability, claims, and demands arising out of work undertaken by the permittee pursuant to this permit, due to any negligent act or omission by the permittee, its servants, agents, employees, or contractors. This provision shall not inure to the benefit of any third party or operate to enlarge any liability of the Department beyond that existing at common law if this right to indemnity did not exist.

8. Upon a violation of any of the provisions of this permit, the Department may revoke the permit by giving notice to the permittee in writing to remove from the right-of-way any facilities placed thereon within a reasonable time as set forth in the notice, and in the event said facilities are not so removed, and the right-of-way restored the Department may cause same to be removed, and the costs thereof shall be charged to the permittee.

9. The permittee, his successors and assigns shall use the encroachment premises in compliance with all Federal requirements imposed pursuant to the provisions of the Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000-1) and regulations of the U.S. Department of Transportation as set forth in Title 49 C.F.R., Part 21, and as said regulations may be amended.

10. Permittee agrees that in the event it should become necessary, as may be reasonably determined by the Department, for the facilities covered by this permit to be removed or relocated in connection with the reconstruction, relocation, or improvement of the abutting highway, the Department may revoke this permit and require removal or relocation by the permittee at his own expense according and pursuant to the procedures provided in Paragraph 8 above except in those cases where the Department is required by law to pay any or all the same.

11. The permittee understands and agrees that this permit is personal to the permittee and shall not inure to his successors and assigns without the written approval of the Department that he is bound by the provisions of this permit as long as the encroachment exists unless a written release has been obtained from the Department. (Does not apply to utilities serving the general public.)

12. If the work authorized by this permit is on a project in the construction phase, it shall be the responsibility of the permittee to make personal contact with _____ Resident Engineer on the project to coordinate the permitted work with the State's prime contractor on the project.

13. This permit does not alleviate any requirements of any other government agency.

14. Permittee agrees to keep the priority route in which this permit was issued clear of dirt, mud, and debris during construction and for the life of this permit.

ANY ATTEMPT TO ALTER THIS FORM CONSTITUTES A VOID PERMIT.

THE UNDERSIGNED APPLICANT (being duly authorized representative/owner) DOES AGREE TO ALL TERMS AND CONDITIONS SET FORTH HEREIN.

☐ January 1st, 20 ☒ July 1st, 20 06	11/9/05	
Completion Date	Date	Signature

RECOMMENDED FOR APPROVAL

Title	Signature	Chief District Engineer	Date

PRIVATE ENTRANCE: TO BE COMPLETED BY PERSONNEL INSTALLING FACILITY.

Installed By:		
Title	Signature	Date

ANY ATTEMPT TO ALTER THIS FORM CONSTITUTES A VOID PERMIT.

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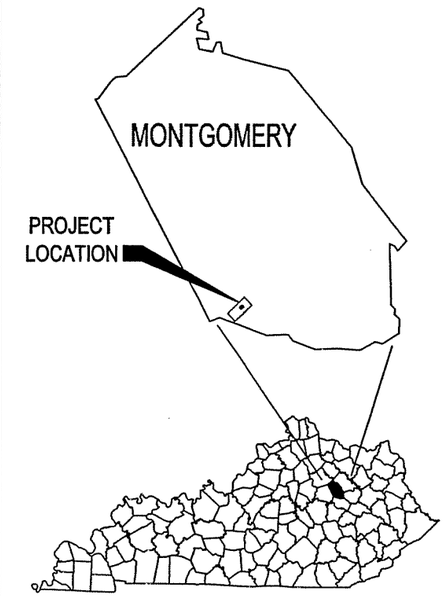
EXISTING TANK LOCATION
(NEW TELEMETRY)

EXISTING PRV LOCATION
(NEW ELECTRIC VALVE)

NEW 6" / 8" WATERLINE

PROPOSED TANK LOCATION

SCALE: 1" = 3000'



VICINITY MAP
Not to Scale

CAMP McKEE WATER IMPROVEMENTS PROJECT

EXHIBIT D
LOCATION OF PROPOSED FACILITIES

EXHIBIT E

Camp McKee Water Improvements Project
Estimated Annual Operation, Maintenance, and Replacement Costs for New Facilities

Tank:

Estimated Maintenance Free Period is 10 years. Estimated Cost at 10 year period is $10,000. Assumed Interest Rate is 5%.
➪ (A/F, 5%, 10) = 0.0795, ➪ 0.0795 x $10,000 = $795 Annual Cost

Telemetry (Solar Powered, See Note):

Expendables (batteries, etc.), estimated as $200 annually. Estimated useful life of 20 years with 50% replacement.
➪ $30,000 x (A/F, 5%, 20) = $907.

Electric Valve:

Operation (1/4 hp, 0.5 hours per day, $0.20/kwh).
➪ (.25 hp x .75 kw/hp x 0.5 hr./day x 365 day x $0.20/kwh) = $7
Replacement, useful life at 10 years at 25% replacement.
➪ (A/F, 5%, 10) x $3,000 = $239

Annual Totals:

Tank	$795
Telemetry	$200
	$907
Electric Valve	$7
	$239
Total Estimated Annual Cost	$2,148

NOTE: The new proposed telemetry also functions to monitor and control an existing storage facility.

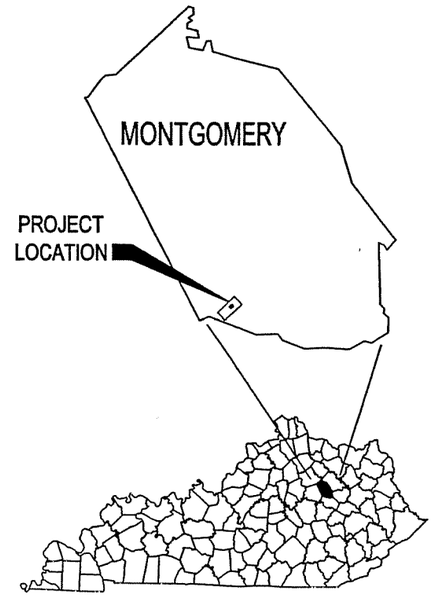
EXISTING TANK LOCATION
(NEW TELEMETRY)

EXISTING PRV LOCATION
(NEW ELECTRIC VALVE)

NEW 6" / 8" WATERLINE

PROPOSED TANK LOCATION

SCALE: 1" = 3000'



VICINITY MAP
Not to Scale

EXHIBIT D
LOCATION OF PROPOSED FACILITIES

CAMP McKEE WATER IMPROVEMENTS PROJECT

CAMP MCKEE WATER IMPROVEMENTS
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TECHNICAL SPECIFICATIONS

SPECIAL NOTES

A. Unless noted, all waterline fittings are Mechanical Joint. Unless specifically noted, **all waterline fittings including all ells, tees, and valves, shall be equipped with grip rings at all branches.**

B. Crushed stone for backfilling and bedding of pipe is a Pay Item. This reduction in cost should be reflected in your Unit Price for waterline piping.

C. All concrete in the job, with the exception of items shown within 'Pay Limits' (for example at a Master Meter), is a Pay Item, including concrete kickers, all patches, and creek crossing concrete, and is payable at your Unit Price for that bid item.

D. Special attention should be afforded all areas that are marked with 'Pay Limits'. Notes as they appear on the drawings will be strictly adhered to concerning pay items. Note that some external valves are excluded from this requirement if they lay within Pay Limits and these valves may be paid for at their unit price as submitted if Pay Limits lines point towards this fact.

E. Contractors should note the placement of No. 12 copper wire in the location of all plastic water pipe. Substitutes such as line marking tape will not be accepted. Smaller diameter wire will not be accepted. Contractor should note the looping of wire into all valve boxes for subsequent line tracing.

F. Any sequence of construction as noted on the Drawings or in these specifications shall be strictly adhered to.

G. The Contractor should notice that there is no Reinforced Concrete Pay Item. Reinforced concrete as discussed here does not include cast-in-place vaults or other appurtenances. The Engineer may at his discretion, require reinforced concrete in other locations. If additional reinforced concrete is used, it is anticipated that it will be for replacement of driveways, highways, or other concrete structures where reinforcement is required . This reinforcement may vary from a minimum of 6x6, 10/10 W.W.M. up to a maximum of #6's @ 9" ea. way, each face. There will be no adjustment in your Unit Price for General Concrete for this work.

H. Contractor shall arrange for (through the Levee Road Water Association) any and all required Electrical and/or Telephone service. The Contractor shall make these contacts with the appropriate utility as soon as he is awarded the project. Any delay in project completion caused by the Contractor's lack of getting these installations into the appropriate utilities "system" shall be considered an unreasonable delay.

I. Use extreme caution in areas where other utilities are shown, especially gas. All utility

locations as shown on the drawings should be considered approximate. All known utility crossings (after this determination by the utility) shall be flagged by the appropriate agency. These crossings may require hand digging for discovery and/or clearance.

J. Contractor shall contact all utilities and arrange for flagging of all existing lines.

K. Valve collars shall be required at all valves and cost shall be included in the unit price for the valve and box. Additionally, valve markers shall be placed at all valves or valve groupings. These valve markers are detailed on the drawings. The cost of these valve markers shall be included in the unit cost of valves. Additionally, line markers shall be placed where indicated on the Drawings (see Line Marker Detail for requirements).

L. All "TIES" are bid items including all necessary materials required to make the same. The Drawings designate limits and what each tie includes.

M. Contractor should note that **an Encroachment Bond is required** from the Kentucky Transportation Cabinet. All cost associated with this bond is the responsibility of the Contractor. Contractor should read and understand all the requirements in the section of these Specifications entitled "Additional Transportation Cabinet Requirements".

N. The plans serve as a guide to the final line location. The line location as shown on the Drawings represents the Engineer's interpretation of proper line location. However, the Contractor, because of his extensive knowledge obtained from line installation, shall immediately contact the Engineer (not just the Engineer's resident observer) should construction appear unreasonable, dangerous, or liable to generate property damage in any location. This notification shall include all likely areas of slip, slide, or other ground movement. The Contractor is responsible for all construction activities and any detrimental result of his construction. The Contractor, in accepting any portion of this Contract, assumes all associated responsibility for any and all construction activity. As such, the Contractor has the right, **and obligation,** to request changes in line location which benefit the project, the adjoining land owners, area residents, or any other person or place which appears to have less negative impact by a revised line location. Contractor is responsible for contact with local Boy Scout officials before any work in the Camp McKee area.

O. **Very important note.** The Contractor should note and pay careful attention to the location of all lines as they are constructed around/over/under existing cross drains. The line locations as shown have been interpreted by the Engineer as the most desirable location for the new line. The Contractor shall consider all work as shown on the Plans in his Bid, with the understanding that modification or relocation of these lines in cross drain areas will not occur without written permission from the Engineer.

P. **The use of a trencher is mandatory along any State maintained roadway.** The Engineer, Owner, and Transportation Cabinet understand that there will be limited particular areas where the use of a backhoe or excavator are required and use of a trencher is impossible. For all other areas along State highways a trencher shall be used. The use of a small

trencher, with a chain width of 8" or smaller, is required in certain portions of the project. The Contractor should consider the above two facts in his bid for the work. The Contractor shall submit to the Engineer prior to the beginning of any work an equipment list which includes the trencher considered for mainline work and the trencher considered for small line work.

Q. **A project video tape is mandatory. The Contractor** shall slowly drive the project and video tape the entire length designated for new construction. The Contractor shall also provide indepth video and commentary in all areas which he deems problematic. These areas should include all possible cross drain conflicts, driveway drains, areas with construction close to road, slip/slide prone areas, and any other areas which would catch the attention of a reasonable person. This video tape/s shall be submitted to the Engineer prior to commencement of any construction activity. This video tape is done for the protection of the Owners, engineers, and contractors.

R. **A very important note:** Along any State maintained roadway, 36" of cover is the minimum allowable. 30" cover is the minimum allowed for any line on private or County owned right-of-way. Any pipe discovered as not having these minimum covers will be relayed at the Contractor's expense.

S. Contractor is required to provide a compact disk (CD) with digital pictures of all valves or valve groupings. These pictures shall be taken or processed into JPEG Format. The individual pictures shall be entitled with a name that is descriptive in and of itself. For example, if a valve or valve group lay at the intersection of Third and Denmar Streets, it shall be entitled, "Third_Denmar".

T. The Project will not be considered complete, nor final payment made, until release is obtained from the Highway Department and all punch list items have been completed and valve CD submitted and approved.

U. The Boy Scouts of America (BSA) have several special or different requirements for construction in the Camp McKee area. These requirements include, but are not limited to, special refill requirements for road crossings, endophyte free seed, additional line markers, best management practice (BMP) plan submission requirements, and schedule submission requirements. The Drawings present these requirements in more detail. Also see "Additional BSA Requirements" in these Specifications.

SCOPE AND SEQUENCE OF WORK

Sequence:

The Sequence of Construction shall generally follow the sheet layout. Where it is convenient and practical for the Contractor to construct mainline portions first he may do so. Construction may proceed in any sequence deemed reasonable by the Engineer. Other special sequences, if any, are shown on the Drawings.

Scope of Work, Waterline:

The Drawings show the required Scope of Work for the Waterline portion of the project. The Owner specifically reserves the right to add or deduct reasonable quantities of any Bid Item to match available funding.

Scope of Work, Tank:

The Drawings show the required Scope of Work for the new Tank. The Tank Contractor shall complete all site and tank work as delineated on the Drawings. Specifically, the tank Contractor should review the crushed stone requirements for both ditches and his portions of the road that are included in his Lump Sum bid.

Scope of Work, Telemetery:

The Drawings show the required Scope of Work for the Telemetry Contract. The Telemetry Contractor should carefully review the Drawings for the additional work required at the existing PRV vault and existing tank.

INSTALLATION:

Trenching - The CONTRACTOR should note the trencher requirements under Special Notes within these specifications. Trenching shall be done in a true straight line at all times and fittings shall be used only at the direction of the RESIDENT ENGINEER.

Trenching shall include all clearing and grubbing, including all weeds, briars, trees, and stumps encountered in the trenching. The CONTRACTOR shall dispose of any such material by burning, burial, or hauling away, at no extra cost to the OWNER. Shrubs, hedges, and small trees (3" in dia.) shall be removed and replanted, at no extra cost to the OWNER. Trenching also includes such items as street, road, sidewalk, pipe and small creek crossings; cutting, moving, or repairing damage to fences, poles, or gates and other surface structures, regardless of whether shown on the Plans.

All material encountered in excavation shall be Unclassified. In areas where rock is encountered, a min. of 4" of crushed stone shall be placed in the bottom of the trench before installation of the pipe. Extra payment will be made for the installation of the crushed stone at your submitted unit price for crushed stone. The price for the pipe in place shall also include hauling off of all excavated material.

The CONTRACTOR shall determine, as far as possible in advance, the location of all existing sewer, culvert, drain, water, electric, and gas pipes and other subsurface structures and avoid disturbing same in opening his trenches. In case of sewer, water, and gas services, and other facilities easily damaged by machine trenching, same shall be uncovered without damage ahead of trenching, and restored immediately after trenching machine has passed, without extra cost to the OWNER. The CONTRACTOR shall protect such existing facilities, including power and telephone poles and guy wires, against danger or damage due to settlement of his backfill. It shall be the responsibility of the CONTRACTOR to inform customers of utilities of disruption of service as soon as it is known that it has or will be cut off.

The CONTRACTOR shall at all times during trenching operations on the streets, carry a stock of pipe and fittings likely to be needed for replacement of pipe to facilitate immediate repair.

Construction equipment will not be approved for use where treads are injurious to paving encountered. Curbs, sidewalks, and other structures shall be protected by the CONTRACTOR from damage by his construction equipment. Where the CONTRACTOR damages pavement or other structures where it is deemed avoidable by the ENGINEER, these areas shall be repaired by the CONTRACTOR at no cost.

In case of damage to any existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases, restoration and repair shall be such that the damaged structure will be in as good condition and serve its purpose as completely as before and such restoration and repair shall be done without extra charge, except as set forth under the provisions of the General Conditions. Where there is the possibility of damage to existing utility lines by trenching machine, the ENGINEER may order hand search excavation ahead of machine

trenching to uncover same, at no extra cost to the OWNER.

All trenches must be dug neatly to lines. Hand trenching may be required by the ENGINEER, at no extra payment, where undue damage would be caused by existing structures and facilities by machine trenching. Trenches in earth shall be dug to just above grade by machine and shall be finished down to grade by hand, unless otherwise specified.

Where trenching is cut through paving, which does not crumble on edges, trench edge shall be cut to at least two (2") inches deep to straight and neat edges before excavation is started, and care taken to preserve edge to facilitate neat repaving as shown on the Drawings.

All excavation shall be open trenches, except where otherwise called for on the Plans or by special permission of the ENGINEER, for boring or jacking under railroads, sidewalks, and the highway.

When working along the highway the CONTRACTOR shall furnish, install and maintain necessary signs, lights or other warning devices as prescribed by the Kentucky Department of Transportation and shall furnish and employ sufficient flagmen to direct traffic in the construction area all as directed by the Department of Transportation. All signs, devices, flagmen, etc. shall be as prescribed in the "Manual on Uniform Traffic Control Devices, Part VI," latest revision.

The CONTRACTOR shall so coordinate his work as to produce a minimum of interference with normal traffic on highways and streets. He may, with the approval of the ENGINEER and governing agency, close a street to traffic for such length of time considered necessary by the ENGINEER, provided persons occupying property abutting the streets have an alternate route of access to the property which is suitable for their needs during the time closure. It shall be the responsibility of the CONTRACTOR to give 24 hours advance notice to Fire and Police Departments and to occupants of a street which will be closed in a manner approved by the ENGINEER.

The opening of more than 500 feet of trench ahead of the pipe laying and more than 500 feet of open ditch left behind pipe laying before backfilling, will not be permitted except upon written consent of the OWNER. No trench shall be left open or work stopped on same for a considerable length of time. If such is necessary, trench shall be refilled according to backfill specifications. In crossing a road or street a temporary bridge must be placed over the excavation if traffic conditions require its use before backfilling. Where required or when directed by the ENGINEER, road or street crossings will be limited to one-half of travel width before placing temporary bridge over the excavated side. Whenever trenching is performed on public ways, the CONTRACTOR shall furnish and maintain barricades, lanterns, warning sign and signals as far as one block ahead or at locations directed by the governing agency as required for public safety. All such necessary bridges, barricades, lanterns, signs and signals shall be provided by and at the expense of the CONTRACTOR. The CONTRACTOR shall maintain road crossings in a passable condition for traffic until the final acceptance of the work at no cost to the OWNER.

Where pipelines run through wooded terrain, cutting of trees within limits of maximum permissible

trench width, as set forth in this article, will be permitted. However, cutting of additional trees on sides of trench to accommodate operation of trenching machine will not be permitted. The CONTRACTOR shall obtain specific permission of the OWNER before cutting any tree larger than four (4") inches in diameter.

Sheeting and shoring of trench will be required of this CONTRACTOR where necessary to protect life, property, or the waterline structure from damage or to maintain maximum permissible trench widths at top of pipe. Sheeting, sheet piling, trench jacks, braces, shores, and stringers shall be used to hold trench walls. These shall be withdrawn as the trenches are being backfilled, after backfill has been placed over pipe at least 18". If their removal, before backfill is completed to surface, endangers adjacent structures such as pipelines, street paving, sidewalk and buildings, then they shall be left in place until such danger has passed and then pulled if possible. Voids caused by sheeting withdrawal shall be backfilled and tamped with thin rammers designed for the purpose so as not to form an obstruction at the ground level. Dewatering of the trenches shall be considered a part of trenching at no extra cost to the OWNER. Dewatering of trenches shall include ground water and storm or sanitary sewage. Suitable pumping and other dewatering equipment is to be provided by the CONTRACTOR to insure the installation of the pipeline structure in a dewatered trench and under the proper conditions. Dewatering shall include all practical means available for prevention of surface runoff into trenches and scouring against newly laid pipe.

Piles of excavated material shall be trenched or temporarily piped to prevent, as far as practical, blockage of drainage ditches and gutters and resultant water carriage of excavated materials over street surfaces.

Where subgrade of trench has insufficient stability to support the pipeline and hold it to its original grade, the ENGINEER may order stabilization by various means. Exclusive of dewatering normally required for construction and instability caused by neglect of the CONTRACTOR, it shall be paid for at unit prices set up in the Contract such as extra excavation, crushed rock for pipe bedding, concrete cradle, or piling.

The location of pipe and their appurtenances, as shown, are those intended for the final construction. However, conditions may present themselves before construction of any line is started, that would indicate desirable changes in location. Also, development of property traversed may require location changes. In such cases, the OWNER reserves that right to make reasonable changes in line and structure location without extra cost except as may be determined by the application of the unit prices bid to the quantities actually involved. The OWNER is under no obligation to locate pipelines, so they may be excavated by machine.

The work of uncovering and backfilling required for locating existing sewers, waterlines and other existing facilities for connection of improvements, or avoidance in location of proposed pipeline, where such uncovering and backfilling is not within trench for improvements, shall be at the CONTRACTOR's expense.

The CONTRACTOR will be required to test all pipelines and appurtenances with water at 150 lbs.

per square inch before backfilling. Backfilling before testing will be allowed at the discretion of the ENGINEER at points where danger to the public, or other hazards, demand that such be done immediately after pipe is laid. All leakage apparent after testing must be repaired before backfilling.

Backfilling Trenches:

Backfilling must be started as soon as practicable after pipe has been laid. Packing of earth across and around pipe at six (6') foot intervals and between joints shall be the usual procedure as the laying proceeds. This is in order to avoid danger of mis-alignment from slide, flooding or other causes. The ENGINEER shall be given a maximum of 24 hours for inspection before backfilling. Only earth, or rock less than 2-1/2" size, shall be used as backfill materials up to six (6") inches above top of pipe. No stones or other hard or heavy substances may be thrown directly upon the pipes or into the trench until the above named cover of earth is obtained. Above the 6 or 12 inches above pipe, rock may be used in the backfill to an extent not greater than one-half of the total backfill materials used. If additional earth is required, it must be obtained and placed by the CONTRACTOR. Filling with rock and earth shall proceed simultaneously in order that all voids in the rock may be filled with earth. Where noted on the Plans and within the shoulder of the Kentucky Highways, the CONTRACTOR shall backfill to finish highway grade with DGA. The DGA shall be tamped in six (6") inch layers in accordance with Department of Transportation Specifications. In these areas (if any) DGA will be a pay item. All material hauled away shall be placed at no cost and at a location specified by the ENGINEERS.

No extra charge shall be made for supplying outside materials for backfill or removing excess excavation material from the site of the work.

Extra cost of compaction of backfill on street and driveway crossings and tunnels shall be included in price bid for Blacktop Replacement.

Where highway slopes, thin grass, or cover crops are destroyed by trenching, laying, or backfilling operations, and access to them, surface shall be prepared by disking, fertilizing 5 lbs. of 5-10-5 or 6-8-6 per 1,000 square feet and seeding 21 lbs. of Italian Rye Grass per 1,000 square feet, light harrowing, then reseeding with crop destroyed or one part Red Top, three parts certified Kentucky Bluegrass seed mixed together at the rate of 2 lbs. per 1,000 square feet of surface. This shall be included in the price for trenching and backfilling. Requirement of the Department of Transportation, Bureau of Highways, for reseeding shall take precedence over these specifications.

Cleaning Up and Repairing Damage:

The Contract will not be considered complete until all construction structures and equipment and rubbish from construction are cleaned from the site of the work.

All damage to existing grounds and structures caused by construction operations must be repaired or the OWNER compensated for such damage before contract will be considered complete. This does not include replacement of sod, but does include required shaping of ground for sodding or

planting of grass and the removal and disposition of all rock from blasting three (3") inches or over in size.

Hauling and Storage:

The CONTRACTOR will be required to deliver all pipe, fittings, valves and valve boxes and other materials and place same as and where required for laying.

Care must be exercised in the handling of all materials and equipment and the CONTRACTOR will be held responsible for all breakage or damage to same caused by his workmen, agents of appliances for handling or moving. Pipes and other castings shall in no case be thrown or dropped from cars, trucks, or wagons to the ground but same shall be lowered gently and not allowed to roll against or strike other castings and unyielding objects violently. Pipe and special castings may be distributed at places that will not interfere with other building operations as unloaded or yard and distributed as required, as the CONTRACTOR may elect.

Valves, valve boxes, jointing materials, meter box covers, castings, fabricated metal, reinforced steel, etc. shall be yarded or housed in some convenient location by the CONTRACTOR and delivered on the ground, as required.

The cost of all hauling, handling, and storage shall be included in the price bid for equipment and materials in place.

The OWNER takes no risk or responsibility for fire, theft, flood, or damage until after the final acceptance of the work.

Testing of Lines:

On all projects involving the installation of water pipeline, the finished work shall comply with the provisions listed below, or similar requirements which will insure equal or better results.

..a. All water mains shall be given a hydrostatic test to 150 psi, under which leakage shall not exceed the limits established in Section 4 of AWWA Standard Specifications C600.

..b. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet.

..c. Duration of test shall be not less than two hours.

..d. Where leaks are evident on the surface where joints are covered, the joints shall be recaulked, repoured, bolts retightened or relaid, and leakage minimized regardless of total leakage as shown by test.

..e. All pipe, fittings and other materials found to be defective under test shall be removed and

replaced.

..f. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.

..g. The CONTRACTOR shall furnish a recording gauge and clock used during leakage test and recording pressure charts during duration of test. Recording pressure charts shall remain the property of the ENGINEER at conclusion of test.

The new potable waterlines shall not be placed in service, either temporarily or permanently, until they have been thoroughly disinfected in accordance with the following requirements and to the satisfaction of the ENGINEER.

After testing, a solution of hypochlorite using HTH, or equal, shall be introduced into the section of the line being disinfected sufficient to insure a chlorine dosage of at least 50 ppm in the main. While the solution is being applied the water should be allowed to escape at the ends of the line until tests indicate that a dosage of at least 50 ppm has been obtained throughout the pipe. Open and close all valves and cocks while chlorinating agent is in the piping system. The Chlorinated water shall be allowed to remain in the pipe for 24 hours, after which a residual of at least 25 ppm shall be obtained. The disinfection shall be repeated until 25 ppm is obtained, after which time the main shall be thoroughly flushed until the residual chlorine content is not greater than 1.0 ppm.

Following disinfection of the line, bacteriological samples shall be collected and analyzed in accordance with the requirements of Kentucky Department of Natural Resources and Environmental Protection. When the samples have been approved, the new line then may be connected to the system.

Dust and Mud Control:

The Contractor shall have on-hand, or shall acquire, suitable equipment to control dust and mud on City, County, and State maintained roadways. The Contractor is responsible to ensure that unhealthy levels of dust are not generated by the project along any roadway. The Contractor is required to have adequate equipment to remove mud which may gather on a roadway. The Contractor shall maintain roads so to not jeopardize the safety of the traveling public. The Contractor maybe required to have water trucks with suitable spraying capability, sweepers, or other equipment as necessary to provide suitable conditions.

Additional BSA Requirements:

The Drawings detail some of the additional requirements for constructing on BSA property. These detailed requirements include full depth crushed stone backfill for road crossings, special seeding requirements, additional line markers, disposal issues of chlorinated water, preparation of a best management plan, and submission of a construction schedule. In addition to the requirements shown on the Drawings, the additional requirements for construction on BSA property apply: 1) where

constructing in wooded areas, any wooden debris generated by the construction process shall be removed from the site unless specific written permission is received from BSA otherwise; 2) BSA may require a specialized seed mix over and above the endophyte free fescue mentioned; 3) the project will not be considered complete, nor final payment made, until written release from BSA has been obtained.

One Year Guarantee:

The CONTRACTOR, and through him each subcontractor, in accepting the contract for this construction, or respective portions of the construction covered by these Plans and Specifications, does hereby agree to replace and make good, without expense to the OWNER, any work or material which may be found to be defective within one (1) year from the date of the final certificate of payment of said CONTRACTOR. The deterioration due to ordinary use and wear and failure of materials furnished by the OWNER are excepted from this guarantee.

This guarantee shall include damage done by settlement of backfills and filling regrade elevations, such damage and sinking of fills being considered as defective workmanship. This shall also include pavement failure.

The CONTRACTOR shall reimburse the OWNER for cost of damage, if any, as well as cost of replacing defective materials or workmanship. If replacements are not made within ten (10) days in case of materials, then the OWNER shall have the right to make replacements and charge cost of same to the CONTRACTOR or his Bondsman.

MATERIAL:

PVC Pipe - Class 200:

Waterline designated as PVC shall be PVC type pressure pipe designed ASTM Class 200. The pipe shall conform to ASTM 2241 for Standard Dimension Rations, SDR 21 for pressure characteristics. The pipe shall be extruded from clean, virgin, approved class 12454-A PVC compound conforming to ASTM resin Specification D1784. Rubber rings shall conform to ASTM D 1869. This pipe shall be CertainTeed Fluid-Tite PVC Pressure pipe or approved equal. Laying radius of pipe shall in all cases be equal to, or greater than, that listed by the manufacturer of the pipe. All tees, elbows, and bends shall be Mechanical Joint unless noted on the Plans. All Tees, elbows and bends shall also be equipped with Grip Rings unless specifically excluded on the Plans.

Ductile Iron Pipe:

All pipe designated as ductile iron shall be of Grade 60-42-10 material meeting AWWA C151 Minimum physical properties. Thickness of the pipe shall be determined in accordance with ANSI/AWWA C150/A21.50 and shall be Type 4 Bedding Condition except in high traffic areas where Type 5 Bedding shall be used; all pipe shall be thickness Class 50 with the exception of 4" and 3" which shall be thickness Class 51. Joints shall meet the requirements of AWWA C111 for Fastite Joint Pipe ANSI/AWWA C151.51 and Mechanical Joint ANSI/AWWA C111/A21.11. Pipe shall be equal to that manufactured by the U. S. Pipe Company or approved equal. All tees, elbows, and bends shall be Mechanical Joint. The exterior of the pipe shall be furnished with an asphaltic coating. Installation shall be as recommended by the manufacturer in their printed manual. Pulling devices and tie-in devices shall be that normally furnished by the manufacturer for this type of installation. All Tees, elbows and bends shall also be equipped with Grip Rings unless specifically excluded on the Plans. All Tees, elbows and bends shall also be equipped with Grip Rings unless specifically excluded on the Plans. In lieu of Grip Rings the Contractor may use Retainer Glands.

The Bid Form or Plans may list D.I.M.J., and D.I.C.J. These abbreviations stand for Ductile Iron, Mechanical Joint and Ductile Iron, Compression Joint (Push-On) Pipe, respectively.

Installation shall be as recommended by the manufacturer in their printed manual. Pulling devices and tie-in devices shall be that normally furnished by the manufacturer for this type of installation.

Polyethylene (PE) Pipe (Water):

Polyethylene Pipe shall be manufactured in accordance with AWWA CD01 for sizes 1/2" through 3" and in accordance with AWWA C906 for sizes 4" through 54". All PE pipe shall be high density polyethylene (PE 3408) intended for the transportation of potable water. All PE pipe larger than one inch shall have a pressure rating of 200 psi and have a dimension ratio (DR) of 9. All PE pipe fittings shall be either mechanical joint with stiffeners, accessories and other items as required by the pipe manufacturer (and approved by the pipe manufacturer), or butt fusion welded per the manufacturer's requirements. All mechanical joint fittings shall be equipped with Grip Rings and

with stiffener of adequate length to allow Grip Ring to function. All joints between plain ends of polyethylene pipe shall be made by butt fusion. The Contractor shall follow all requirements in the pipe manufacturer's printed literature for butt fusion welds including test well requirements. All PE pipe shall be Plexco or approved equal.

Water Service Tubing (3/4"):

All service tubing to be Class 200. Acceptable manufacturers are Phillips and Orangeburg. Any other manufacturer shall be approved by the Engineer.

Valves:

All valves must be of cast iron with bronze mountings, unless otherwise specified. Only makers of well-known and approved standings who have been making similar devices for a period of at least ten (10) years, prior to the bid date, will be considered. Also, maker shall be prepared to furnish through the bidder, within one (1) week after award is made, complete catalogues or other descriptive matter giving complete details and dimensions of valves they proposed to furnish.

All valves shall be provided with suitable operating devices and adapted for operation in the position in which they are shown on the plans. All screw operated valves shall open by turning to the left.

All valves shall have mechanical joints both ends (unless noted on the Plans) and shall conform to A.W.W.A Specifications D-150, N.R.S. complying to A.W.W.A. C222 and ANSI A21.11.

All 4" through 10" Gate valves shall be resilient seat Gate valves, 200 psi max working pressure, 400 psi test pressure, Mueller A-2370-20, or approved equal. 3" and 2" Gate valves shall be double disc, parallel seat, bronze faces and disc rings with wedging mechanism simple and direct, Mueller A-2380-20, or approved equal. 1-1/2" and 1-1/4" Gate valves shall be Mueller H-10914, bronze Gate valve with solid wedge and F.I.P. thread with appropriate fittings and hand wheel. All valves shall conform to the latest revision of "Specifications for Gate Valves for Ordinary Water Works Service," adopted by A.W.W.A. Test pressure 300 lbs. (min.) per square inch and working pressure 150 lbs. (min. allowable working pressure) per square inch.

Valve Boxes:

Valve Boxes for 1-1/4" through eight (8") inch valves shall be telescope type with screw top, of extension length twenty-five (25) through thirty-six (36") inches. Ten (10") inch and twelve (12") inch valve boxes shall have an extension length ranging from eighteen (18") inches to twenty-four (24") inches. These minimum valve box lengths redefine depth of cover over pipe at valve locations. These requirements shall be maintained. Pieces of scrap PVC or ductile iron pipe with lid installed **shall not** be acceptable. Valve boxes shall be Tyler 461-S for ten (10") inch and twelve (12") inch valves, Tyler 562-S for two (2") inch through eight (8") inch valves, or approved equal. All valve boxes shall have a minimum inside diameter of 4-1/4" for intersection with an arc base. All valve box lids shall be manufactured by the same firm as the box and marked WATER. All

valve boxes shall have installed a valve box collar similar in all respects to the Cloud Company U-235 Valve Retainer Ring, alternate as shown on the detail sheet, or approved equal.

Type II Blow-Offs:

Type II Blow-off's of 3" through 1-1/2" shall be self-draining, non-freeze, compression type with 2-3/16" main valve opening. Outlet size shall be 2-1/2" NST. Blow-offs shall have cast iron box, locking lid, and 3" Ductile Iron Riser Pipe. Principal operating parts shall be Brass and be removable from the blow-off for servicing without excavation. Blow-offs shall be set in four cubic feet min. of crushed stone to allow for proper drainage. Inlet shall be suitably sized for the pipe used and shall be Mechanical Joint for all sizes. If reducer is required, given pipe size, it shall be provided. No difference in unit price for 1-1/2" through 3" is considered.

The blow-off shall be ECLIPSE No. 85 Box Hydrant as manufactured by John C. Kupferle Company, St. Louis, Mo., or approved equal.

SPECIAL NOTE: All flushing valves to be connected using same type (PVC) (C900, or D.I.) line as to the main to which they connect. Install all appurtenances as shown on the Standard Drawings. Contractor shall also review the project Drawings to see the requirements for tying all hydrants back to mainline tees. This tying shall consist of either duc-lugs and all-thread or grip rings when PVC pipe is used. When ductile iron pipe is used, retainer glands will be considered equal to the above.

Deductive Alternate Blow-Off:

The Drawing detail a possible deductive alternate for blow-offs. Should limited project funds so dictate, the Owner may accept these deductive alternate for the blow-offs. The space for the deductive alternate price is given on the Bid Form.

Air Release Valves:

Air Release Valves shall be simple lever, float operated. The body and cover shall be cast iron. The float shall be stainless steel with bronze linkage. All connection sizes shall be as shown on the Plans. The air relief valve shall be so designed as to operate at a pressure of 150 psi. The maximum venting capacity shall be 22 cubic feet of free air per minute. The valve shall be Valmatic 15A, or approved equal.

ARV Box and Cover:

All ARV's shall be installed within a circular plastic meter box of nominal 18"x30" interior dimensions. The properties of the box shall be equal to Mid-States Meter MS 183010. The cover shall be Ford, Type C, appropriately sized, or approved equal.

Small River Test Station:

River test stations shall be installed where shown on the Drawings. Where undesignated test stations are shown, they shall be "small" river test stations. This river test station consists only of the materials herein specified. The valve, 1" service line, and other items necessary are paid at your unit price for those items. The river test station consists of a standard meter box and cover as previously specified with the exception that a 24" diameter box shall be used. Additionally, use the specified copper setter with dual check valve feature replaced with extra Angle Valve and being sized for 1" x 1". Unit shall be copper. Service saddle shall be 1" bronze, same as previously specified for standard meter sets. Corp. Stop to be 1", same as previously specified for standard meter sets. The meter shall be Badger RecordAll, Model No. M70, suitable for a maximum continuous flow rate of 70 gpm. All the above materials shall be as specified or approved equal. This river test station is detailed on Sheet 9 of the Plans.

Meter Box and Cover:

In low traffic areas, as designated by the Engineer, high impact plastic meter boxes having the same material specifications as those given for the ARV box shall be used. The box shall be Mid States Meter MS 182410, 18" diameter x 24" depth, or approved equal. The cover shall be Tyler 6880 Cast Iron, or approved equal.

In high traffic areas, meter boxes shall be equal in all respects to Cloud Concrete UT-050 having an inside diameter of 18" and a depth of 24". When using the concrete box the lid shall be as specified above.

Tie #1 (Wet Tap):

At the locations shown on the Plans, the Contractor shall provide a full body M.J. x Flgd. Tapping Sleeve and Flgd. x M.J. Tapping Valve. Non full body Tapping Sleeves are unacceptable. The tapping sleeve shall be a Mueller H-615, or Engineer approved equal. The tapping valve shall be a Mueller T-2360 6" or Engineer approved equal.

Clear and Grub:

Where indicated on the Plans, the Waterline Contractor shall clear and grub an area that crosses along an old abandoned trail. This trail is rough with fairly dense growth in it. The Contractor will be required to construct a suitable area to lay the water line. This area is to be fully mulched and reseeded but is not subsequently to be used for access. The Contractor shall be required to properly dispose of all wooden debris to the satisfaction of the Boy Scouts of America (BSA). Unless specifically authorized in writing by BSA and local fire officials, this wooden debris shall not be burnt.

In the area designated on the Plans, the Contractor shall be required to clear and grub and construct a new access road to the tank. Wooden debris requirements are the same as those discussed above.

This road shall have a suitable width, grade, and firmness for subsequent application of crushed stone and reasonable driveability.

PRV to Electric Valve, Waterline Contractor Portion:

At the location indicated on the Plans, the Waterline Contractor shall modify an existing PRV pit to an electrically operated valve pit with by-pass. The Waterline Contractor shall complete all work as noted on the Plans including the installation of a new solenoid operated valve. This valve shall be a 4" Burmad 710-F-1 electric remote control valve equipped with large control filter and position indication. The valve shall be equipped with opening and closing speed control to limit surge. Other details of the valve are shown on the Drawings. The Contractor shall provide liquid filled Ashcroft 4" minimum diameter, stainless steel cased, gauges as indicated. The gauges shall be installed with a pressure snubber and stainless steel protective diaphragm and ball valves as indicated on the Drawings. The Contractor shall complete the other work as indicated on the Drawings. The Contractor is responsible for complete coordination with the telemetry contractor.

Liner Pipe:

Liner Pipe of the size and location, as shown on the Plans, shall be installed. The pipe shall be a high quality Wrought Steel Schedule and weights as listed below, with the same properties as determined by the American National Standard for welded and seamless wrought steel pipe. Used pipe will not be accepted unless it is delivered to the job site in as-new condition as determined by the Engineer.

Liner Pipe Table

Pipe Size	Sch. #	Wall (In.)
6"	--------	.250
8"	30	.277
10"	30	.307
12"	30	.330
14"	30 (Std.)	.375
16"	30 (Std.)	.383
18"	(Std.)	.383
24"	20 (Std.)	.383

Creek Crossings:

1) When making a creek crossing, the branch shall be excavated to grade, pipe installed, backfill installed, backfill compacted by tread or other methods, to density satisfactory to the Engineer. The stream shall, in all cases, whether caused by your work in, nearly, parallel, or upstream, remain clear of sediment.

2) The required structures for silt control, as determined by the Engineer, shall be put in place

to satisfy Paragraph 1 of this Section.

After this, if required by stream bottom conditions (see Paragraph 3 below) apply stream crossing concrete. After application of concrete, apply revegetation measures to the creek crossing (see other sections of these specifications). If you do not have the ability to complete these operations within a twenty-four (24) hour period, **DO NOT BID THIS PROJECT.**

3) All creek crossings as noted on plans shall have a minimum cover of 30" as measured from the original channel floor. Bedding shall be the same as that for "open areas" shown on the "Standard" sheet with the following exceptions:

A. Begin at 6" above pipe and refill with removed material.

B. 6" from original channel floor apply Class "C" concrete flush to top of rock.

If channel floor is not of a Rocky nature, then this requirement may be waived at the discretion of the Engineer.

Concrete Work

(a) Proportioning Mix:

Concrete is to be proportioned in two classes according to use as follows:

Class "A" for reinforced concrete structures, surface courses of highway, and street paving.

Class "C" for interceptor structures, curbs, gutters, driveways, sidewalks, base courses for highway and street paving, thrust blocks, creek crossings, and valve pads.

Class "A" concrete is to be proportioned one 94 lb. sack of Portland Cement, 195 lbs. of sand, 270 lbs. of coarse aggregate, and no admixture. These proportions may be varied by the Engineer after the materials supplied have been tested and proportions for the greatest density and workability determined, provided that no more than 7.25 nor less than 6.50 bags of cement per cubic yard of concrete will be required. Class "A" concrete shall have a minimum compressive strength of 4,000 lbs. per square inch in 28 days. All reinforced concrete structures used on this project shall have Class "A" concrete.

Class "C" concrete shall have a minimum compressive strength of 3,000 lbs. per square inch and shall contain not less than 5.5 sacks of cement per cubic yard of concrete. The relative amounts of fine and admixture will not be required.

The water used in mixing must be a minimum required for a plastic mix. No water will be permitted to be used for purpose of hastening mixing and reducing of tamping and vibration.

The water content allowed will be at all times subject to regulations by the Engineer. In the case of Class "A" concrete, not more than five and one-half gallons of water to the bag of cement will be allowed in mixing concrete (or proportionately less when slump is about 4" and/or mix is wet), except in cases where, in the judgement of the Engineer, additional water is necessary to obtain proper results.

Batching equipment shall include scales for weighing contents of wheelbarrows and a device for accurately measuring water by the gallon, to be used for proportioning each batch.

In case of ready-mixed concrete, specifications for proportioning of mixes shall be the same, except that from the manufacturer's experience with his own aggregates, he shall vary proportions of sand and coarse aggregate for the greatest density and workability of mix. Prior to actual delivery of concrete, and at any change of proportioning, the manufacturer shall furnish a statement to the Engineer giving the proportion by weight (dry) of cement and of fine and coarse aggregates that will be used in the manufacture of each mix ordered. Proportions must be approved by the Engineer. Otherwise, proportioning of mix and batching plant shall be according to ASTM Designation C-94, latest revision, specifications for ready-mixed concrete.

(b) Forms:

Forms for concrete with exposed surfaces shall consist of dressed and sized lumber or metal and must match on edges sufficiently to prevent leakage of mortar. Forms shall be built to such accuracy and braced to such an extent that they shall not vary from true lines and surfaces where exposed more than 1/4" before pouring concrete, nor more than 3/8" after pouring. Angle strips (3/4" size) shall be placed in all exposed corners of forms.

(c) Steel Reinforcement Placing:

All such steel shall be delivered in new condition either clean or with only a slight coating of rust. If stored on the site it must be kept under shelter or supporting at least 12" above ground to prevent its becoming coated with dirt and when placed in forms it must be free from scale or dirt.

When placing in forms, steel must be tied together to form a rigid frame before pouring concrete and must be secured in the walls or slabs in such a manner as to insure its holding and position designed for it in the finished work by use of form stands, steel or concrete chairs or spacers. As a rule, steel bars must have a minimum covering of 2" when exposed to air and a minimum of 3" when exposed to earth" of concrete, unless otherwise noted on the plans. All splices shall be 24 diameters long and 1" between spliced bars.

(d) Mixing and Placing:

Concrete shall be thoroughly mixed at least two minutes after all materials, including water, are in the mixer drum having a capacity of at least one sack batch.

Concrete must be poured into forms slowly enough to permit thorough tamping and vibrating

to eliminate any honeycombed surfaces.

Concrete pouring will not be permitted under conditions where there is danger of freezing or when materials are frozen. After pouring, concrete must be protected from freezing weather for at least 72 hours.

Ready-mixed concrete delivery facilities pledged to the concrete pour shall be approved by the Engineer before permission will be given to start the pour. The period between termination of placing by one truck and starting by the next shall not be longer than 10 minutes at temperatures above 70° F., nor longer than 20 minutes below 70° F. The concrete in a truck mixer or agitator must be totally discharged within 1-1/2 hours after the introduction of mixing water to the cement and aggregates. The mixing operation shall begin within 30 minutes after the cement has been intermingled with the aggregates. Otherwise, mixing, mixers, agitators, and inspection shall be according to ASTM Designation C-94, latest revision, specifications for ready-mixed concrete. Non-agitating trucks for hauling concrete from central mixing plant will not be accepted.

(e) Tempering:

All concrete must be kept wet or moist for a period of at least 48 hours after pouring in order to prevent too rapid drying out. In dry weather, wooden forms must be thoroughly wet before concrete is placed in them and must also be kept in this condition during the period above mentioned. Concrete must be covered and kept damp to protect it from the sun as soon as the surfaces are firm enough to allow the placing of such covering or protection.

TESTING CONCRETE

(a) Slump Test:

At least one slump test shall be made before first concrete pour, at the start of pouring any concrete and at each 5 cubic yards deposited during one operation. These shall be made from samples as those taken from cylinder tests and records of same kept therewith. Tests shall be made according to ASTM Designation C-143 and as required under ASTM Designation C-94, for ready-mixed concrete. Mix is designed for a slump test of 2" and not more than 4", except in cases where thin sections would indicate, in the opinion of the Engineer, that a wetter mix is more desirable. The **Contractor** shall furnish necessary equipment for the slump tests.

(b) Cylinder Test:

Cylinder tests will be taken on all important structures such as the storage tank foundation. However, on sewer and waterline jobs requiring only small amounts of concrete per pour, the cylinder tests will be waived. However, should the Engineer have reason to doubt that the concrete being furnished meets the strength requirements, he shall have the right to order cylinder tests according to the following specifications:

At the start of concreting or before, if practical, the **Contractor** shall make from a single batch a set of four (4) cylinders per ASTM Designation C-31. Two (2) shall be tested at 7 days and two (2) at 28 days per ASTM Designation C-39.

At each time when twenty or more cubic yards of concrete are placed during one operation and when the sum of smaller deposits of concrete equal thirty cubic yards since previous test and at any change in the mix four (4) cylinder tests will be required, two tested 7 days and the other two at 28 days per ASTM Designation C-39. In case of ready-mixed concrete, requirement for testing of ASTM Designation C-94 and C-172 shall be added. Class "A" concrete sampled shall show a compressive strength of not less than 3,000 lbs. per square inch in 7 days and 4,000 lbs. per square inch in 28 days. Class "C" concrete shall have a compressive strength of 3,000 lbs. per square inch in 28 days. Seven (7) day tests on Class "C" concrete shall have the same relation to 28 days requirements.

The **Contractor** shall furnish all equipment for sampling and curing on the job and shall bear the cost of laboratory curing and testing.

GEOTEXTILE

SCOPE

This work shall consist of furnishing and placing geotextile beneath ditches, around subsurface drains, and/or other applications as directed by the ENGINEER.

MATERIALS

Geotextile used on the project shall be a non-woven, polyester or polypropylene fabric meeting the following minimum physical properties.

Minimum Physical Properties
Geotextile

Property	Value
Burst Strength	300 psi
Grab Strength	160 lbs.
Permeability	3×10^{-1} cm/sec
Apparent Opening Size	0.21 - 0.15

The CONTRACTOR shall submit, for each roll of geotextile material delivered, a certification that the delivered products meet or exceed the values specified in this section, and all supporting data.

INSTALLATION

The surface to receive geotextile and aggregate shall be prepared to a relatively smooth condition free of obstructions, debris, or sharp objects that may puncture the

fabric. The fabric shall be placed with long dimension parallel to the flow line and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. If more than one strip is necessary, the strips shall overlap (longitudinally) a minimum of 24 inches. Transverse overlaps shall be a minimum of 18 inches and shall be placed so the upstream strip overlaps the downstream strip. Fastener pins shall be installed through the midpoint of the lap and at any other locations as necessary to prevent slippage of the geotextile.

The geotextile shall not be exposed to sunlight for a period greater than two weeks. If the fabric is damaged during construction, the torn or punctured section shall be repaired by placing a piece of fabric that is large enough to cover the damaged area and meet the overlap requirement.

The geotextile shall be protected from damage due to the placement of the channel lining by limiting the height of drop of the material to no greater than three (3) feet, or by placing a cushioning layer of sand on top of the fabric before dumping the material, at the CONTRACTOR'S option. Fabric shall not be placed until it can be covered with stone promptly to avoid damage from water, wind, and deterioration from undue exposure. The CONTRACTOR shall demonstrate that the placement technique will not damage the fabric.

MEASUREMENT AND PAYMENT

No payment will be made for the geotextile as it considered incidental to all other items of work.

GROUND WATER STORAGE TANK

General:

The Tank Contractor shall construct, on a site prepared by himself, a storage tank of nominal 25' (25.17' actual) inside diameter and 33' nominal height (33.01' actual) and 122,000 gallon capacity as shown on the Plans. The Contractor should note the deductive alternate for a 97,000 gallon capacity tank with the same side water height on the bid form. This deductive alternate will account for all reduction in cost related to this reduced diameter including all foundation work. The Tank Contractor should also note the Deductive Alternate for omission of the altitude valve and associated by-pass with possible reduction in vault size.

The Tank Contractor shall include the furnishing of all labor, materials, paint, and all equipment for a complete job. The Tank Contractor shall include ductile iron pipe outside the valve vault for the waterline main retie as detailed on the plans. The Tank Contractor shall construct all overflow and drain lines including any headwalls as shown on the plans. Over and above the site excavation and embankment, the Tank Contractor shall also provide all final site grading, ringwall and other final excavation, any required haulage, and reseeding as described earlier in these

specifications at the completion of the work. The Tank Contractor shall provide and install all site fencing (see Site Plan), gates, drain pipes, and other appurtenances as detailed on plans.

The Tank Contractor should note that the foundation is detailed assuming an allowable bearing pressure of 3,500 psf and using Glass Lined tank details. The Geotechnical Investigation for the tank is not complete at the time of preparation of this Specification. The Geotechnical Investigation and Report at the tank will be prepared before the time of bidding, and the Contractor shall include foundation modifications (if any) as indicated by this investigation and report in his base bid for the tank. The Geotechnical Report for the site will be available in the office of the Engineer. Copies will be made available to suitable tank contractors.

The exterior color of the tank shall be selected by the Owner. As this tank is constructed within confines of a Boy Scout Reservation, it is anticipated that the Owner will select a paint color which will blend with the treed environment as much as possible. Any proprietary or tradename identification will be specifically excluded from the tank exterior.

The Owner will consider glass lined tanks, steel storage tanks (only with special coatings as noted herein) and concrete storage tanks as equals. No maintenance allowance will be considered in the Bid for Concrete or Glass Lined tanks. All prospective bidders (steel, glass lined, concrete) shall provide equivalent shell accessories as noted on the plans.

The tank shall have a self-supporting roof. This roof may be either conical or domed shaped. Roof shall be fitted with a 24" square or round hatch and a ventilating finial. Center supported roofs will not be accepted as part of the base bid for any tank.

SHELL ACCESSORIES:

Shell accessories shall include outside vertical ladder with "safety climb" and locking safety cage, appropriately sized cast iron, aluminum, or steel overflow as shown on the Drawings, one (1) 24" manhole as shown on the Plans, roof hatch, stainless steel inlet pipe with flanged flared outlet to elevation shown on the plans, and level indicating equipment as shown on the drawings. The bottom shall be equipped with inlet/outlet as detailed on the plans. The valve pit piping shall be as shown on the plans.

FOUNDATION:

The Tank Contractor shall provide all work and materials and all else to provide a complete base for the proposed tank. The foundation shall be designed for the side water height as shown on the Drawings. All concrete work will be completed in strict accordance with specifications given earlier in these documents. All foundation and valve pit concrete shall have a minimum 28 day compressive strength (f'c) of 4,000 psi. The Tank Contractor shall be responsible for all excavation required to properly found the tank.

TANK CONTRACTOR SITE WORK:

The Tank Contractor is responsible for mass excavation and embankment and/or disposal of waste material at tank site. The Tank Contractor is also responsible for any final excavation that is not

covered by the Waterline Contractor's work.

The Tank Contractor shall use means and methods of excavation which do no damage to adjoining property. All material is unclassified. Should rock locations/elevations vary from those indicated in the Geotechnical Report no adjustment will be made to your Lump Sum price for Site work.

The Tank Contractor shall complete all fencing, crushed stone as required for his foundation, crushed stone for road as delineated on the plans (Waterline Contractor to provide crushed stone for road to point shown), crushed stone for ditches, drain pipes, headwalls, pit drains and tank drains, and other work as shown on the Drawings at the tank site.

NOTE: All Telemetry supplied by another Contractor. Tank Contractor is responsible for making all required taps in valve pit lines for pressure switches, transducers and any other equipment which may be necessary. Additionally, Tank Contractor shall provide an appropriately sized and located service exit through the valve pit sidewall for any required Telemetry Line/s. The Tank Contractor is responsible for coordination of these items with the selected Telemetry Contractor.

TANK SCHEDULE:

Description	Tank 1	Deductive Alternate
Cap. (gal)	122,000	97,000
I.D. (ft.)	25.2	22.4
Wat. Ht. (ft.)	33.0	33.0
Base Elev.	1050.0	1050.0
Regrade	1049.5	1049.5
Inlet Elev.	1071.8	1071.8
Overflow	1083.0	1083.0
Vault Fl.	1043.3	1043.3
Var. Pipes	6" D.I.	6" D.I.
Riser Pipe	6" S.S.	6" S.S.
O.F. Pipe	6" AL.	6" AL.
Acc. Doors	1	1

SHOP DRAWING SUBMISSION:

All shop drawings and calculations of a structural nature submitted to the Engineer for approval shall bear the stamp and signature of a Professional Engineer licensed in the State of Kentucky. These shop drawings shall be of a nature which adequately defines all proposed construction. The following Specification Sections detail the requirements for each particular construction type:

GLASS LINED TANK

Scope:

Furnish and erect a glass-coated, bolted-steel water storage tank, including foundation, tank structure and tank appurtenances, and site work, as shown on the contract drawings and described herein. Provide all required labor, materials, and equipment.

Qualifications of Tank Supplier:

The Engineer's selection of factory applied glass-fused-to-steel bolt together tank construction for this facility has been predicated upon the design criteria, construction methods specified, and optimum coating for resistance to internal and external tank surface corrosion. Deviations from the specified design, construction or coating details, will not be permitted.

The bidder shall offer a new tank structure as supplied from a manufacturer specializing in the design, fabrication and erection of factory applied glass-fused-to-steel, bolt together tank systems. The manufacturer shall own and operate its production plant, fabricate and glass coat the tank at one location.

Submittal Drawings and Specifications:

Construction shall be governed by the Owner's drawings and specifications showing general dimensions and construction details, after written approval by the Engineer of detailed erection drawings prepared by the tank bidder. There shall be no deviation from the drawings and specifications, except upon written order from the Engineer.

The bidder is required to furnish, for the approval of the Engineer and at no increase in contract price, four (4) sets of complete specifications and construction drawings for all work not shown in complete detail on the bidding drawings. A complete set of structural calculations shall be provided for the tank structure and foundation. All such submissions shall be stamped by a Registered Professional Engineer licensed in the state of project location, as well as by a Registered Professional Engineer employed on the tank manufacturer's engineering staff.

When approved, two sets of such prints and submittal information will be returned to the bidder marked "APPROVED FOR CONSTRUCTION" and these drawings will then govern for the

work detailed thereon. The approval by the Engineer of the tank supplier's drawings shall be an approval relating only to their general conformity with the bidding drawings and specifications and shall not guarantee detail dimensions and quantities, which remains the bidder's responsibility.

Design Criteria:

The materials, design, fabrication and erection of the bolt together tank shall conform to the AWWA Standard for "Factory-Coated Bolted Steel Tanks For Water Storage" - ANSI/AWWA D103, latest revision.

The tank coating system shall conform solely to Section 10.4 of ANSI/AWWA D103.2.4.3. The tank shall be certified and listed by the National Sanitation Foundation (NSF) to meet ANSI/NSF Additives Standard No. 61.

Design Loads:

Specific Gravity 1
Wind Velocity 100 mph
Shape Factor .6
Allowable Soil per Geotech's Bearing Capacity Soils Report
Roof Snow Load 30 psf
Earthquake Seismic Zone, per AWWA D103

Materials Specifications:

Plates and Sheets -

Plates and sheets used in the construction of the tank shell, tank floor or tank roof, shall comply with the minimum standards of AWWA D103, Section 2.4.

In no event shall a yield strength greater than 50,000 psi be utilized for calculations detailed in AWWA D103, Sections 3.4 and 3.5.

Rolled Structural Shapes shall conform to minimum standards of ASTM A36 or AISI 1010. Horizontal Wind Stiffeners shall be of the Web Truss Design, hot dipped galvanized. Bolt Fasteners used in tank lap joints shall be 1/2" - 13 UNC2A rolled thread, and shall meet the minimum requirements of AWWA D103, Section 2.2. Bolt Material shall be SAE Grade 2, Tensile Strength 74,000 psi Min., Proof Load 55,000 psi Min., Allowable Shear Stress 18,164 psi: SAE grade 8/ASTM A325 heat treated to Tensile Strength 150,000 psi min., Proof Load 120,000 psi Min., Allowable shear stress 36,818 psi. Bolt Finish - Zinc Plate, electro-galvanized.

Sealants -

The lap joint sealant shall be a one component, moisture cured, polyurethane compound. The

sealant shall be suitable for contact with potable water and meet applicable FDA Title 21 regulations, as well as, ANSI/NSF Additives Standard 61. The sealant shall be used to seal lap joints, bolt connections and sheet edges. The sealant shall cure to a rubber-like consistency, have excellent adhesion to the glass coating, have low shrinkage, and be suitable for interior and exterior exposure. Sealant curing rate at 73F and 50% RH. Tack-free time: 6 to 8 hours. Final cure time: 10 to 12 days. Neoprene gaskets and tape type sealer shall not be used.

Glass Coating Specifications:

Surface Preparation -

Following the decoiling and shearing process, sheets shall be steel grit-blasted on both sides to the equivalent of SSPC-10. Sand blasting and chemical pickling of steel sheets is not acceptable. The surface anchor pattern shall be not less than 1.0 mil. These sheets shall be evenly oiled on both sides to protect them from corrosion during fabrication.

Cleaning - After fabrication and prior to application of the coating system, all sheets shall be thoroughly cleaned by a caustic wash and hot rinse process followed immediately by hot air drying. Inspection of the sheets shall be made for traces of foreign matter or rust. Any such sheets shall be recleaned or grit-blasted to an acceptable level of quality.

Coating - All sheets shall receive one coat of a glass precoat to both sides and then air dried. A final coat to both sides of the sheets, of cobalt blue glass frit, shall be made. The sheets shall then be fired at a minimum temperature of 1500F in strict accordance with the manufacturer's quality process control procedures, including firing time, furnace humidity, temperature control, etc. Minimum dry coating thickness shall be 6.0 mils. The finished inside color shall be cobalt blue. The finished outside color may be other than cobalt blue (Owner selected) as specified but the color shall be fired over a cobalt blue base. Inspection - All coated sheets shall be inspected for mil thickness (Mikrotest or equal).

All coated sheets shall be checked for color uniformity by an electronic colorimeter. An electrical leak detection test shall be performed on the inside surface after fabrication of the sheet. Sheets with excessive electrical leakers shall be rejected so as to minimize field touch up.

The standard floor design is glass-coated, bolted steel. Bolted steel panels shall be either placed over a three (3) inch compacted sand base contained by a steel or concrete ring wall, or a non-extruding and resilient bituminous type filler meeting the requirements of ASTM D1751 if set on a concrete slab. Polyethylene co-polymer caps and sealant shall be used to cover the bolts, nuts and washers exposed on the inside of the floor. Leveling of the starter ring shall be required and the maximum differential elevation within the ring shall not exceed one-eighth (1/8") inch, nor exceed one-sixteenth (1/16") inch within any ten (10ft) feet of length.

Sidewall Structure - Field erection of the glass-coated, bolted-steel tank shall be in strict accordance with the procedures outlined in the manufacturer's erection manual, and performed by

an authorized dealer of the tank manufacturer, regularly engaged in erection of these tanks. An electrical leak test shall be performed during erection using a nine (9) volt leak detection device. All electrical leak points found on the inside surface shall be repaired in accordance with manufacturer's published touch up procedure. The placement of sealant on each panel may be inspected prior to placement of adjacent panels. However, the Engineer's inspection shall not relieve the bidder from his responsibility for liquid tightness.

No backfill shall be placed against the tank sidewall without prior written approval and design review of the tank manufacturer. Any backfill shall be placed according to the strict instructions of the tank manufacturer.

Roof -

Roof shall be constructed of non-corrugated triangular aluminum panels which are sealed and firmly clamped in an interlocking manner to a fully triangulated aluminum space truss system of wide flange extrusions, thus forming a spherical dome structure. The dome shall be clear-span and designed to be self-supporting from the periphery structure with primary horizontal thrust contained by an integral tension ring. The dome dead weight shall not exceed 3 pounds per square foot of surface area. The dome and tank shall be designed to act as an integral unit. The tank shall be designed to support an aluminum dome roof including all specified live loads.

Field Testing:

Hydrostatic - Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling tank to its overflow elevation. Any leaks disclosed by this test shall be corrected by the erector in accordance with the manufacturer's recommendations. Water required for testing shall be furnished by the owner at the time of tank erection completion, and at no charge to the tank erector. Disposal of test water shall be the responsibility of the tank contractor. Labor and equipment necessary for tank testing is to be included in the price of the tank.

One Year Guarantee:

The Contractor, and through him each Subcontractor, in accepting the Contract for this construction, or respective portions of the construction covered by these plans and specifications, does hereby agree to replace and make good, without expense to the Owner, any work or material which may be found to be defective within one year from the date of the final certificate of payment to said Contractor. The deterioration due to ordinary use and wear and failure of materials furnished by the Owner are expected from this guarantee.

This guarantee shall include damage done by settlement of backfills and filling re-grade elevations, such damage and sinking of fills being considered as defective workmanship.

The Contractor shall reimburse the Owner for cost of damage, if any, as well as cost of replacing defective materials or workmanship. If replacements are not made within ten (10) days after notice

is given of such defect in workmanship, or thirty (30) days in case of materials, then the Owner may make replacements and charge cost of same to the Contractor or his Bondsman.

Sterilization:

The storage tank will be sterilized by the Tank Contractor.

END OF SECTION FOR GLASS LINED TANK

STEEL TANK

The steel tank shall be of all welded construction with plate sizes in compliance with A.W.W.A. Standard D 100, Latest Edition. The bottom shall be of a size and thickness as required by AWWA D100. The steel tank Contractor may propose an aluminum top if he desires.

PAINTING

(a) Surface Preparation

Interior and exterior surfaces shall be prepared as in Steel Structure Paintings Council sspc-sp-10 Near White Metal Blast Cleaning. Exterior surfaces shall be prepared as in SSPC-SP-6 Commercial Blast Cleaning. All steel shall be cleaned by sand blasting. The sand blasting shall remove all loose mill scale and other substances down to the bare metal. Before painting, sand adhering to steel in corners and elsewhere shall be removed. The cleaning shall be approved by the Engineer prior to any painting. The material shall be painted before rust forms.

(b) Material

All paints shall be Sherwin-Williams Co.,or approved equal. All paints shall be delivered to the job in unbroken containers marked with manufacturer's label and shall not be opened before inspection by the Engineer. The paints shall meet the A.W.W.A. and NSF (National Sanitation Foundation) Standards and Specifications for paints for steel water reservoirs.

Manufacturer's recommendations shall be followed in mixing and applying all paints. Paints to be applied by conventional or airless spray.

(c) Painting Interior

1. Prime Coat -

The coating shall be Sherwin-Williams CoPoxy Primer, or approved equal. Paint the

entire interior surface to a dry minimum film thickness of 1.0 - 1.5 mils. All surfaces to be coated the same day as sand blasted. Allow coating to dry a minimum of 24 hours before recoating. The interior of the tank to have circulating air continually during drying period supplied by an air compressor of adequate size in relation of the size of the tank. At the end of the drying period, the dry coating thickness is to be measured by an approved inspector using Tinsley thickness gauge or other device for this purpose.

2. Finish Coat -

The coating shall be Sherwin-Williams Polyurea Lining Systems Envirolastic AR520, or approved equal. Coat the entire interior surface to a dry minimum film thickness of 20.0 - 25.0 mils.

The interior of the tank to have circulating air continually for a period of 24 hours supplied by an air compressor of adequate size in relation to the size of the tank. At the end of the drying period, the dry coating thickness is to be measured by an approved inspector using Tinsley thickness gauge or other device for this purpose. The tank shall be allowed to dry at least another 168 hours (7 days) before the tank is filled with water. During this period all manholes both at the bottom and the top must be opened.

(d) Painting Exterior

Painting of the exterior of tank shall be accomplished as follows:

1. Prime Coat -

The coating shall be Sherwin-Williams Copoxy Primer, or approved equal. Paint the entire exterior surfaces to a dry minimum film thickness of 2.0 - 3.0 mils. All surfaces to be coated the same day as sand blasted. Allow coating to dry a minimum of 24 hours before recoating. At the end of the drying period, the dry coating thickness is to be measured by an approved inspector using Tinsley thickness gauge or other device for this purpose.

2. First Intermediate Coat -

After priming, all exterior surfaces shall be painted with one coat of Sherwin-Williams Macropoxy 646, or approved equal, to a dry film thickness of 4.0 - 5.0 mils making a total of 6.0 - 8.0 mils for the primer and first intermediate coat. Allow first intermediate coat to dry a minimum of 24 hours before recoating.

At the end of the drying period, the dry coating thickness is to be measured by an approved inspector using Tinsley thickness gauge or other device for this purpose.

3. Second Intermediate Coat -

Sherwin-Williams 218 HS Acrylic Polyurethane, of a color selected by the Engineer, or approved equal. Spray the entire exterior surface to a dry minimum film thickness of 2.0 - 3.0 mils making a total of 8.0 - 11.0 mils for the three coats.

At the end of the 24 hour drying period the dry coating thickness is to be measured by approved instrument for this purpose.

4. Finish Coat -

Sherwin-Williams Diamond Clad Clear Coat Urethane, or approved equal. Spray the entire exterior surface to a dry minimum film thickness of 1.0 - 2.0 mils making a total of 9.0 - 13.0 mils for the three coats.

At the end of the 24 hour drying period the dry coating thickness is to be measured by approved instrument for this purpose.

(e) Application

Paint to be applied by conventional or airless spray on the exterior of the tank.

WELD INSPECTION

Weld inspection shall be in accordance with AWWA D100-96 except that inspection of full penetration butt welded joints shall be made by radiographic method.

ONE YEAR GUARANTEE

The Contractor, and through him each Subcontractor, in accepting the Contract for this construction, or respective portions of the construction covered by these plans and specifications, does hereby agree to replace and make good, without expense to the Owner, any work or material which may be found to be defective within one year from the date of the final certificate of payment to said Contractor. The deterioration due to ordinary use and wear and failure of materials furnished by the Owner are expected from this guarantee.

This guarantee shall include damage done by settlement of backfills and filling re-grade elevations, such damage and sinking of fills being considered as defective workmanship.

The Tank Contractor also warrants that if within a period of one year from the date of completion of the tank and acceptance by the Owner the coating on the tank chips, cracks, fades, blisters or peels as a result of normal usage the Contractor will make such repairs as are necessary to the coating system to restore it to same as new condition.

The Contractor shall reimburse the Owner for cost of damage, if any, as well as cost of replacing defective materials or workmanship. If replacements are not made within ten (10) days after notice is given of such defect in workmanship, or thirty (30) days in case of

materials, then the Owner may make replacements and charge cost of same to the Contractor or his Bondsman.

END OF SECTION FOR STEEL TANK

CONCRETE (PRESTRESSED COMPOSITE) TANK

GENERAL:

The circular tank shall be of prestressed composite construction.

The tank floor shall be of concrete or shotcrete construction containing no less than 0.625 percent reinforcing steel in each orthogonal direction.

The wire-prestressed composite wall shall consist of a shotcrete core wall encasing a steel shell diaphragm continuous the full wall height. All prestressing shall be done with high tensile wire, permanently bonded to the tank wall.

The tank roof shall be a circumferentially prestressed free-span dome of concrete or shotcrete construction containing no less than 0.25 percent reinforcing steel in each orthogonal direction.

The entire tank, including all portions of the floor, wall, and roof shall be built by the Tank Construction Company, using its own trained personnel and equipment.

QUALIFICATIONS & EXPERIENCE OF THE TANK CONSTRUCTION COMPANY.

The Tank Construction Company shall have the following qualifications and experience:

The Company constructing the tank shall be a firm with at least five years experience in the design and construction of wire-wound circular prestressed composite tanks; and shall give satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tank in accordance with the quality required by these specifications. The Company constructing the tank shall have built completely in its own name in the past five years, and be presently responsible for, a minimum of five (5) dome-covered prestressed composite tanks of .5 Million gallon size or larger, which meet these specifications and which are now giving satisfactory services.

The Tank Construction Company shall have on its staff a full-time professional engineer, who shall have no less than five years experience in the design and field construction of circular prestressed composite tanks, and who shall be in responsible engineering charge of the work to be done. All working drawings and design calculations shall carry the seal of such registered professional engineer.

DESIGN CRITERIA

The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.

Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.

The design shall be in conformance with American Concrete Institute (ACI) Title 344R-W "Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures," and currently accepted engineering principles and practices for the design of such facilities.

	Concrete	
Compressive Strength	f'_c	3500 psi at 28 days
	Shotcrete	
Compressive Strength	f'_g	4000 psi or greater at 28 days
Allowable Compressive Stress	f_g	1250 + 75t with 0.45 f'_g maximum*
Allowable Compressive Stress Due to Initial Prestressing Force	f_{gi}	0.5 f'_{gi} or less, with a maximum of 2250 psi (where f'_{gi} is defined As compressive strength at time Initial prestressing force is applied)
	Prestressing Wire	
Wire Size	Diameter	0.162" (8 gauge), 0.192" (6 gauge) or Larger, but no larger than 0.250"
Working Stress, Wall	f_s	115,000 psi
Working Stress, Dome Ring	f_s	120,000 psi
Allowable Tensile Stress Before Losses	f_s	145,600 psi or no greater than 0.70 f'_s
Ultimate Tensile Strength	f'_s	231,000 psi or greater for 8 gauge 222,000 psi or greater for 6 gauge
	Reinforced Steel	
Allowable Tensile Stress	f_s	18,000 psi
Yield Strength	f_y	60,000 psi

*t = thickness of core wall

SUBMITTALS

Submit to the Engineer complete design calculations and a complete set of detailed working drawings for the tank.

(a) If a sliding waterstop is used in the floor/wall joint, submit load/shear/deflection data to support shear and deflection calculations for base of wall. Tests must have been generated for the particular waterstop configuration proposed.

(b) Concrete mix designs.

FLOOR

Concrete membrane floors (minimum 4 inches thick) shall have a minimum thickness of 8 inches of concrete over all pipe encasements and around sumps. The minimum percentage (0.625%) of reinforcing steel applies to these thickened sections and shall extend a minimum of 2 feet into the adjacent membrane floor.

Floors shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.

Floors shall be continuously water cured until tank construction is completed.

CORE WALL

The core wall shall be constructed of shotcrete, encasing a steel diaphragm continuous the full wall height without horizontal splices.

The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, backfill, and other applicable loads. The wall may taper uniformly on the outside face from top to bottom as required by design computations. In no case shall the core wall be less than 3-1/2 inches thick. Horizontal sections of the wall shall form true circles without flats, excessive bumps, or hollows.

To compensate for bending moments and for shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the core wall:

(a) The top 2 feet of core wall shall have not less than 1 percent circumferential reinforcing.

(b) The bottom 3 feet of core wall shall have not less than 1 percent circumferential reinforcing.

(c) Inside Face:

(1) 26 gauge steel shell diaphragm continuous the full wall height without horizontal splices.

(2) Additional vertical and horizontal reinforcing steel bars as required by design computations.

(d) Outside Face:

(1) Vertical reinforcing steel: minimum of #4 bars at 12 inches center to center.

(2) Additional vertical and horizontal reinforcing steel bars as required by design computations.

Interior and exterior surfaces of the core wall shall be water cured until prestressing starts.

STEEL SHELL DIAPHRAGM

A 26 gauge steel tank shell, complying with ASTM A-366 for Commercial Quality Cold Rolled Steel, shall be used within and throughout the core wall, providing a positive waterstop. The steel shell diaphragm shall be encased and protected with shotcrete no less than one inch thick at all places. The steel shell is to be so formed and erected that a mechanical key between shotcrete and diaphragm will be created. The sheets of steel diaphragm shall be continuous from top to bottom of wall; horizontal joints or splices will not be permitted.

All vertical joints in the diaphragm shall be sealed watertight by epoxy injection.

Epoxy injection shall be carried out from bottom of wall to top of wall, using a pressure pumping procedure, after the steel shell has been fully encased, inside and outside, with shotcrete. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements off ASTM C 881, Type III, Grade 1, and shall be a 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77 degrees F.

The steel shell design and its epoxy injection procedure (covered by U.S. Patent 5,150,551) shall have been used in the ten tanks required in the Tank Construction Company's experience record. No nail or other holes shall be made in the steel shell for erection or other purposes except for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.

In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to this waterstop.

SHOTCRETE

All shotcrete shall be applied by or under direct supervision of experienced nozzlemen certified in accordance with guidelines by ACI Committee 506. Certification will be accomplished by a recognized authority such as ELF/FC&PA*, ACI, or approved equal.

*ELF	- Engineering Laboratory Forum, Florida Institute of Consulting Engineers
FC&PA	- Florida Concrete and Products Association

Shotcrete mixes, measured by weight, shall be:

First coat on steel shell diaphragm and prestressing wire:	1 part cementitious material to 3 parts sand
All other shotcrete	1 part cementitious material to 4 parts sand

Up to 20 percent of cementitious materials may be fly-ash.

Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer. No shotcrete shall be applied to reinforcing steel or diaphragm which is encrusted with overspray. No less than 1/8" thick shotcrete shall separate reinforcing steel and prestressing wire.

DOME ROOF

The dome roof shall be constructed of reinforced concrete or shotcrete, circumferentially prestressed. Dome shell reinforcement shall consist of reinforcing steel bars or welded wire fabric meeting ASTM A-185, not galvanized. Bolsters for wire fabric and reinforcing bars shall be plastic tipped. Wire tires shall be galvanized.

The dome shell shall be designed as a free span, spherical thin shell, with a one-tenth rise. The dome ring girder shall be prestressed with sufficient wire to withstand the dome dead load and design live loads. The ring girder shall have a cross section suitable to accept the applied prestressing forces. All surfaces in the wall/dome ring girder joint shall be coated with an approved bonding epoxy.

The high water level in the tank shall be permitted to encroach on the dome shell no higher than the upper horizontal plane of the dome ring girder. Overflow outlets shall be installed on the dome roof in such numbers as will provide an overflow open area two times the area of the largest tank pipe.

HORIZONTAL PRESTRESSING

Circumferential prestressing of the tank shall be achieved by the application of cold-drawn high-carbon steel wire complying with ASTM A-648 Class II, placed under high tension. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.

Placement of the prestressing steel wire shall be in a continuous and uniform helix or such pitch as to provide in each lineal foot of core wall height an initial force and unit compressive stress equivalent to that shown on the drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire, or when removing a defective section of wire.

Areas to be prestressed will contain not less than 10 wires per foot of wall for 8 gauge and 8 wires per foot of wall for 6 gauge. A maximum of 24 wires per layer per foot for 8 gauge and 20 wires per layer per foot for 6 gauge will be allowed. Shotcrete shall be used to completely encase each individual wire, and protect it from corrosion. To facilitate this encasement, the clear space between adjacent wires is to be no less than one wire diameter.

Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire after it is positioned on the tank wall. This stress measuring equipment shall include: electronic direct reading stressometer accurate to within 1 percent; calibrated dynamometers; test stand to field verify the accuracy of the stressometer. The initial tension in each wire shall be recorded.

EXTERIOR COVERCOAT

After circumferential prestressing wires have been placed, they shall be protected by encasement in shotcrete. This shotcrete encasement shall completely encapsulate each wire, and shall permanently bond the wire to the tank wall. The shotcrete cover shall have a thickness of no less than one inch over the wire. When multiple layers of wires are required, shotcrete cover between layers shall be no less than 1/8 inch thick.

WALL OPENINGS

When it is necessary for a pipe to pass through the tank wall, the invert of such pipe shall be no less than 18 inches above the floor slab, and the prestressing wires required at the pipe elevation shall be distributed above and below the opening, leaving an unbanded strip around the entire tank. Ordinarily, unbanded strips shall have a vertical dimension of no more than 36 inches.

An axi-symmetric finite element shell analysis will be required for unbanded wall spaces having a vertical dimension greater than 36 inches.

All pipe sleeves passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

PAINTING

Painting of the exposed exterior surfaces of the tank shall consist of a prime coat of masonry undercoater, plus two coats of exterior masonry paint. All painting shall be done in accordance with the paint manufacturer's recommendations. The final exterior color shall be as directed by the Owner.

ONE YEAR GUARANTEE

The Contractor, and through him each Subcontractor, in accepting the Contract for this construction, or respective portions of the construction covered by these plans and specifications, does hereby agree to replace and make good, without expense to the Owner, any work or material which may be found to be defective within one year from the date of the final certificate of payment to said Contractor. The deterioration due to ordinary use and wear and failure of materials furnished by the Owner are expected from this guarantee.

This guarantee shall include damage done by settlement of backfills and filling re-grade elevations, such damage and sinking of fills being considered as defective workmanship.

The Contractor shall reimburse the Owner for cost of damage, if any, as well as cost of replacing defective materials or workmanship. If replacements are not made within ten (10) days after notice is given of such defect in workmanship, or thirty (30) days in case of materials, then the Owner may make replacements and charge cost of same to the Contractor or his Bondsman.

END OF SECTION FOR CONCRETE TANK

SECURITY FENCING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor and materials required to place fencing as shown on the Drawings and specified herein.

B. Fence fabric shall be woven wire, chain link type and shall be 8 feet in height. A three strand barbed wire extension shall be provided. Layout of fences and gates are shown on the Drawings.

C. All fittings necessary to make a complete installation shall be provided. Fence shall be provided with center brace, top brace and stretcher wire as shown on the Drawings.

1.02 RELATED WORK

A. Special requirements for equipment and materials are included in other areas of these specs.
B. General site work is included in other areas of these specs.
C. Concrete work for post anchors is included in other areas of these specs.

1.03 SUBMITTALS

A. Shop drawings shall be submitted to the ENGINEER.

PART 2 PRODUCTS

2.01 POSTS AND RAILS

A. General

1. All ferrous materials shall be thoroughly galvanized by the hot dip method as specified in ASTM A525, latest revision.
2. Schedule 40 piping shall be used for all post and rails in the fence framework unless otherwise specified. Characteristics of the posts are shown in the Security Fence Post Schedule following:

SECURITY FENCE POST SCHEDULE

Size Schedule 40 Pipe	Weight Pounds Per Foot	Concrete Depth	Dia.
1 5/8" O.D.	2.27 lbs.		
2" O.D.	2.72 lbs.		
2 1/2" O.D.	3.65 lbs.	30"	10 inches
3" O.D.	5.79 lbs.	3 ft.	12 inches
4" O.D .	9.11 lbs.	3 ft.	12 inches
6 5/8" O.D.	18.97 lbs.	4 ft.	14 inches
8 5/8" O.D.	25.00 lbs.	4 ft.	16 inches

B. Corner, Terminal and Pull Posts

1. Corner, terminal and pull posts shall be hot galvanized inside and outside at a rate of 2.0 ounces per square foot of actual surface area. The 3 inch diameter seamless steel pipe shall weigh 5.79 pounds per foot and extend 3 feet below ground level. All posts shall be capped with a heavy malleable iron top, of bullet type construction, to exclude moisture.

2. Stainless steel SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Schedule 40 pipe. The SS-40 pipe sizes may be less than the Schedule 40 sizes but shall have greater strength.

C. Line Posts

1. Line posts shall be 2 1/2 inch diameter high carbon seamless steel pipe, hot galvanized inside and outside at a rate of 2.0 ounces per square foot of actual surface area. the 2 1/2 inch pipe shall weigh 3.65 pounds per foot and extend 30 inches below ground level. Line posts shall be capped.
2. SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Schedule 40 pipe. The SS-40 sizes may be less than the Schedule 40 sizes but shall have greater strength.

D. Gate Posts

1. The posts shall be in conformance with the "Gate Post Schedule" shown below and shall be capped with a heavy malleable iron top, of bullet type construction to exclude moisture. Gate posts shall be coated inside and outside with hot galvanized at a rate of 2.0 ounces per square foot of surface area.

GATE POST SCHEDULE

Single Gates	Double Gates	Schedule 40 Pipe
Up thru 5'	Up thru 10'	3" O.D.
Over 5' thru 8'	Over 10' thru 16'	4" O.D.
Over 8' thru 12'	Over 16' thru 24'	6 5/8" O.D.
Over 12' thru 18'	Over 24' thru 36'	8 5/8" O.D.

2. SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Schedule 40 pipe. The SS-40 sizes may be less than the Schedule 40 sizes but shall have greater strength.

E. Rails

1. Top rails, center braces and top brace rails shall be 1 5/8 inch outside diameter seamless steel tubing, weighing 2.27 pounds per foot, hot galvanized at a rate of 2.0 ounces per square foot of actual surface area. Rails shall be not less than 20 feet in length jointed with extra long pressed steel sleeves as specified herein.
2. SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Schedule 40 pipe. The SS-40 sizes may be less than the Schedule 40 sizes but shall have greater strength.

2.02 FABRIC

A. The fabric shall be aluminum coated steel to meet ASTM A491, latest revision, composed of individual wire pickets, helically wound and interwoven from No. 9 gauge steel wire to form continuous chain link fabric having a 2 inch mesh. Both the top and bottom edges shall be twist selvage construction. Basic wire shall conform to the following:

Carbon	0.18 - 0.31
Manganese	0.60 - 0.90
Phosphorous	0.040 Max.
Sulphur	0.050 Max.

B. The aluminum coating weight shall be a minimum of 0.40 ounces per square foot of wire surface. The breaking strength of the aluminum coated wire shall be a minimum of 1,290 ft.-lbs.

C. Barbed Wire

1. Barbed wire shall be 3-strand each of two No. 12-1/2 W. & M. gauge twisted copper- bearing steel line wires, hot galvanized after weaving with No. 14 W. & M. gauge 4-point barbs, spaced not more than 4" apart.

2.03 GATES

A. Frames

1. Swing frames shall be 2 inches outside diameter galvanized seamless Schedule 40 steel pipe weighing 2.72 pounds per foot, corners fitted with rigid watertight heavy malleable iron castings or electrically welded joints. Internal bracing shall be 1 5/8 inch outside diameter galvanized seamless Schedule 40 steel pipe weighing 2.27 pounds per foot.
2. SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Schedule 40 pipe. The SS-40 sizes may be less than the Schedule 40 sizes but shall have greater strength.

B. Fabric

1. Gate filler fabric shall be the same as that used in fence.

C. Hinges

1. Gate hinges shall be double clamping offset type allowing gates to swing back parallel with line of fence. They shall be malleable iron and forged steel heavily galvanized.

D. Latches

1. Gate latches shall be eccentric double locking type which engages the strikes securely bolted to either gate frame or gate post at both the top and bottom. In the case of double gates, latches shall also engage a heavy malleable iron non-freezing gate stop anchored in concrete footing. Latches shall be equipped for locking with padlock.

E. Keepers

1. Gate Keepers shall be furnished with each gate frame to automatically engage gate frame when swung to open position.

F. Barbed Wire

1. Barbed wire shall be 3-strand each of two No. 12-1/2 W. & M. gauge twisted copper- bearing steel line wires, hot galvanized after weaving with No. 14 W. & M. gauge 4-point barbs, spaced not more than 4" apart.

G. Gate Posts

1. Refer to post specification under Article 2.01.

H. Repair of Galvanized Surfaces

1. Galvanized surfaces damaged by welding or other reasons shall be repaired according to Federal Specification MIL-P-21035 (Galvanized Repair Spec.) as follows:

a. Remove foreign matter from both damaged and contiguous undamaged area by wire brushing and cleaning with metal conditioner recommended by cold galvanizing coating manufacturer.
b. Apply 2 coats of cold galvanizing coating to damaged area, ensuring an overlap of the surrounding undamaged galvanizing for continuity of galvanic protection. Cold galvanizing coating shall be Z.R.C. Chemical Products Co. "Z.R.C. Cold Galvanizing" or Galvicon Corp., "Cold Galvanizing", or equal.

2.04 CHAIN LINK FITTINGS (PER ASTM 626-79)

A. Barbed Arm

1. Barbed wire extension arms for immediate and corner posts shall be of pressed steel riveted to malleable iron base, at 45° angel, carrying 3-strands of barbed wire. Barbed wire attached to the am in angle slot shall be automatically locked in place by tension. Arms shall be hot galvanized after fabrication. The intermediate arm shall have provision for passing top rail and corner arm casting equipped with set screw.

B. Brace and Tension Bands

1. Brace and tension bands shall be beveled edge type fabricated from prestressed steel or aluminum. Steel bands shall be hot dipped galvanized with a minimum of 1.2 ounces of zinc coating per square foot of surface.
2. Brace bands shall be a minimum of 12 gauge in thickness and a minimum width of 3/4 inch or 19.05 mm.
3. Tension bands shall be a minimum of 14 gauge with a minimum of 3/4 inch or 19.05 mm in width.

C. Post Caps and Rail Ends

1. All post caps and rail ends shall be designed to fit snugly over post and prevent moisture from entering the inside of the tube.
2. Post caps shall be fabricated from malleable iron, pressed steel of aluminum. Line post caps shall be designed to allow top rail to pass through. All ferrous materials shall be thoroughly galvanized by the hot dip method with a minimum of 1.2 ounces of zinc coating per square foot of surface area.

D. Top Rail Sleeve

1. Top rail sleeve shall be fabricated from pressed steel or round steel tubing. Sleeve shall be hot dip galvanized with a minimum of 1.2 ounces of zinc coating per square foot of surface area. The design of the sleeve shall be such that no movement along the rail can take place upon installation.

E. Tension Bars

1. Tension bars for attaching fabric to terminal post shall be a minimum of 3/16 inch thickness by 3/4 inch in width. The length shall be a minimum of 2 inches less than full height of the chain link fabric.

F. Truss Rods

1. Truss rods shall be a minimum of 5/16 inch in diameter fabricated from merchant quality steel rod and hot dip galvanized with a minimum of 1.2 ounces of zinc coating per square foot of surface area. All rods shall be designed and equipped with a truss tightener.

G. Tie Wires (Aluminum Only)

1. Aluminum ties shall be used for attaching fabric to top rail, brace rails and line post. the aluminum ties shall be 9 gauge round wire of alloy 110-H or equal.

H. Bolts and Nuts

1. Carriage bolts shall be hot dip galvanized or aluminum, 5/16" x 1 1/4", with nut and shall be used in conjunction with brace and tension bands.
2. Galvanized bolts and nuts shall be coated in accordance with ASTM A 153-80.
3. Larger bolts as required at gates or latches shall be galvanized coated in accordance with ASTM A 153, latest revision.

PART 3 EXECUTION

3.01 SITE PREPARATION

A. The location of fence line, gate and terminal posts shall be as shown on the Drawings. Prior to construction the CONTRACTOR shall locate and flag all underground utilities in or about the fence construction. Adequate clearing and grading shall be done to the satisfaction of the OWNER prior to fence construction. The CONTRACTOR shall remove and properly dispose of all conflicting brush, trees, tree limbs or other debris that interferes with the installation of the proposed fence.

3.02 POSTS

A. General

1. All posts shall be set 10 feet or less on centers equally spaced between pull posts in a hole filled with concrete as required per the Security Fence Post Schedule. All concrete shall be at least 2 inches below grade to allow for cover. Posts shall be accurately lined and plumbed. Intermediate pull posts with bracing shall be equally spaced when a straight run becomes greater than 300 feet in length. If solid rock is encountered, excavation shall be at no extra cost to the OWNER.

B. Terminal, Gate, Pull and Corner Post Bracing

1. A center rail is required with horizontal braces and truss rods to adjacent line post, securely fastened with adequate adjustment.

3.03 TOP RAIL

A. The top rail shall run through the openings in the line post tops on a continuous grade uniformly parallel with the ground surface.

B. Connection to the corner, gate, terminal and pull posts shall be with brace bands and rail ends. Offsets at corners will not be permitted.

3.04 FABRIC STRENGTHENING

A. Two stretcher bars shall be threaded through the fabric from top to bottom at a location in the center of the fence section to be stretched. The bars shall be adequately spaced such that when stretched the installer has room to thread a looser picket link down through the meshing links of the two ends to make a perfect jointing. The stretching shall be done with two blocks and when released the fabric shall be taut along any point of the fence line. The top selvage shall be dressed above the top rail and the fabric secured with the tie wires spaced not more than 24" apart and uniformly tied. The fabric shall be fastened to the line posts with specified tie wires spaced not more than 14 inches on center uniformly tied.

TELEMETRY SPECIFICATIONS
1.0 PART 1 - PROJECT DESCRIPTION
1.01. Description

A) Description of Work

The work to be accomplished under this section shall consist of furnishing the equipment necessary for a complete automatic control and monitoring system to function as specified herein and as shown on the drawings. The Contractor shall furnish a completely integrated all solid-state radio telemetry base Supervisory Control and Data Acquisition (SCADA) system. It shall be the Telemetry Contractor's responsibility to supply a system that is compatible with new or existing equipment supplied by others as part of this contract, and equipment supplied in other contracts. The complete system shall be designed, fabricated, programmed, tested, started up, and warranted by a single supplier to insure a single source of responsibility.

B) Scope of Work

This section covers a radio telemetry based SCADA and Instrumentation System to include:
(1) Remote Unit at an existing Elevated Water Tank, including taps, sensing/lines, power pole rework, as detailed, and all other work necessary for a complete installation,
(1) Solar Powered Remote Unit at a New Ground Water Tank,
(1) Locally Controlled Valve, complete with all items as detailed on the Drawings,
(1) Operator Display Consoles, and
a Central Terminal Unit located at the Levee Road Water Association office,
(1) Coordination with the selected Water Line and Tank Contractors for all required work.

The Central Terminal Unit located at the Water Association Office shall be the basis of control and shall interrogate the remote (and local) units to send control data and receive level, pressure, flow, and status and alarm data as detailed from each remote (and local) unit.

An overview of the functions to be provided by this new telemetry system are as follows:

1. Pressure data from one existing elevated storage tank and one new ground storage tank shall be converted to side water heights of each appropriate tank. These side water heights shall be displayed at the water association office and be available for subsequent telemetry operations.

2. Based upon the side water height reported from the new ground storage tank, and after querying the existing elevated tank that it has enough water, the telemetry shall direct a new valve to open and allow water to fill the new ground storage tank. Once the new ground storage tank has reached a suitable elevation, the telemetry shall direct this valve to close. The valve position shall be reported and displayed at the water office.

3. Should alarm conditions exist, such as high or low tank levels, low battery level (in the solar powered device), or improper valve position, the telemetry shall automatically call by telephone a minimum of four (4) telephone numbers and report the alarm status.

4. With the addition of a new telephone line at the water associations office, the Owner shall have the ability to communicate with and observe the status of operational parameters.

C) Contractor Shall Supply:

All equipment required by schedule.

1) All labor for installation and start-up of the system.
2) Engineering submittal and shop drawings prior to installation.
3) All the paper work and fees necessary to obtain a FCC radio license in the name of the Owner.
4) All ancillary equipment, hardware, software, and appurtenances needed for proper installation and operation of equipment.
5) Provide spare parts and maintenance tools as described below.
6) Operations and maintenance manuals as detailed below.
7) All start-up labor and services.
8) All operator training.

D) Owner Shall Supply:

1) Access and easements as needed for all sites.
2) 120VAC power at the existing tank site (no power at new tank).
3) Pressure sensing taps for all sensing points in the system (except at the existing tank, by telemetry Contractor).
4) Meter pits for sensing tank levels or line pressures in the system.
5) Desks and chairs for Operator Display Console computer.

1.02. Quality Assurance

A) Contractor's Qualifications

The system specified herein shall be the product of a manufacturer who can demonstrate at least ten (10) years of satisfactory experience in furnishing and installing comparable radio telemetry/control systems for water and wastewater installations.

The manufacturer of this system shall maintain a 24-hour available inventory of all replaceable modules to assure the Owner of prompt maintenance service and a single source of responsibility. The manufacturer shall certify this to the Engineer in writing at the time of bidder post-qualification.

B) Post-bid Submittal

All Telemetry Contractors are required to provide a post-bid submittal no later than seven (7) days after Notice of Award. Submissions that fail to include a complete submittal as detailed shall be deemed unresponsive. The Consulting Engineer and the Owner shall be the sole judge as to whether the alternate equipment is considered an approved equal. Approval of an alternate system by the Engineer will not relieve the alternate system of strict adherence to these specifications. The post-bid submittal shall include the following:

1) Block diagrams for the various sites in the proposed system.
2) Sample electrical drawings for typical sites proposed by this contract.
3) A product performance data sheet shall be included for each proposed component in the system (i.e. antennas, radios, coaxial cables & arrestors, remote unit equipment, central terminal unit equipment, power supplies, time delays and relays, and the various sensors

required).

4) Radio path study for each radio path in the system. Bidders shall satisfy themselves that the necessary radio frequency can be obtained. The radio path study provided by each bidder shall utilize either:
   a) Computer generated techniques utilizing a USGS 3 second terrain database to plot the path profiles for each radio path with elevation samples at not more that 200 foot increments.
   b) Actual field measurements to determine the necessary antenna heights, transmitter power, and antenna gains required to insure a 20db fade margin as detailed in Section 2.02 of these specifications. The a physical path analysis shall be made using temporary equipment installations and an IFR 1000 or equal equipment to measure actual path margins. The bidder shall include in his bid, all the calculations used to extrapolate the measured data. The bidder is expected to obtain the necessary temporary FCC license for the study.
5) An installation list with the names and phone numbers of both the Owner and Consulting Engineer for at least ten projects of similar size and complexity.
6) A "statement of compliance" detailing paragraph by paragraph his compliance or exceptions to these specifications.

C) Codes & Standards

The control system and its components shall comply will all applicable requirements of the following:

1) Electrical Code Compliance (National & Local)
2) NEMA Compliance
3) IEEE Compliance
4) EIA Compliance
5) FCC Compliance

D) Approved System Contractors

1) Micro-Comm, Inc., Olathe, Kansas
2) Auto-Con (U.S. Filter), represented locally by C. I. Thornburg, Huntington, WV

E) Base Bid

These specifications have been prepared considering Micro-Comm, Inc., equipment. As noted, AutoCon (U.S. Filter) equivalent equipment is considered equal to the stated Micro-Comm equipment. Either of these manufacturers can bid the project without a post bid submittal requirement. Other manufacturers and system intergraders are encouraged to bid but must endure the post bid process. Alternate manufactures will be considered based upon quality, past performance, compliance with these specifications, documented product support and product support history, and other factors for the determination of "BEST" Bid. As always, price is important but will not be the only factor considered in the decision making process. The decision of the Engineer/Owner is final.

F) Base Bid System Contractor

The base bid shall be based upon a system as supplied by Micro-Comm, Inc., of Olathe, Kansas, or Auto-Con Equipment. If used, all other proposed Post Bid APPROVED manufactures shall be listed

in the Alternate portion of the Bid Form. These "Post Bid Approved" manufacturers should include additional information in their bid submittal to allow the Owner/Engineer to make a prompt decision concerning equipment, experience, and other factors related to the subsequent Owner/Engineer request for Post Bid submittal.

1.03. Post Selection Submittals:

Complete submittal shall be provided to the engineer for approval prior to equipment fabrication. The submittal data shall include the following:

A) Product Data
Provide product data sheets for each instrument and component supplied in the system. The data sheets shall show the component name as used on reference drawings, manufacturer's model number or other product designator, input and output characteristics, scale or ranges selected, electrical or mechanical requirements, and materials compatibility.

B) Shop Drawings
Provide drawings for each panel showing the wiring diagrams for control circuits and interconnections of all components. The drawings shall include wiring diagrams for all remote devices connected to the panel.

C) Panel Layout Drawings
A front panel and sub-panel layout shall be included as part of each control panel drawing. Components shall be clearly labeled on the drawing.

D) Installation Drawings
Typical installation drawings applicable to each site in the system shall be included.

E) Operator Interface Software
The submittal shall include a generic but detailed technical description of the Operator's Interface Software as proposed for this system including:

1) Sample text screens and menus
2) Sample graphics screens
3) Sample report logs and printed graphs

1.04. Maintenance Information

A) Maintenance Data Manuals
Submit maintenance manuals and "as built" drawings on all items supplied with the system. The manuals and drawings are to be bound into one or more books as needed. In addition to "as built" engineering submittal data and drawings, the manual shall include trouble shooting guides and maintenance and calibration data for all adjustable items.

1.05. Job Conditions
All instruments and equipment shall be designed to operate under the environmental conditions where they are to perform their service. The equipment shall be designed to handle lightning and

transient voltages as normal environmental hazards. The environmental conditions are as follows:

A) Outdoor

The equipment will be exposed to direct sunlight, dust, rain, snow, ambient temperatures from -20 to +120 degrees F, relative humidity of 10 to 100 percent, and other natural outdoor conditions. The installations shall be hardened to with stand normal vandalism.

B) Indoor

The equipment will be capable of operating in ambient temperatures of +32 to +130 degrees F and relative humidity of 20 to 100 percent.

1.06. Delivery, Storage, & Handling

All items shall be stored in a dry sheltered place, not exposed to the outside elements, until ready for installation. All items shall be handled with appropriate care to avoid damage during transport and installation.

1.07. Sequencing & Scheduling

A) Coordination

The Telemetry Systems Contractor shall coordinate with the selected Water Line Contractor and Tank Contractor and other electrical and mechanical work including new valves or appurtenances, wires/cables, raceways, electrical boxes and fittings, controls supplied by others, and existing controls, to properly interface installation and commissioning of the control system.

B) Sequence

Sequence installation and start-up work with other trades and Contractors to minimize downtime and to minimize the possibility of damage and soiling during the remainder of the construction period.

2.0 PART 2 - PRODUCTS

2.01. Distributed Control Operation Description

A) General

The control system shall use "Programmable Logic Controllers" (PLCs) for the Central Terminal Unit (CTU) and Remote Terminal Units (RTUs). The system shall be a "distributed intelligence" type control system that provides the features of both a "Central Control" (ie centralized control of RTUs from the CTU) and "Distributed Control" (ie RTU self control using local inputs and peer-to-peer communications) in to a unified control system. The control system shall support master-slave (ie CTU to RTU) and peer-to-peer (i.e. RTU to RTU) communications to provide completely automatic control with no single point of system failure.

The control system shall be capable of implementing radio, leased phone-line, dial-up phone-line, and high speed data highway communications as required by these specifications. Each remote site in the system shall be assigned a unique digital address.

The software programs used at all locations shall be stored in non-volatile EEPROM or Flash type memories that are field re-programmable using software detailed later in these specifications. The system shall be "self-initializing" and not require operator intervention after power interruptions, transients from lightning storms, or component changes. All units in the system shall include "watch-dog" circuitry to insure automatic restarts of the system.

The term "Central Control Unit" shall refer to the combination of computers and display devices used at the Main Control location. The "Central Unit" shall be composed of two separate computer systems communicating over a high-speed serial data highway. The first computer (called the Central Terminal Unit or CTU) shall provide all communications with remote units, local inputs and outputs, and local hardware display devices. The second computer (called the Operator Display Console or ODC) shall be responsible for the operator interface to the system and provide display, alarm, and logging of all data.

The "Central Terminal Unit" (CTU) shall be a PLC and provide the primary control of the system with operator input from the Operator Display Console (ODC) and/or the hardware operator interface as detailed later in these specifications. The CTU shall address each remote site in sequence, to send command data and receive status, alarm, flow, pressure, voltage and level data as required from each site. The Central Unit shall indicate, display, alarm, and record (by CTU hardware and/or ODC software as detailed in the Central Unit section of this specification) all information received. Data received shall be compared to set points, hand-off-auto control selections, and pump control logic to generate control outputs.

The system shall be capable of supporting multiple Central Units with mixed and overriding control responsibilities. Each Central Unit shall be responsible for polling and controlling the operation of its assigned RTUs. Each Central Unit shall pass information on its RTUs to the Main Central Unit and receive information on RTUs assigned to other Central Units as needed for alarm, display, and control. Each Central Unit shall be capable (manually initiated) of interrogating and/or overriding control of the other Central Units' RTUs. The "control overridden" RTU shall indicate this condition to its associated Central Unit.

B) Central Unit "Centralized Control" Software Features

The Central Unit control algorithms shall have the ability to integrate both hardware and software operator inputs at the Central Unit along with hardware inputs at the remote sites in to a cohesive automatic operating control system. As data is received, changes, or lost (i.e. a loss of signal from a RTU or CTU), the Central Unit control logic shall automatically adjust the controlling algorithm to the new situation. At a minimum the control logic shall provide the following features:

1) Monitor input conditions at RTUs to determine the validity and/or usability of controlling input signals (i.e. altitude valves must be open before controlling pumps from the associated tank level). Additionally, determine the correctness of generating pump call commands (i.e. monitoring high discharge and low suction cut-off controls at pump stations) before starting or running pumps.

2) Integrate fully automatic control of up to 8 pumps (at up to 8 separate locations) from up to 8 different levels. The Central Unit shall be able to automatically transfer control from one level to another or from one pump to another in the event of RTU

failure.

3) Automatic alternation/staging type operation pumps of identical or differing capacities. The CTU shall integrate different combinations of pumps in to the operation of each stage and automatically choosing alternate combinations of pumps for each stage should a pump fail or otherwise not be available (i.e. HOA is off). The CTU shall automatic alternate like sized pumps and automatic transfer to the next available pumping stage in the event of pump failure.

4) Automatic transfer of pump call to the next available pump on pump failure with out waiting for the controlling level, pressure, or flow to degrade to the next start level.

5) The Central Unit shall be capable of integrating both software (on the ODC) and hardware HAND/OFF/AUTO control selections at the Central Unit with the existing control panel HOA selector switches at remote units (if specifically listed in the RTU input/output requirements).

6) Automatic staging of in-line pump station operation including: starting of downstream pump stations on confirmation of upstream pumps running, implementing alternate course of action during pump failure, and monitoring station pressures to enable pump calls.

7) Peak power load management by comparing current tank levels and tank fill rates for all tanks in the system to operator inputs for peak period inhibit/restore times and generating pump start commands to top-off tank levels prior to the beginning of the peak demand period.

C) RTU "Distributed" Control Software Features

All RTUs shall be capable of providing local control to augment and/or replace Central Control operations as detailed in the appendix. Setpoints for "distributed" control at the RTUs shall be operator settable from the Central Unit, an optional RTU front panel Keypad & Display Unit, and/or an optional portable computer. The RTUs shall be capable of implementing the following control operations

1) Provide for High Discharge Cut-off and Low Suction Cut-off control of pumps from locally entered setpoints at RTUs equipped with suction and discharge pressure transmitters and/or from existing pressure switches.

2) Automatic Pressure/Flow pump staging operation of pumps of different sizes (including variable speed pumps) from local discharge pressure and discharge flow inputs in a closed-loop system. The pumps shall be up-staged on decreasing discharge pressure and down-staged on decreasing flow rate. The control shall include PID (Proportional Integral Derivative) loop control of variable speed pumps mixed with constant speed pumps for the various stages required.

3) "Compound Loop" PID control of final devices (ie chemical feeders) from multiple

inputs (ie flow rate and a chemical process analyzer, such as chlorine residual).

4) The RTU shall be able to implement back-up modes of control in the event of CTU failure. Pump Station RTUs shall provide for back-up pressure control by comparing the discharge pressure or wetwell level transmitter (if required by these specifications) to locally stored setpoints for back-up pressure control or automatically switching to existing back-up pressure controls.

D) Multiple Levels of Back-up Control

The control system shall have four (4) levels of Back-up Control operation. The "Telemetry Control" lamp and the Central Control lamp at the Tank Sites and valve site will indicate that the RTU is operating under telemetry control.

The primary level of operation will be under the guidance of the Operator's Display Console (ODC) computer at the "central" unit. This computer will provide the operator interface to the control system. Analysis of incoming data will determine the outgoing control signals. The remote sites will be monitored and/or controlled through the "central" unit per the designed mode of operation. Hand-Off-Auto and stop/start set point control of all remote devices will be accomplished by the "central" unit. In the event of a fault or an interruption of operation of the ODC, the operation of the system shall automatically revert to the secondary level of control.

The secondary level of control will be by the Central Terminal Unit computer (CTU) at the "central" unit in the event of a failure of the ODC. In this level the Central Terminal Unit shall continue fully automatic control the system from the last known operator set parameters. In either the primary or secondary level of control, tank and valve remotes will have the "Telemetry Control" lamp and Central Control lamp turned on. Failure of the Central Unit to maintain communications with the remote units (ie failure of the CTU radio, CTU, or both CTU and ODC) shall cause the system to shift automatically to the third level of control.

The third level of control will employ peer-to-peer data transmission between specific RTUs (i.e. "water tower" remotes and their respective valve as detailed below. At this level of control the tanks will act as "master units" to interrogate their own water tower RTUs and for level data and generate their own valve commands based on locally stored set points. The peer-to-peer transmissions shall be accomplished via independent logic in the RTU, separate communications processors (ie Prosoft Modules) sharing the primary communications channel, or a parallel back up RTU sharing the primary communications channel.

In the third level of control tank remotes will have only the "Telemetry Control" lamp turned on. The peer-to-peer level of back-up control shall be established between the following remote sites:

New tank to reworked solenoid valve.

In the event of failure in the peer-to-peer level of control, the system shall automatically revert to the last level of control on a station by station basis. If the system is operating in this level of control and a "water tower" fails to transmit its level or a "valve" fails to respond to transmissions, only the failed tower/valve combinations will revert to the fourth level of control. The remainder of the system continues to function in third peer-to-peer level.

The fourth level of control will utilize any existing local back-up pressure controls at the tanks or local back-up valve settings from the local RTU transmitter as detailed above. In this level of control neither the "Telemetry Control" or "Central Control" lamps will be turned on. The back-up pressure controls will be inhibited in the first, second, and third levels of control. The Central Unit may automatically elect to shift an RTU to this last level of control in the event of communication failure of the controlling water tower.

At all times the system shall attempt to operate in the highest level of control (lowest number) available. Whenever a failure is corrected, the system shall automatically transfer to the highest available level of control, always trying to reach primary control. Protective overriding controls will be operative in all four levels.

Note that portions of the system utilizing "distributed" control as a normal mode of operations may operate in the third and/or forth level control at all times. The operator shall be able to command the Central Unit "override" the distributed modes at anytime to handle unusual situations.

2.02. Radio Channel Data Operation

A) General

The control system shall be specifically designed for radio channel data communications. All of the equipment required for operation of the system shall be directly owned by the Owner and included as part of this contract. Systems using third party repeaters, trunking masters, or leased equipment will not be allowed. The Telemetry Contractor shall select radio equipment as detailed below to insure reliable operation and be able to implement all software features listed in this specification whether currently required or described as a "shall be capable" feature.

The overall system design and operation shall provide a 20db pad over the minimum required for operation on all primary data paths (primary paths may include data relays) to insure a 98% reliability of communications. Remote sites required to support peer-to-peer back-up control shall provide 30db of pad to insure operation under all weather conditions and provide a 99.9% communications reliability. The 20db and 30db pad requirements and FCC rule compliance shall be demonstrated (at no additional cost) to the Engineer at his request. The testing shall be accomplished using an IFR AM/FM 1000S communications analyzer or equal equipment.

B) Communications

The control system shall operate in a half-duplex mode over a single VHF (154 - 173MHz) radio frequency using "point-to-point" communication techniques. The RTUs shall monitor for the channel to avoid data collisions with other RTUs during peer-to-peer communications. The system shall be capable of sharing the radio channel with other radio telemetry system.

To facilitate system layout and future expansion all RTUs shall under the direction of the CTU be able to implement store-and-forward communications to relay data and commands to and from other RTUs as required to establish the desired path. Should the assigned relay site for a distant remote be inoperative, the Central Unit shall automatically choose another remote site to access the distant remote. Any RTU shall be able to provide automatic antenna switching as part of their relaying operations.

All data transmitted shall be in digital word form using FSK (frequency shift keying) transmission. All transmissions shall include the address of the sender and the receiver, and be subject to check sum, parity, and framing error checks, to insure a minimum data reliability of 1 error in 1,000,000,000 bits. Any transmissions that fail the data checking will be retried until correct. No data correction methods will be allowed. A plug-in RS232C data port shall be provided at all locations in the system to allow the use of a standard data terminal to view data exchanges between the sites and to provide a means of extensive de-bugging.

The system shall provide a complete data update at least once every (2) minutes with some functions updating faster as required by local system conditions.

C) Radio Channel Operation

The system shall be capable of operation on the narrow band splinter frequencies of the Private Land Mobile Radio Services within the Federal Communications Commissions (FCC) rules and regulations regarding these telemetry channels. The manufacture shall guarantee operation under co-channel conditions with other radio systems without interference to this system. FSK tones, data baud rates, transmitter output power, transmitter deviation, antenna gain, and antenna height shall be chosen to comply with the FCC requirements Part 90 - Subpart 90.35 and 90.238 for the Industrial/Business frequency pools. The radio system shall specifically meet the operating requirement that the sum of the highest FSK frequency and the amount of deviation shall not exceed 1.7 kHz for 3F2 emission (or 2.8 kHz for 6F2 emission) as detailed by the FCC for the specific frequency assigned.

CTUs and RTUs shall be capable of automatically switching antennas and/or radios (including radios on different frequencies) during CTU-RTU, RTU-RTU, and store & forward communications. The antenna/radio switching at remote units shall automatically default back to RTU-CTU paths if communications are lost with the CTU.

D) FCC Licensing

The system manufacturer/supplier/Contractor shall be responsible for collecting all information, generating all paper work, and paying all fees required obtaining a license on behalf of the Owner.

2.03. Radio Transceivers & Accessories

A) General

The radio transceivers shall be standard "un-modified" mobile two-way that an be tuned, aligned, and repaired at any two-way radio shop. Interface to external data modems shall be through the front panel microphone jack. The radios shall be synthesized and fully field programmable and include a built-in time-out timer to disable the transmitter after 0-60 seconds. The units shall be tuned to FCC specifications for the specific frequency assigned. The radio equipment shall be FCC type approved and the system capable of operation on the narrow band splinter frequencies (154 or 173MHz) in the Industrial/Business radio service.

B) VHF Radio Transceiver (154Mhz or 173Mhz)

The system manufacturer shall supply a 5-watt VHF radio transceiver to insure a high level of quality and reliability. The radios shall be adjustable to 4 watts output power as may be required by the FCC for ERP (Effective Radiated Power) restrictions. All connections to the radio shall be plug-in. The VHF radio transceiver shall have the following specifications:

Transmitter:

RF output power	5 watts minimum (adjustable to 4)
Spurs & Harmonics	16 dBm (25uW) (or –50dBc)
Frequency stability	±0.00025% (-30 to +60 degrees C)
Emission	6F2 (2.5kHz DEV max) or 3F2 (1.2kHz DEV max)
FM hum and noise	-40 dB

Receiver:

Sensitivity	.35uV @ 12 dB SINAD (.5uV @ 20db quieting)
Selectivity	-65 dB
Spurious image rejection	-50 dB
Intermodulation	-65 dB
Frequency stability	±0.00025% (-30 to +60 degrees C)
Receive bandwidth	*6kHz (or 3kHz) as required to match the transmitter

* The receiver bandwidth shall be reduced to match the transmit bandwidth of the transmitter and provide a minimum adjacent channel rejection of -50db.

The radio transceivers shall be Motorola Radius SM50-M33 or DTS.

C) UHF Radio Transceiver (450Mhz)

If the system supplier can demonstrate to the satisfaction of the Engineer that no VHF (154-173 MHz) frequency can be obtained, an UHF (450-470 MHz) frequency may be used. The UHF shall operate under Part 90.35 and 90.238 for secondary fixed operations. The system will still be required to operate with point-to-point operation within the FCC rules and regulations and provide the same RF path margins as detailed in these specifications.

The UHF radios must meet or exceed the requirements set forth in these specifications for VHF radios, except that the radio output power must be adjustable to 2 watts as needed to meet FCC requirements. Antennas shall provide a minimum 10db of gain.

No changes to the contract amount will be made for a change to UHF operation.

D) Antenna & Coaxial Cable

The radio antennas at all locations shall be a five element Yagi, constructed with 3/8" diameter solid aluminum rod elements and 1-1/16" diameter aluminum pipe element support with a type N coaxial connector. The antenna shall have a minimum 8.0db forward gain with a 20.0db front-to-back ratio. The antenna shall be wind rated for a 100-MPH wind speed. The VHF antennas shall be MC-Yagi, Decibel Products DB292, or Celwave PD390S. The UHF antennas shall be MC-Yagi or Celwave PD688S.

Antennas shall be cabled to the transmitter enclosure connection by a RG/8U low loss (less than 1.8db per 100ft @ 100MHz) coaxial cable with cellular polyethylene (foam) dielectric. The coaxial cable shall have a braided copper shield coverage of 97% and a long life weather resistant polyvinyl chloride jacket. The antenna coaxial cable connection shall be a constant impedance weatherproof Type N connector, taped with a weather resistant electrical tape to insure a lifetime watertight assembly. The coaxial cable shall be Belden 8214 or 9913 cable.

E) Antenna Lightning Protection

Coaxial connection to remote and central unit enclosures shall be by means of a coaxial type bulkhead lightning arrestor. The units shall be rated at 1 kilowatt with a minimum 500V and maximum 2000V-breakdown voltage. Coaxial lightning arrestors shall be a PD-593 or PolyPhaser IS-B50LN-C1.

F) Antenna Mounting Systems

Antennas shall be mounted at a height above ground that is consistent with FCC rules and regulations and provides adequate signal fade margin as described earlier. Antennas must be a minimum of 15 feet above ground and mounted as follows:

1) **Water Towers:** The antenna shall be mounted on the ladder or the water tower catwalk railing at a height consistent with FCC requirements. The coaxial cable shall be secured to the ladder or obstruction lighting conduit. A 3/4" rigid conduit with a weather-head shall be provided from the transmitter to the ladder on the tower.

2) **Above Ground Structures:** The antenna shall be mounted on a 10' long X 1-1/2" diameter galvanized mast with top mounted weather-head. The mast assembly shall be secured to the side of the structure with Uni-strut clamps. The coaxial cable shall feed through the mast assembly to the interior of the building.

3) **Antenna Towers:** A 30' freestanding antenna tower shall be supplied where specifically noted on the plans, where required for proper system operations, or in the RTU & CTU site descriptions. The tower shall be assembled from 10 sections built on a 12-1/2" (for ROHN 25G) equilateral triangle design. Tower sections shall be constructed of 1-1/4" steel tubing with continuous solid steel rod "zigzag" cross bracing electrically welded to the tubing. The entire 10' sections shall be Hot-Dip Galvanized after fabrication for long life. The antenna towers shall be ROHN Model 25G (for unsupported heights of up to 33 feet) or ROHN Model 45G (for unsupported heights less that 45 feet).

2.04. Instrumentation & Accessories

A) General

All items in the control system (electronic cards, power supplies, radios, time delays, relays, etc.) shall be of plug- in construction, make use of a plug-in wiring harness, use plug-in terminal blocks, and be interchangeable without recalibration. To insure field repair-ability by non-technical personnel, equipment that must be un-wired for replacement will not be accepted.

The following instrumentation devices and techniques shall be used as specifically called for in the RTU and CTU input/output sections of this specification.

B) Power Supplies

The DC power supplies shall provide ±0.1% line and load regulation with ±10% input variations. They shall have a temperature coefficient of ±0.02% per degree C. The input/output isolation shall be 100 Mohms DC (900Volts AC) with output transient response of 50 microseconds maximum. The power supplies shall be sized to operate the remote unit equipment with or without the back-up battery in place. Power Supplies shall be a Power One Series MAP130, Sola SLS, or approved equal.

C) Battery Back-up Operation

All remote units indicated shall be supplied with battery back-up operation. The rechargeable batteries shall be the sealed solid gelled electrolyte types, designed for float or standby service. Unless noted otherwise in the RTU descriptions, batteries shall be sized to maintain 24-hour service at water tower remotes. The remote shall include a charging module to recharge the battery when power is resumed, maintain the charge between outages, and provide a low voltage cut-off to protect the battery from excessive discharge during prolonged outages. All discrete, analog, and pulse inputs (i.e. switch closures, pressure, level, flows, etc.) shall continue to function on battery back up. Batteries shall be Globe Gel/Cell or approved equal.

D) Single Phase 120VAC Power Line Lightning Protection

Every site in the system shall be equipped with AC line filtering and lightning protection. The equipment shall provide 2-stage lighting/transient protection including inductive and capacitive filtering and MOV over-voltage protection.

E) Time Delays & Relays

All hardware time delays used in the system shall be of plug-in construction with DIN rail mounted sockets and have pilot duty contacts rated for 3 amps resistive @ 240VAC (or 0.8 amps inductive) loads. The time delays shall have switch selectable ranges from .1-1c, .2-10, 1.2-60, and 12-600 seconds. The time delays shall provide a ±0.2% repeat accuracy. The time delays shall have both "timing" and "timed" LED indicators. Time delays and relays shall be IDEC series GT5Y and RY4S or approved equal.

F) Level & Pressure Transducers

Level & pressure transducers shall be of the all solid-state two-wire transmitter type with a 4-20mA output from a 10.5-24VDC excitation. The units shall be powered from the RTU power supply. The transducers shall have a combined error (linearity and hysteresis) of ±0.25% full scale and be temperature compensated to ±2.5% per 100 degrees Fahrenheit. Zero and span adjustments shall be standardized so that transducers are interchangeable without recalibration. All exposed or wetted parts shall be series 316 stainless steel, PVC, or Buna-N. The units shall be capable of a three times full scale over pressure with out damage or change of calibration.

The transducers shall be mounted at the sensing point and wired to the enclosure. The transducers shall have a 1/4" or 1/2" NPT process pressure connection. Transducers for above ground mounting shall have a 1/2" conduit connection for cable entry. Transducers at water towers (and other outside locations) shall be mounted below grade and below frost line to prevent freezing. Below grade mounted units shall have factory signal cabling and be suitable for a minimum of 100' submerged duty.

Pressure/Level transducers shall be Micro-Comm L5N series, Consolidated A300 Model 221GEE, or Ametek Model 57S.

G) Solar Cells and Batteries

The solar cells shall be installed on an adjustable (15 to 75 degree) aluminum frame. Stainless steel mounting hardware shall be supplied. The cells shall be designed to withstand up to 100mph winds and ambient temperatures of -20 to 140 degrees F. The solar equipment shall have the following specifications:

Solar Cells:

Voltage	15Vdc @ 2 amps
Nominal Rated Power	90W or as needed for the RTU
Conversion Efficiency	At least 13%

Charging Module:

Adjustable Peak Charging Voltage	Adjusted to 14.5Vdc
Adjustable Low Voltage Contact	Adjusted to 10Vdc (disconnecting RTU)
Status Indicating Lights	Low Battery, Charged, Charging
Meters	Array and Battery

Batteries:

Storage Capacity	RTU shall operate a minimum of 7 days (168 Hrs.) during heavy overcast conditions
Type	Marine deep charging
Recharge Time to full	shall not exceed 72 hours (Low voltage to cutout charge)

3.0 PART 3 - CENTRAL UNIT EQUIPMENT

The "Central Unit" shall be composed of two or more separate computers communicating over a

high-speed serial data links. The first computer (called the Central Terminal Unit or CTU) shall provide all communications with remote units, local inputs and outputs, and local hardware display devices. The second computer (called the Operator Display Console or ODC) shall be responsible for the operator interface to the system and provide display, alarm, and logging of all data.

3.01. Central Terminal Unit (CTU)

A) General

The Central Terminal Unit (CTU) will be the center of control for the system. This unit shall control the system by interrogating remote units for status/alarm and level/pressure data, comparing this information to operator set points and command inputs, and generate pump commands to be sent to the remote units.

The CTU and the Operators Display Console (ODC) shall communicate with serial ASCII data communications at switch selectable baud rates up to 9600 baud. The CTU will provide to the ODC computer "on demand" all "real" status, analog, and pulse information from the remote units and "virtual" data points generated by the CTU. The CTU will receive operator input from the ODC computer and generate commands sent to the remote units.

The CTU shall be capable of supporting simultaneous access from multiple ODC computers. These ODC computers may access the CTU either locally, over a multi-drop RS-485 network, or remotely over a dial-up phone modem. The CTU shall support Allen-Bradley DF1 or Modbus communications with local input/output devices.

B) Construction

The CTU Central Processing Unit (CPU) shall be fully programmable from the ODC provide all control processing and short-term data storage for the system. The CPU shall include a combination of RAM, Flash ROM, and EEPROM memory providing a minimum 16K of user memory. The RAM memory shall be used for temporary data storage and manipulation. The Flash ROM memory shall be used for program and configuration data storage. The EEPROM memory shall be used to store the current operating database and operator setpoints. The CPU shall include a battery backed Real Time Clock.

The CTU shall be supplied with a Win98/2000 compatible programming software that shall be installed in the ODC for use by the owner locally or the Systems Integrator via the remote access system. The CTU and programming software shall support the same feature set as detailed in the RTU specifications section.

The base CPU shall have multiple COM port(s) to support remote programming, communications with the ODC, communications with remote RTUs, and communications with local input/output devices. The ports shall support either RS232 or RS485 interfaces. COM ports shall provide LED indicators so show channel activity for TXD, RXD, and RTS. Communications with devices over cables greater than 50ft in length shall be by a RS485 multi-drop network communications. Each termination shall be accomplished via an isolated RS485 to RS232 converter that provides 750VDC of optical isolation. The CTU assembly shall be a M1500, S4500 CPU or Allen-Bradley 5/03 or 5/04 processor with Prosoft Modules added to support either Allen-Bradley DF1 or Modbus RTU

protocols. The CTU shall support the following communications methods:

Local RS232 communications with ODCs and remote access modems.
Local RS485 Multi-drop Data Highway communications with local PLCs for local I/O.
VHF (or UHF) radio modem with remote RTUs.
High Speed Data Radios with remote ODCs and local I/O.

Local CTU inputs and outputs shall be accomplished via Programmable Logic Controllers (PLCs) as detailed in the Remote Terminal Unit (RTU) section of these specifications. The CTU shall communicate with local PLCs via high speed data modems or high speed data highway as detailed in the appendix of this section.

The CTU control panel shall be equipped with a battery back up. The CTU shall operate for a minimum of 8 hours controlling all radio/RTU operations. The rechargeable 12 amp hour batteries shall be sealed solid gelled electrolyte type batteries. The CTU shall recharge, maintain, and contain a low voltage cut-off protecting the battery from excessive discharge.

C) Enclosures

All of the CTU and PLC equipment (including CPU card cage, radio, power supplies, automatic antenna switching, and local inputs & outputs) at the master shall be housed in a free standing or wall mount NEMA 12 enclosure.

Refer to Appendix for specific enclosure requirements.

D) Front Panel Hardware Displays

As detailed in the appendix, the Central Unit may include front panel displays of the specified remote unit data for each remote unit. In such case, each remote unit shall have its own display. Single unit display devices that provide scanning displays of information or that require operator intervention to display the desired data will not be allowed. HOA switches CRF lamps, alternator selector switches, and associated alarm/status lamps shall be grouped in a logical manner.

The indicator lamps, pushbuttons, and selector switches used in the system shall be IP65 oiltight/waterproof/corrosion resistant rated. The indicators use slide or bayonet based colored LED light sources. The lenses shall be acrylic and color matched to the LED color. The lamps shall have translucent marking plates for legends and be constructed such that the acrylic lens covers the legends for dust and water protection. The pushbutton and selector switch operators shall be Nema 600V rated with contacts rated for 6A @ 120VAC inductive. The contact blocks shall be stackable and snap-fit with screw terminals for termination.

Levels & Pressures - Front panel displays of levels and pressures shall be .5" high 3.5 digit LCD displays.

HOA Selector Switches – Front panel HAND/OFF/AUTO selector switches shall be oiltight rated 3 position selector switches with engraved nameplates.

Indicator Lamps – Front panel indicator lamps shall be oiltight rated LED lamps with engraved lenses.

Common Lamp Test & Alarm Acknowledge Pushbuttons - The common Lamp Test pushbutton shall light all lamps on the front of the panel when pressed. On the occurrence of any displayed alarm, the common Alarm Horn shall sound and the specific alarm lam shall light. Pressing the common Alarm Acknowledge Pushbutton shall cause the alarm horn to silence. The Alarm Lamps shall remain on until the alarm has cleared. Acknowledging an alarm shall not prevent the alarm horn from resounding on the occurrence of a new alarm.

Refer to Appendix for specific front panel display requirements.

E) Local Control Functions

In general the CTU shall be programmed to provide generic control functions as detailed earlier. The integrator shall be responsible to meet with the owner and the engineer to develop the automatic control strategy required for the system.

Refer to Appendix for special input and output control requirements.

3.02. Operator Display Console

A) General

As described previously the Central Unit shall have two microprocessors tied together with separate operating responsibilities. The first processor (Central Terminal Unit or CTU) shall handle all the telemetry, set-point comparison and command duties. The second processor (Operator Display Console or ODC) shall handle the CRT display, operator keyboard, alarm/log printer, and data storage duties.

B) System Unit

The Operator Display Console (ODC) computer shall be a Intel/Windows base processor with a Pentium IV microprocessor operating at a minimum of 2.6GHz with 512K cache memory. It shall include the following features:

Pentium 4 CPU with 512K L1 cache memory, operating at 2.6GHz
512MB (minimum) of 133MHz SDRAM, expandable
16MB ATI Rage 128 Pro graphics card capable of driving (2) CRTs
80GB (minimum) Ultra ATA Hard Drive
3.5" 1.4MB floppy drive
8x/4x/32x Read/Write CD-ROM
Soundblaster PCI Sound Card with external speakers
(2) Serial Ports
(1) Parallel Printer Port
QWERTY Keyboard with numeric keypad and cursor keys
Microsoft Mouse
Microsoft Windows 2000 Millennium edition, or XP.

The system unit shall be housed in a desktop or mini-tower case as required by the owner. The CTU shall store all command inputs and set points as downloaded from the ODC. The hard drive in the

ODC shall be used for program and data storage. The floppy disc and R/W CD-ROM shall be used for archive data storage and back-up protection of the operating program.

The separately mounted keyboard shall have a standard typewriter format with tactile feedback, twelve special function keys, and a separate numeric keypad for entering set point data and cursor control. The 256-character symbol set shall include 96 ASCII characters and the IBM (International Business Machine) graphic symbols. The system shall include an 2-button Windows compatible mouse with mouse pad.

C) CRT Video Displays

The system unit shall be equipped with 0ne (1) CRT displays. The CRT display shall be a 17" (diagonal, 16" viewable) high-resolution (1024 x 768) color display terminal with minimum .24mm dot pitch and IBM XVGA compatibility. The CRTs shall be utilized for display of station and system graphics and real-time data display. The CRT display shall be of the same manufacture as the System Unit above.

D) Printer

The system shall include a color "graphic" inkjet printer with a 600dpi black and 300dpi color resolution, 8ppm color & 5ppm black & white output speed, and 1000 page/month duty cycle. The printer shall provide for printing of alarms summaries, data logs, trend graphs, and reports. The graphic capability will be required to draw pressure, level, and flow rate graphs for each remote on command. The printer shall be interfaced to the processor via a parallel port. The printer shall be a HP DeskJet 990cse printer or equal.

E) Phone-Line Debug & Remote Access Port

The Central Terminal Unit shall be equipped with a 33.6Kbps direct connect phone modem to provide long distance factory debugging over dial-up phone lines. This de-bug system shall allow the factory technician to monitor data transmissions to and from all sites, to manually send interrogations and receive data from the remote sites, and to reprogram the Central Unit CPU. The debug system shall allow testing all inputs and outputs at the "Central". The de-bug service shall provide sufficient detail to pinpoint the defective module for operator replacement. De-bug entry shall require a 4 digit access code to prohibit unauthorized access. The modem shall be universally compatible with all standard V.34, V.32bis, V.32, V.22bis, Bell 212A/V.22, V.23, V.25, and Bell 103/V.21 modems. The remote access modem shall be a US Robotics Sportster External 33.6 Faxmodem.

The ODC shall include Symantec's current version of PCAnywhere for remote access by the Owner's or Systems Integrator's remote computers.

F) Enclosures

The Operator Display Console unit (including CRT display, Keyboard, and System Unit) and the graphic printer shall be located on top of a desk supplied by the Owner. All interconnecting cabling shall be plug-in and supplied by the contractor.

G) Battery Back-up Operation

The ODC shall include 20 minutes of back up. The ODC back-up unit shall be a Stand-by Uninterruptible Power Supply (UPS) system that provides power line filtering and transient protection. The unit shall automatically take over (within 4mS) when the power line fails without interrupting or restarting the system and automatically recharge the battery within 10 hours after the power returns to normal. The UPS shall be located at the desk location of the ODC and shall power the System Unit, CRT display, and printer. The UPS shall be a APC Back-UPS 650, 1000, or 1400 as required.

3.03. Operator Display Console Software

A) General

The software shall be capable of operating in the ODC hardware described above as well as in customer supplied Win 98/NT compatible hardware with XVGA display, 50MB hard drive of hard drive space and 64MB of RAM memory. The contractor shall supply a fully functional "developmental" version of the SCADA software (including any required software protection keys) for the first ODC as well as a separate configured "runtime" version for installation and use in a customer supplied back-up computer. The software may be modular, however the operator interface shall provide an integrated interface to all areas of the program. Demo program copies will not be allowed.

The software shall operate in the 32-bit Windows 98/NT/2000 environment and be fully Y2K compliant. The software shall be the latest "full developmental" version of SCADAview, Wonderware InTouch, Intellution FIX-DMACS, or Allen-Bradley RSView32. The software shall be licensed to the owner.

B) System Back-up & Installation

The contractor shall provide a back-up copy of the installed software on a CD-ROM disk. Back-up copies of any setup or graphic files shall be on 1.4MB floppy disks. The copies shall be kept by the Owner for emergency reloading in the event of a catastrophic failure. The contractor shall provide an easy to use installation (or re-installation) program that will automatically setup the hard drive operating system and automatically load (or reload) the software.

C) System Restart

The software shall automatically restart in the event of a power failure. All data necessary for the operation of the system shall be reloaded from mass memory (hard drive). To minimize the restart procedure, a copy of the current state of the following data shall be stored in mass memory:

1) Status Points
2) Measurement Points
3) Calculated Points
4) Pseudo points
5) Accumulator points
6) Date and Time
7) Current limits

D) System Capacity

At a minimum, the operating software shall be capable of accommodating 32,000 tag points as follows:

1) Discrete status & alarm points
2) Measured variables
3) Accumulated variables
4) Calculated status & alarm points
5) Calculated control points
6) Operator consoles
7) Remote Operator Console
8) Printer for each console

E) Operator's Console

In general, the operating software shall display all received data in engineering units with operator generated labels, generate and print alarms, print logs, store manually entered data, update CRT displays, and perform operator commanded functions as required by the database. The system shall automatically generate the following system displays:

1) Main Menu page (with direct access to all screens and other program modules)
2) System Summary page listing key data points for all RTUs in the system
3) RTU specific display pages showing all data for each RTU in the system

Beyond the basic operating software required for SCADA operations, the software package shall accommodate the following:

Analog Data:

a) Display value directly in engineering units
b) Accept operator High & Low alarm limits and generate alarms
c) Accept operator rate of change alarm limit and generate alarm
d) Store data for trending displays

Flow Rate Data:

a) Display value directly in engineering units
b) Accept operator High & Low rate alarm limits and generate alarms
c) Totalize flow total and display in engineering units
d) Accept operator High/Low 24 hour total limits and alarms
e) Store data for trending displays

Pump Control Operations:

a) Display ODC, CTU, and RTU HAND/OFF/AUTO functions
b) Display Pump CALL/RUN/FAIL status for each pump
c) Input/Display control database

Status Point Operations:
Display ODC, CTU, and RTU status functions
Input/Display control database

Alarm Point Operations:
a) Display ODC, CTU, and RTU alarm functions
b) Enter new alarm in data log archive and send alarm to printer
c) Sound alarm horn until alarm is acknowledge by the operator
d) Log alarm acknowledgment to data log and printer
e) Log alarm clearing and send alarm clear to printer
f) Input/Display control database

Event Point Operations:
a) Display ODC, CTU, and RTU alarm functions
b) Display ODC, CTU, and RTU event functions
c) Enter new event in data log archive and send alarm to printer
d) Log event clearing and send alarm clear to printer
e) Input/Display control database

F) Database Editor

The Database Editor shall be an on-line operating software system for the generation and modification of the ODC display database for the system. The integrator shall generate the initial database for the SCADA System, including the graphics displays. It shall be possible to perform the editing function while the system continues to poll remotes for data and performs its normal SCADA control functions. The editor shall operate in an English language type conversational mode and shall not require an understanding of programming as a prerequisite for its use or modification. All data displays of the measurement point shall be color designated based on which limit has been violated (e.g., green-normal, red-emergency, etc.). The editor shall allow for the creation and modification of text and graphic displays pages. At a minimum, the following editors shall be available to create or modify the database:

1) RTU and Station Editor
a) Add, delete, or modify RTU displays.
b) Modify individual RTU displays including renaming or re-scaling existing points and adding and defining new data points, .

2) Status Point Definition Editor
a) Add, delete or modify individual points including the following specific characteristics:
b) Status points logic
c) Point and Station name
d) Alarm conditions
e) Normal state
f) Designation of multiple status points associated with a single control point to allow for verification of proper operation

3) Measurement points

a) Point and Station name
b) Scaling factors
c) Rate of change limit
d) High/Low alarm limits
e) Normal Condition

The editor will allow for the entry of the following type of information:

4) Text Display Pages:

a) Alphanumeric, line and special functional characters for Text Displays
b) Status/Control points (On/off/alarm display)
c) Foreground/Background color selection

5) Custom Pixel Level Graphic Displays

a) Modifying existing and adding new graphics. The graphics development system shall include predefined symbols, allow the operator to generate custom symbols, and provide for importing third party bmp graphics. The status of the equipment shall be indicated by the color of the symbol shown on the display. The following colors shall be used consistently in all displays to indicate the status of equipment:

Pumps:	Called For	- Yellow
	Running	- Green
	Off	- Black
	Failed	- Red
	Signal Loss	- Gray (out of service)
Alarms:	High Level	- Red
	Low level	- Blue
	Signal Loss	- Gray (out of service)

b) Digital Display Windows with control of :

1. Numerical format
2. Special display scaling

c) Analog Bar graph Display Windows with control of:

1. Width
2. Height
3. Display range
4. Text strings

6) As a consequence of the database entry and normal system operation, the system software shall generate the following CRT pages:

1. Active alarm summary page
2. Alarm/event history summaries

7) The contractor shall generate a custom graphic display to for each control grouping in the system. For example a graphic display will be required for each tower/pump station combination in the system.

8) The system shall provide for password protection to any desired area of the system. Each operator shall be assigned a unique password to control his access. At a minimum, the system shall be capable of limiting access to certain user-designated areas:

a) Engineering Level – access to system setup parameters
b) Supervisory Level – access to start/stop and high/low alarm settings
c) Operator Level – access to HAND/OFF/AUTO controls

G) Real-time Graphic Displays

The system shall include real-time custom graphic displays. The graphic displays shall be pixel level graphics with full control of the 1024x768 pixel resolution and 16 bit color capabilities of the CRT display.

H) Data Archiving

The program shall track all of the activity in the system. The program shall take a snapshot of all of the active data in the system every 6 minutes and store this data to the hard drive. The archive data shall be organized by in to monthly files for each RTU. At the end of the month, the operator shall be prompted to move the archived data from the hard drive to floppy disks. The data archiving shall be automatic and employ data compression to allow 1 month of stored data for up to 4 RTUs to be stored on a floppy disk. The data shall be directly usable by the system in its compressed form from either the hard disk or floppy disk storage media.

I) Automatic Logging

The system shall automatically log all alarm and event activities (i.e. occurrence, acknowledgement, and clearing) and operator changes to the system. This logging shall be to a monthly file on the hard drive. In addition to the event and alarm log the system shall provide operator selected data logs as follows:

1) Hourly Logs
2) Daily Logs

J) Historical Data Trending Module

The Central Unit shall generate historical data files, stored in available space in the system mass memory. All data is to be accumulated on the hard disk until moved by operator command to the floppy disk storage (ASCII format). Data stored on the floppies shall be capable of being reread directly from the floppies into the system for report generation with out disturbing the current database.

K) Trend Graph Module

This module shall allow the user to output up to 8 data points stored in historical files in trend graph form on the CRT and/or to the printer. These graphs shall be generated by the entry of the following information:

a) Graph type selection (single pen or 8 pen)

b) Historical data set to be used
c) Names of points to be displayed (up to eight different points)
d) Start date selection

L) Operator Notes Module

The Operator Notes module shall allow the operator to enter typed data into the system for each of the RTUs. The notes module shall allow operators to pass important information from one operating shift to another. The note module shall also provide for operator input to describe specific circumstances of the operation or maintain a log of operator activities.

M) Historical Report Generator Module

The system shall include a Historical Report Generator module that allows for operator selected data to be pulled from the archived database and converted to an ASCII, comma delimited file format. The format shall allow for data import into other software packages for data review by the Owner or his engineer. The data search shall allow for 1 to 365 days of accumulated data.

N) Alarm Dialing Module

The system shall include an alarm dialing module that allows for operator selected alarms to be dialed out over a voice grade modem utilizing standard pone lines. The software dialer shall be SCADAdial, Win 911, or approved equal.

4.0 PART 4 - REMOTE TERMINAL UNIT & LOCAL I/O EQUIPMENT

A) General

The Remote Terminal Units (RTUs) shall be "smart" Programmable Logic Control (PLC) units at all locations. The core software program used at all locations shall be identical and stored in non-volatile FLASH type ROM memories that can be upgraded in the field by the owner using configuration software supplied as part of this contract. The core RTU software shall provide the basic operational logic including communication with other sites in the system, responding to control commands from the CTU, and providing back-up peer-to-peer control in the event of a CTU failure. The RTUs shall be M1500, U.S. Filter LC3000, or Allen-Bradley Micro-Logix 1500 units with LRP series processor.

Program and configuration data shall normally be stored in battery-backed or flash type memory for use by the CPU. In addition, this data shall also be stored in a plug-in operator interchangeable EEPROM memory module. This module shall be fully enclosed with no exposed electrical leads, similar to the Allen-Bradley MM1 memory module, providing protection against damage due to handling and static electricity. The module shall be programmed via the CPU and without the use of external adapters. The RTUs shall include "watch-dog" circuitry and be "self-initializing" without operator intervention. In the event that the program or configuration data is corrupted, the CPU shall reload the program and configuration data from the EEPROM memory module.

The RTUs shall be fully online programmable while the RTU continues to communicate with the rest of the system and performs its assigned control tasks. The RTUs shall support

"fill-in-the-blank" type configuration for basic operation and to set-up common features such as COM port set-up, peer-to-peer data collections, local back-up control set points, input and output setup, output on/off time delay settings, front panel display setup, etc. The RTU shall also support a process script language or ladder logic type programming for site-specific customizations including special input and output manipulations, local sequential control, math functions, and PID control as follows:

Relay (Bit) Type	- Examine if ON, Examine if OFF
Timer & Counter	- Timer ON, Timer OFF, Timer DONE
Compare Functions	- Equal, Not Equal, Greater Than, Less Than, etc
Math Functions	- Add, Subtract, Multiply, Divide, Square Root
Scaling Functions	- Scale & Scale with Parameters
Logical Functions	- AND, OR, & NOT
Program Control	- Jump & Skip Next functions
PID	- PID with compound loop input

The RTU/PLC programming software shall be written for the 32 bit interface of Win98/NT/2000. The supplier shall provide a licensed copy of the RTU configuration and programming software along with the necessary communications cables to the owner. Training on the use of the software shall be provided as part of the system training.

B) Construction

The RTU shall use modular construction. The base unit shall be composed of the power supply, CPU, communications modules, and basic inputs and outputs. The unit shall have expandable inputs and outputs via either a card rack design or integrated high-performance serial I/O bus. All terminations on the RTU or expanded I/O shall use removable, NEMA-style "finger-safe" terminal blocks on the controller and I/O.

The RTU shall be capable of being powered from AC, DC, or solar sources. DC and solar powered RTUs shall have an integral battery charging circuit that protects the external battery from over and under voltage conditions and provides automatic charging of the battery after power failures. The back-up power supply shall be either 12VDC with 24VDC DC/DC converter or 24VDC with a 12VDC DC/DC converter to run the 12VDC radio and 24VDC to power external sensors from a single battery source. Series tapped 24VDC batteries for 12VDC will not be allowed. Back-up batteries shall be rechargeable sealed lead-acid type batteries as manufactured by PowerSonic or equal. The back-up battery shall provide for 24 hours of back-up operation at water tower remote units and 3 hours at all other sites.

The RTU shall have a minimum of two (2) communications ports. The first shall be used primarily for CTU-RTU and RTU-RTU communications. It shall support baud rates of 110-19,200 baud and have a plug-in standard 25pin or 9pin sub-D connector that provides both full RS232 interface and radio modem interface for use with either "data" radios or standard business band type radios (i.e. radios with out internal modems). This port shall also have a 9 pin sub-D connector to allow monitoring of the communications activity. The second communications port shall provide for multi-drop type communications with operator interfaces, external inputs and outputs (I/O), and programming terminals. The port

shall provide for both 2 and 4 wire RS485 interface with data rates to 9600 baud. The communications ports shall include LED's to show the status of all control lines.

The RTU shall provide for sufficient installed and configured spare inputs and outputs (I/O) to meet the site requirements as detailed and provide for 25% spares of each type. The unit shall have a minimum of (4) discrete (relay) outputs, (8) discrete inputs (DI), (4) analog inputs (AI), and (1) high speed pulse input (PI). The analog and pulse inputs shall provide for sensor excitation with separate fuses for each input. The fuses may be the self-resetting type. All input and output connections to the RTU shall be via Nema "finger-safe" plug-in terminal blocks. The RTU inputs, outputs, and operator interface shall be as follows:

1) **Discrete Outputs** - The discrete outputs shall be isolated relay outputs rated at 5.0A continuous @ 240VAC. LEDs on the front of the RTU base unit or expansion module shall indicate the status of each output point. Interposing relays shall be provided if the voltage or current of the external load on a contact exceed the 5.0A 240VAC ratings. Each output shall be provided with operator settable software ON and OFF time delays

2) **Discrete Inputs** - The discrete inputs shall be optically isolated and provide for 24VDC excitation to remote sensors and switches. Each input shall be separately fused or current limited such that accidental grounding shall not render the other inputs non-functional. LEDs on the front of the input module shall indicate the status of each input point.

3) **Analog Inputs** - The analog inputs shall provide filtered and scalable analog to digital conversion of input signals. The analog inputs shall be switch selectable from 0-5VDC to 0-20mADC and provide a minimum of 0.3% resolution and 0.5% accuracy over the temperature range of 0-70degrees C. The RTU shall provide separately fused 24VDC excitations to the remote sensors.

4) **Analog Outputs** - The analog inputs shall provide a 0-5VDC signal to RTU panel mounted devices or 4-20mA isolated signals if sent to other panels as specified.

5) **Pulse Inputs** - The high-speed counter/pulse inputs shall provide for pulse rates up to 1KHz direct from flow meter transmitter heads without interposing equipment. The pulse input shall include fused 12VDC excitation to the meter transmitter.

6) **Power Supply** - Each RTU assembly shall include an integral power supply. Power supplies shall be designed for 12VDC or 24VDC input power and suitable for use in battery back-up operations. DC/DC converters shall be required to insure that both the 12VDC and 24VDC are regulated separately from the common source.

7) **Keypad & Display Unit** - The keypad & display unit shall have a 4x20 back-lighted LCD display to display the status of all local inputs and the tank level of the associated control water tower level. The 5x5 keypad shall provide for operator input of set points and timer settings. The operator interface shall be menu driven and provide for dedicated keys for cursor position and input functions. The operator interface shall provide for up to 50 screens of data display. The keypad & display unit shall be supplied and mounted on the

front of the RTU enclosure if detailed in the specific RTU I/O requirement list. The keypad & display unit shall maintain the Nema 4 rating of the RTU enclosure.

C) Enclosures

The remote unit enclosures for indoor mounting (office only) shall meet all the requirements for NEMA Type 12 enclosures. The enclosures body shall be made of a minimum 14 gauge steel with continuously welded seems and be furnished with external mounting feet. The enclosure door shall be made of a minimum 16 gauge steel with have a 14 gauge steel hinge. Enclosures larger than 16x14 shall have a rolled lip on 3 sides of the door for added strength. The door opening shall have a rolled edge on 4 sides to protect the door gasket. The door gasket shall be heavy neoprene and attached to the door with oil resistant adhesive. Sub-panels shall be 14-gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. The enclosure finish shall be gray polyester powder coating inside and out over phosphatized surfaces. The subpanels shall be finished in white. Nema 12 enclosures shall be Hoffman "CH" or "CONCEPT" wall mount enclosures.

Remote site installations requiring equipment to be mounted outside shall have a double box enclosure with the remote unit enclosure mounted inside a lockable NEMA 3R enclosure. The double enclosure shall be required to control vandalism, provide complete weather protection, reduce the heating effects of the sun, and prolong the life of the equipment. The NEMA 3R enclosure shall be constructed of 14 gauge galvanized steel, with a drip shield top and seems free sides front and back, and a stainless steel hinge pin. The enclosure finish shall be gray polyester powder coating inside and out over phosphatized surfaces. The NEMA 3R enclosure shall be Hoffman Bulletin A-3.

The remote unit enclosures mounted in damp corrosive areas (such as concrete meter vaults) shall be NEMA Type 4X rated enclosures. The enclosures shall be made of molded fiberglass polyester and be furnished with external mounting feet. The door shall have a seamless foam-in-place gasket and corrosion-resistant hinge pin and bails. Sub-panels shall be 14-gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. The enclosure finish shall be a light gray inside and out. The subpanels shall be finished in white. Nema 4X enclosures shall be Hoffman "Fiberglass Hinged Cover".

D) Front Panel Hardware Displays

The RTU units shall include front panel displays of the specified inputs and outputs. The indicator lamps, pushbuttons, and selector switches used in the system shall be IP65 oiltight/waterproof/corrosion resistant rated. The indicators use slide or bayonet based colored LED light sources. The lenses shall be acrylic and color matched to the LED color. The lamps shall have translucent marking plates for legends and be constructed such that the acrylic lens covers the legends for dust and water protection. The pushbutton and selector switch operators shall be Nema 600V rated with contacts rated for 6A @ 120VAC inductive. The contact blocks shall be stackable and snap-fit with screw terminals for termination.

E) Local Control Functions

In general the RTU shall be programmed to provide generic control functions as detailed earlier and to work in concert with the CTU. The integrator shall be responsible to meet with the owner and the engineer to develop the automatic control strategy required for the system.

5.0 PART 5 - EXECUTION

5.01. Equipment Examination

The control system shall be completely tested prior to shipment. The entire control system shall be "Burned In" at the factory for a period of at least 20 days. The component equipment shall be computer tested and temperature cycled at zero degrees and at fifty degrees centigrade.

5.02. System Start-up

The manufacturer shall supply "Factory" personnel for start-up service as needed to insure satisfactory operation. Subsequent trips to the job site to correct defects shall be made at no charge to the Owner during the warranty period.

5.03. Training

The system manufacturer shall supply "factory" personnel to conduct two separate on-site training sessions, totaling a minimum of three days of training.

The initial training session shall be conducted during start-up as needed until the Owner and Engineer are satisfied that the operators are comfortable with the operation and maintenance of the system. Training shall be done on site with the owner's personnel.

Three to six months after the Owner commencing system operation, the system manufacturer shall supply "factory" personnel to conduct follow-up training of the Owner's personnel. The follow-up training shall be conducted on-site and consist of reviewing the operation and maintenance of the system. The Owner shall be contacted a minimum of two weeks in advance, prior to scheduling the training session to allow proper coordination.

5.04. Substantial Completion

The Engineer will grant substantial completion only after completion of the start-up and initial training phase of the project. The Engineer shall make an inspection of the system to determine the status of completion. Substantial completion will be awarded only when the system is providing usable service to the Owner. If the system is commissioned in phases, the Contractor may request substantial completion for the completed phases.

5.05. Warranty/Support Program

The Telemetry Contractor shall supply a **full, non-prorated five (5) year parts and labor warranty and comprehensive support program for all items and software supplied under this section** (except as noted below). Power surges and lightning damage shall be

included as part of the warranty.

The warranty shall begin from the time of "substantial completion" as issued by the engineer. The manufacturer shall provide a 24-hour response to calls from the Owner. The manufacturer, at his discretion, may dispatch replacement parts to the Owner by next-day delivery service for field replacement by the Owner. Any damage to the control system caused by the actions of the Owner in attempting these field replacements shall be the sole responsibility of the manufacturer. If, during the warranty period, satisfactory field repair can not be attained by field replacement of parts by the Owner, the manufacturer shall dispatch "factory" personnel to the job site to complete repairs at no cost to the Owner.

The support program shall begin from the time of "substantial completion" as issued by the engineer. The support program shall include free updating of all software as needed and providing free phone support from the integrator throughout the warranty period.

The ODC Computer System Unit, keyboard, CRT display, printer, and associated UPS (and Portable Operator Display Console if specified in this contract) shall be covered by a one (1) year warranty beginning with "substantial completion". Lightning damage shall be included as part of the warranty on these components. Batteries associated with the solar powered RTU shall have a one (1) year warranty.

Flow meters and control valves supplied, as part of this contract shall be covered by a one-(1) year warranty beginning with "substantial completion".

6.0 APPENDIX: DETAILED EQUIPMENT DESCRIPTION

6.01. CENTRAL UNIT REQUIREMENTS:

A) Installation Requirements:
All of the Central Terminal Unit equipment (including CTU, radio, power supplies, and local inputs & outputs) at the central shall be housed in a 24"Wx36"Hx8"D NEMA 12 enclosure. The ODC equipment will be placed on a desk provided by the owner.

The central controls shall include discrete inputs, discrete outputs, analog inputs, pulse inputs, and the associated instrumentation for controlling local devices listed below. The controls shall include two wire pressure transducers for sensing of local pressures, flows, and levels.

B) CTU Communications Method:
The CTU shall communicate with local PLCs via a wired High Speed Data Highway. The Systems Integrator shall provide the communications cable to link the PLCs into a wired local area network. The CTU shall communicate with the RTUs listed elsewhere in these specifications via VHF (or UHF) radio communications as detailed previously. A 30 foot ROHN 25G antenna tower as specified earlier will be installed by the contractor at the central office location for mounting the required radio communication antennas. The local inputs and outputs shall be as follows:

C) Front Panel Display Requirements:

1) System Normal Lamp
2) See previous specifications

D) Discrete Outputs:

1) (1) System Normal
2) Valve CALL
3) (spare)
4) (spare)

E) Discrete Inputs:

1) Valve Open

F) Specific Control Requirements:

The local control (fill valve) will be controlled by the level in the New Ground Storage tank. Based on operator setpoints this valve will open and close as required to maintain a desirable level in the new tank but in order to maintain proper back pressure the control of this valve will be enabled (or inhibited) based on the level in the existing Oldham Elevated tank. The control valve is approximately 500 feet away from the central office. It is the intent that this control be accomplished over buried DC control wires in ¾" conduit from the valve solenoids, limit switch and the Central Control Panel.

6.02. WATER TOWER REMOTE UNIT REQUIREMENTS:

A) Installation Requirements:

The tower transceiver and RTU shall be mounted inside a vented, lockable, NEMA 3R enclosure as specified.

The level transducer shall be a two-wire transmitter suitable for below ground mounting as specified earlier. The level transducer shall be installed at a point below freezing in the valve vault. The pressure connection shall be equipped with a corporation stop providing a 1/4" NPT female connection for the transducer. The contractor shall run 3/4" rigid conduit from the vault to the transceiver enclosure for the transducer signal cable.

The antenna shall be as specified and mounted on the water tower at a height consistent with FCC requirements. The contractor shall provide a 3/4" rigid conduit with a weather-head from the transmitter to the ladder on the tower.

B) CTU Communications Method:

The CTU shall communicate with these RTUs via VHF (or UHF) radio communications as detailed previously.

C) Front Panel Display Requirements:

1) See Specifications

D) Discrete Outputs:

1) (1) System Normal (displayed on front of RTU assembly)
2) (spare)
3) See Specifications

E) Discrete Inputs:
1) Power Failure
2) (spare)
3) See Specifications

F) Analog Inputs:
1) Water Tower Level (suppressed head data from new transducer)
2) Battery Level (Solar Powered Water Tower RTU only)
3) Valve position

G) Pulse Inputs:
1) (spare)

ADDITIONAL HIGHWAY DEPARTMENT REQUIREMENTS

A. The Contractor shall be required to post a $_____ Encroachment Bond with the Kentucky Transportation Cabinet. The Contractor is responsible for all costs associated with this bond. A facsimile copy of this bond is given on the following page.

B. The Encroachment Bond shall be completed in the name of the OWNER.

C. The Contract shall not be considered complete, nor final payment made to the Contractor, before written Notice of Release from the Highway Department relative to all construction on the project.

D. A Pre-Construction Conference will be held with Kentucky Transportation Cabinet personnel, Contractor, Owner's representative, funding agencies as applicable, and Engineer. This Pre-Construction Conference will occur before any construction is completed on the project. The Highway Department, at this time, will delineate depth of cover required, location of all appurtenances relative to the ditch line, traffic control, and other important aspects of the project as it relates to Highway Department requirements.

E. The surface restoration methods required by the Kentucky Transportation Cabinet are given on a following page. Note that the minimum dimension on each side of the pipe is 4". Also note that all surface restoration shall be preceded by the placement of flowable fill. Flowable fill is outlined in other areas of these specifications.

F. A copy of the Encroachment Permit and Encroachment Bond shall be

maintained at the project site by the Contractor.

G. The Highway Department requires that all valve boxes, hydrants, blow-offs, meter sets, Air Release Valves (ARV), and generally all other appurtenances which are above ground or could be damaged by highway maintenance equipment, be installed in back of the ditch line. The Waterline Contractor shall be required to have on-hand, or have the ability to get, equipment necessary to meet this provision.

H. As noted previously in these specifications the Highway Department will require a minimum depth of cover within Highway Department right of way of 36". The Contractor shall consider this in his Bid.

County _____

Bond No. _____

Permit No. _____

KENTUCKY TRANSPORTATION CABINET
Department of Highways
Permits Branch

ENCROACHMENT PERMIT BOND

(Attach Standard Power of Attorney)

KNOW ALL MEN BY THESE PRESENTS: That we _____, in the City of _____ State of _____, as Principal, and _____, in the City of _____ State of _____, as Surety, are held and firmly bound unto the Commonwealth of Kentucky, for the benefit of the Transportation Cabinet in District Office No.(s) _____, located at _____ Kentucky, State of Kentucky, obligee, in the penal sum of _____ ($ _____) Doll money of the United States for the payment of which well and truly be made, we bind ourselves, our heirs, executors, ac tors, and assigns, jointly and severally, firmly by these presents.

The condition of the foregoing obligation is such that whereas the said _____ has obtained from the Commonwealth of Kentucky, Transportation Cabinet, authorizing specific facilities upon the State owned right-of-way, and

Whereas, under the terms of said permit, a cash indemnity or bond indemnity is required of said principal and good and s surety, payable to the Commonwealth of Kentucky, for the use and benefit of the Transportation Cabinet and conditioned the permitted encroachment being completed in accordance with the approved permit and being guaranteed that all non-conforming aspects of the encroachment can be corrected without expense to the Transportation Cabinet, by the said prin

Now, therefore, if the above bounden principal shall faithfully and honestly complete the encroachment in accordance wit permit, and if the encroachment for which the said permit is granted fails to meet all specification, or if the said permit is re by the Transportation Cabinet, the above bounden principal shall properly restore the right-of-way and/or roadway or surfa accordance with the Cabinet regulations, and if thereafter such restoration has been completed, then this obligation shall b and void; otherwise to remain in full force and effect until completion of the encroachment has been duly accepted by an authorized agent of the Transportation Cabinet.

That this obligation shall remain in full force and effect until terminated in writing by the Transportation Cabinet.

In witness whereof, we, the parties, have set our hands and seals on this the _____, day of _____, 19 _

_____
(KY Bonding Agent Name)

_____
(Mailing Address)

_____
(City, State, Zip Code)

_____
(Phone Number)

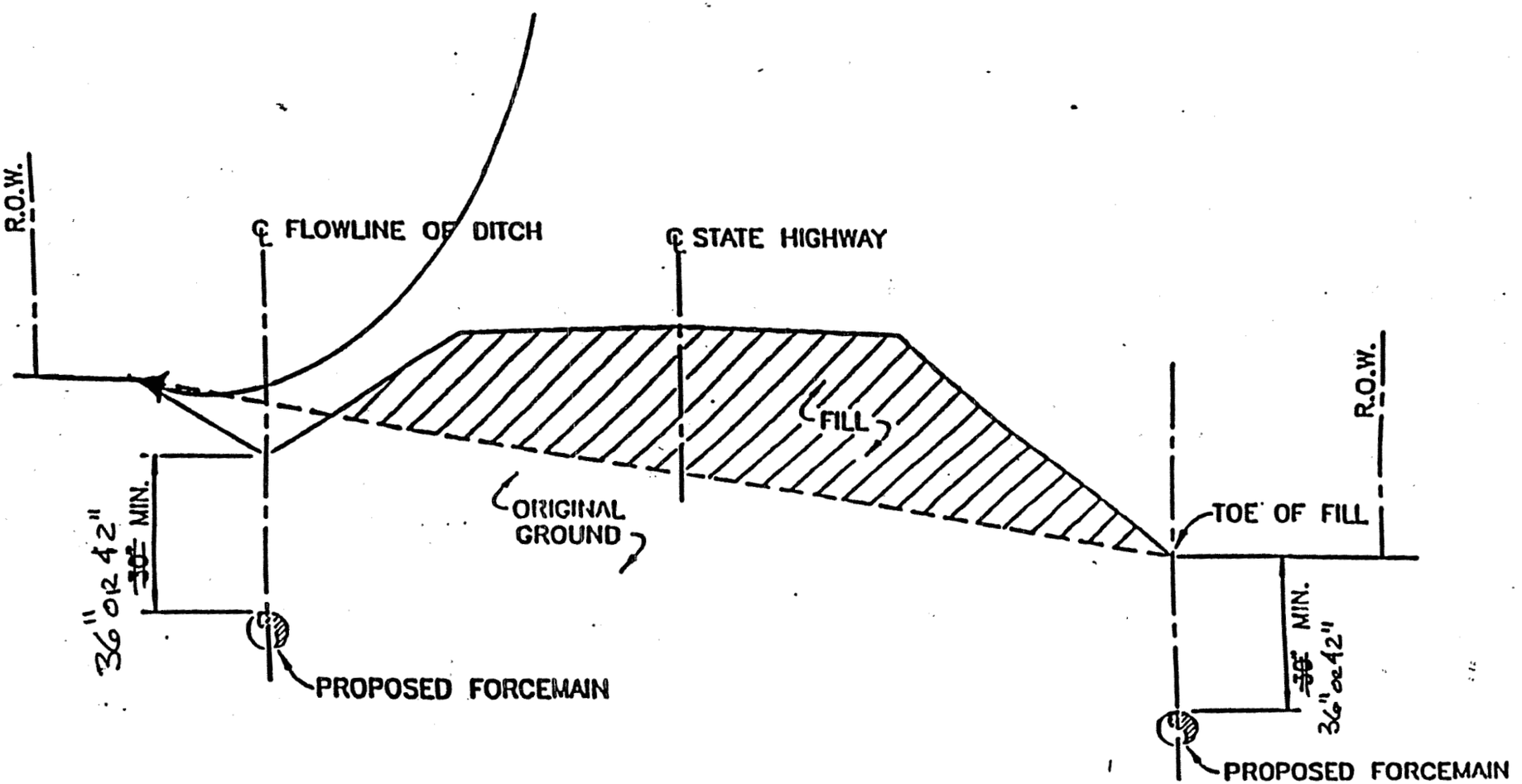
_____
(Principal)

BY _____

_____
(Surety)

BY _____
(Attorney in Fact)

ALL ABOVE GROUND STRUCTURES ARE TO BE PLACED BACK OF DITCH LINE AND MEET THE CLEAR ZONE.



TYPICAL SECTION — **UNDERGROUND UTILITIES**

PARALLEL TO STATE HIGHWAYS

H. A. SPALDING
ENGINEERS, INC.

Levee Road Water Association
Camp McKee Water
Improvements Project

Hydraulic Analysis

651 SKYLINE DRIVE
HAZARD, KY 41701-1664

LA CITADELLE
TEL. 606.436.2151
FAX. 606.436.2291

H. A. SPALDING
ENGINEERS, INC.

May 23, 2005

Mr. Tom Skaggs, Chief Environmental Engineer
Drinking Water Branch
Kentucky Division of Water
Plan Review Section
14 Reilly Road
Frankfort, Kentucky 40601

Re: Camp McKee Water Improvement Project
Levee Road Water Association
Montgomery County, KY

Dear Mr. Skaggs:

Enclosed you will find four (4) sets of Plans and Technical Specifications and the original "Owner's Letter" for the referenced project along with one (1) copy of the Plan Submission Booklet. The Plan Submission Booklet contains a copy of the letter from the Levee Road Water Association, stating their approval, Final Cost Estimate (Scope of Work), Hydraulic Calculation Layout Sheet, and Hydraulic Calculations for the proposed project.

As there are no new customers, a customer list is not included in the plan submission booklet.

The estimated construction cost of this project is approximately $370,000. The Levee Road Water Association will own, operate and maintain the facilities shown. The project is being funded with Tobacco Settlement money.

Should you have any questions or need additional information, please contact me at your convenience.

Sincerely,

H. A. SPALDING ENGINEERS, Inc.

Hank A. Spaulding, P.E.
Project Manager

Enclosures

LEVEE ROAD WATER
P. O. Box 770
Mt. Sterling, KY 40353
(859) 498-6980

May 10, 2005

Ms. Donna Marlin, Branch Manager
Drinking Water Branch
Kentucky Division of Water
14 Reilly Road
Frankfort, KY 40601

Re: Camp McKee Water Improvements Project
Montgomery County, KY

Dear Ms. Marlin:

The Levee Road Water Association has reviewed the Plans and Specifications for the referenced project. The Levee Road Water Association will own, operate and maintain the water facilities as detailed.

The Levee Road Water Association is funding this water improvements project with monies made available through the Tobacco Settlement Program. The estimated construction cost of the project is approximately $370,000.

Should you have any questions or need additional information, please call at your convenience.

Sincerely,

LEVEE ROAD WATER ASSOCIATION

Jimmy Linkous

Jimmy Linkous, President

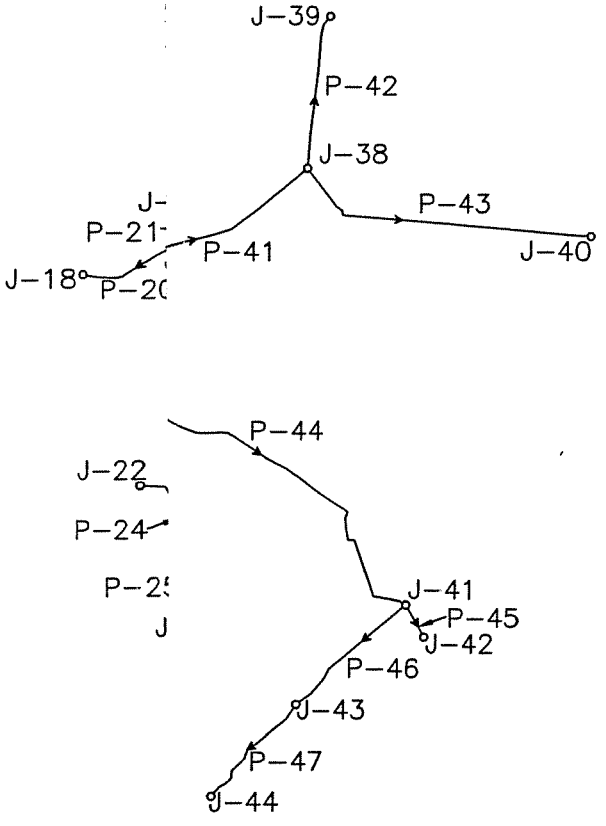
Enclosures

CAMP MCKEE WATE' MPROVEMENTS PROJECT
LEVEE ROAD WATER ASSOCIATION
FINAL COST ESTIMATE

05/05/2005

ITEM NO.	ITEM	UNIT		COST	TOTAL QUANTITY		TOTAL COST
1	6" PVC	L.F.	$	9.00	8120	$	73,080.00
2	8" P.E.	L.F.	$	14.00	100	$	1,400.00
3	3" PVC	L.F.	$	7.00	10	$	70.00
4	3/4" Service Tubing	L.F.	$	6.00	80	$	480.00
5	6" Valve & Box	Ea.	$	700.00	2	$	1,400.00
6	3" Valve & Box	Ea.	$	550.00	1	$	550.00
7	12" Open Cut Liner Pipe	L.F.	$	40.00	30	$	1,200.00
8	Type II Blow Off	Ea.	$	1,150.00	1	$	1,150.00
9	ARV	Ea.	$	350.00	2	$	700.00
10	Small River Test Station	Ea.	$	375.00	2	$	750.00
11	Tie #1	L.S.	$	3,000.00	1	$	3,000.00
12	Class II Stone	Ton	$	22.00	170	$	3,740.00
13	Class III Stone	Ton	$	23.00	45	$	1,035.00
14	Crushed Stone	Ton	$	19.00	900	$	17,100.00
15	General Conc.	CYD	$	130.00	15	$	1,950.00
16	Clear & Grub/New Road	L.F.	$	5.00	3020	$	15,100.00
17	Telemetry	L.S.	$	60,000.00	1	$	60,000.00
18	122K Storage Tank	L.S.	$	145,000.00	1	$	145,000.00
19	Tank Site Work	L.S.	$	30,000.00	1	$	30,000.00
20	PRV to Elec. Vlv.	L.S.	$	12,000.00	1	$	12,000.00
	SUBTOTAL FOR CONSTRUCTION					$	369,705.00
	ENGINEERING DESIGN					$	40,175.00
	ENGINEERING INSPECTION					$	30,470.00
	GEO-TECHNICAL INVESTIGATION					$	10,000.00
	LANDS & R/W					$	5,000.00
	CONTINGENCY					$	5,950.00
	TOTAL ESTIMATED PROJECT COST					$	**461,300.00**

NOTES:
1) SOME PORTIONS OF EXISTING LINES WHE
"RECORD" PLANS ARE NOT AVAIL. USED US
MAPS FOR LINE ELEV. AND LAYOUT DATA.



HYDRAULIC ANAL

SCALE: 1" =

H. A. SPALDING ENGINEERS, INC.
"La Citadelle"
651 Skyline Drive
Hazard, Kentucky 41701-1664

COUNTY OF: MONTGOMERY
FISCAL YEAR: 2005

CAMP McKEE WATER IMPROVEMENTS PROJECT
LEVEE ROAD WATER ASSOCIATION, MONTGOMERY CO., KENTUCKY

SCALE: 1" = 2,600'
DATE: 4/07/2005
DRAWN BY: L.Y.
APPROVED BY: H.A.S.
FILE NAME:
SHEET NO.: 1
OF TOTAL SHEETS: 1

SEAL
SIGNATURE

LEVEE ROAD WATER ASSOCIATION
CAMP MCKEE WATER IMPROVEMENTS PROJECT
HYDRAULIC ANALYSIS NARRATIVE

Background:

This project involves only the construction of approximately 7,900 feet of 6" PVC and a new 122,000 gallon ground water storage tank. For the hydraulic analysis, all known existing water distribution lines and appurtenances downstream of the existing tank, and the new line and tank, were included in the hydraulic analysis.

New System Operation:

The new water system will operate by gravity from the existing elevated storage tank to the new, slightly lower, ground water storage tank. Approximately mid-way between the two tanks, a new control valve will be installed. This valve will be telemetry controlled to open when the new tank reaches a determined low level. When the new tank reaches an appropriate full elevation, this control valve will be directed by telemetry to close. This fill and draw cycle will be endlessly repeated.

Flushing Analysis:

Flushing analysis was completed only at the end of the new proposed line, and at the worst case junction in the existing system. Flushing analysis used a velocity of 2.5 feet per second in the appropriate pipe.

Maximum and Residual (During Flushing) Demands:

Maximum and residual demands were calculated as given on the following page.

LEVEE ROAD WATER ASSOCIATION
CAMP MCKEE WATER IMPROVMENTS PROJECT
CALCULATION OF MAX. PER CUSTOMER DEMAND

JUNCTION #	# OF RESIDENTIAL. CUSTOMERS @ JUNCTION
J- 1	0
J- 2	5
J- 3	10
J- 4	11
J- 5	5
J- 6	3
J- 7	9
J- 8	5
J- 9	16
J- 10	2
J- 11	18
J- 12	27
J- 13	18
J- 14	5
J- 15	8
J- 16	4
J- 17	2
J- 18	3
J- 19	2
J- 20	12
J- 21	2
J- 22	5
J- 23	4
J- 24	2
J- 25	2
J- 26	4
J- 27	2
J- 28	7
J- 29	5
J- 30	7
J- 31	5
J- 32	3
J- 33	12
J- 34	4
SUBTOTAL	229

JUNCTION #	# OF RESIDENTIAL. CUSTOMERS @ JUNCTION
J- 35	5
J- 36	5
J- 37	7
J- 38	6
J- 39	3
J- 40	4
J- 41	6
J- 42	2
J- 43	5
J- 44	3
J- 45	9
J- 46	2
J- 47	3
J- 48	3
J- 49	4
J- 50	1
J- 51	0
J- 52	3
J- 53	6
J- 54	9
J- 55	3
J- 56	6
J- 57	2
SUBTOTAL	97
TOTAL	326

MAX.SYSTEM DEMAND = 10x(# OF CUST.)^.5= 180.55 gpm
MAX. PER CUSTOMER DEMAND = (SYSTEM MAX. DEMAND)/(# TOTAL CUSTOMERS) = 0.55 gpm

RESIDUAL RESID. DEMAND (DURING FLUSHING) USED IS 20% OF MAX. = 0.11 gpm PER CUSTOMER

Scenario: TANK 1 EMPTY, CONTROL VALVE OPEN, TANK 2 FULL, NO DEMAND (MIN. FLOW)
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	896.00	Zone-1	Demand	0.00	ZERO DEMAND	0.00	1,101.99	89.12
J-2	869.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,101.29	100.50
J-3	826.00	Zone-1	Demand	10.00	ZERO DEMAND	0.00	1,100.62	118.81
J-4	796.00	Zone-1	Demand	11.00	ZERO DEMAND	0.00	1,099.78	131.43
J-5	796.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,098.72	130.97
J-6	796.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,098.18	130.74
J-7	800.00	Zone-1	Demand	9.00	ZERO DEMAND	0.00	1,097.25	128.60
J-8	802.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,096.90	127.59
J-9	808.00	Zone-1	Demand	16.00	ZERO DEMAND	0.00	1,095.49	124.38
J-10	802.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,095.06	126.79
J-11	818.00	Zone-1	Demand	18.00	ZERO DEMAND	0.00	1,093.27	119.09
J-12	826.00	Zone-1	Demand	27.00	ZERO DEMAND	0.00	1,091.25	114.76
J-13	863.00	Zone-1	Demand	18.00	ZERO DEMAND	0.00	1,089.78	98.12
J-14	860.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,086.47	97.98
J-15	840.00	Zone-1	Demand	8.00	ZERO DEMAND	0.00	1,098.08	111.66
J-16	819.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,097.68	120.57
J-17	800.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,097.68	128.79
J-18	780.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,097.68	137.45
J-19	800.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,097.68	128.79
J-20	795.00	Zone-1	Demand	12.00	ZERO DEMAND	0.00	1,097.42	130.84
J-21	876.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,097.14	95.68
J-22	860.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,097.14	102.60
J-23	855.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,096.98	104.69
J-24	860.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,096.98	102.53
J-25	865.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,096.77	100.28
J-26	920.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,096.23	76.25
J-27	900.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,096.23	84.90
J-28	860.00	Zone-1	Demand	7.00	ZERO DEMAND	0.00	1,095.85	102.04
J-29	850.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,097.93	107.27
J-30	903.00	Zone-1	Demand	7.00	ZERO DEMAND	0.00	1,097.21	84.03
J-31	934.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,097.21	70.61
J-32	803.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,095.06	126.36
J-33	838.00	Zone-1	Demand	12.00	ZERO DEMAND	0.00	1,095.06	111.22
J-34	870.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,095.06	97.37
J-35	842.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,095.06	109.49
J-36	901.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,096.07	84.40
J-37	909.00	Zone-1	Demand	7.00	ZERO DEMAND	0.00	1,095.23	80.57
J-38	851.00	Zone-1	Demand	6.00	ZERO DEMAND	0.00	1,095.23	105.67
J-39	876.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,095.23	94.85
J-40	820.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,095.23	119.08
J-41	890.00	Zone-1	Demand	6.00	ZERO DEMAND	0.00	1,095.23	88.79
J-42	860.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,095.23	101.77
J-43	900.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,095.23	84.47

Scenario: TANK 1 EMPTY, CONTROL VALVE OPEN, TANK 2 FULL, NO DEMAND (MIN. FLOW)
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-44	900.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,095.23	84.47
J-45	920.00	Zone-1	Demand	9.00	ZERO DEMAND	0.00	1,093.78	75.18
J-46	955.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,093.78	60.04
J-47	910.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,093.27	79.29
J-48	858.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,092.37	101.40
J-49	890.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,092.37	87.56
J-50	861.00	Zone-1	Demand	1.00	ZERO DEMAND	0.00	1,091.90	99.90
J-51	878.00	Zone-1	Demand	0.00	ZERO DEMAND	0.00	1,091.90	92.55
J-52	900.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,091.90	83.03
J-53	890.00	Zone-1	Demand	6.00	ZERO DEMAND	0.00	1,091.90	87.35
J-54	868.00	Zone-1	Demand	9.00	ZERO DEMAND	0.00	1,090.31	96.18
J-55	850.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,090.31	103.97
J-56	890.00	Zone-1	Demand	6.00	ZERO DEMAND	0.00	1,090.31	86.66
J-57	900.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,091.03	82.65

Scenario: TANK 1 EMPTY, CONTROL VALVE OPEN, TANK 2 FULL, NO DEMAND (MIN. FLOW)
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	2,156.00	8.0	PVC	120.0	false	9.90	Open	92.64	1,102.60	1,101.99	0.61	0.28
P-2	2,650.00	8.0	PVC	120.0	false	3.00	Open	92.64	1,101.99	1,101.29	0.70	0.26
P-3	2,574.00	8.0	PVC	120.0	false	1.50	Open	92.64	1,101.29	1,100.62	0.67	0.26
P-4	3,174.00	8.0	PVC	120.0	false	2.00	Open	92.64	1,100.62	1,099.78	0.83	0.26
P-7	691.00	6.0	PVC	120.0	false	1.80	Open	77.31	1,098.72	1,098.18	0.54	0.78
P-8	1,579.00	6.0	PVC	120.0	false	1.20	Open	67.53	1,098.18	1,097.25	0.93	0.59
P-9	588.00	6.0	PVC	120.0	false	0.30	Open	67.53	1,097.25	1,096.90	0.35	0.59
P-10	2,399.00	6.0	PVC	120.0	false	1.20	Open	67.53	1,096.90	1,095.49	1.41	0.59
P-11	538.00	6.0	PVC	120.0	false	2.10	Open	77.31	1,095.49	1,095.06	0.43	0.80
P-12	2,326.00	6.0	PVC	120.0	false	3.90	Open	77.31	1,095.06	1,093.27	1.79	0.77
P-13	2,615.00	6.0	PVC	120.0	false	4.50	Open	77.31	1,093.27	1,091.25	2.02	0.77
P-14	1,902.00	6.0	PVC	120.0	false	3.60	Open	77.31	1,091.25	1,089.78	1.47	0.77
P-15	3,105.00	6.0	PVC	120.0	false	3.00	Open	92.64	1,089.78	1,086.47	3.31	1.07
P-16	4,769.00	6.0	PVC	120.0	false	18.90	Open	92.64	1,086.47	1,081.14	5.33	1.12
P-6	50.00	4.0	PVC	120.0	false	3.70	Open	92.64	1,099.42	1,098.72	0.70	13.99
P-5	292.00	6.0	PVC	120.0	false	3.30	Open	92.64	1,099.78	1,099.42	0.36	1.24
P-17	6,154.00	6.0	PVC	120.0	false	4.00	Open	9.78	1,098.18	1,098.08	0.10	0.02
P-18	3,355.00	4.0	PVC	120.0	false	2.90	Open	9.78	1,098.08	1,097.68	0.40	0.12
P-19	808.00	4.0	PVC	120.0	false	0.80	Open	2.04e-3	1,097.68	1,097.68	0.00	0.00
P-20	1,617.00	4.0	PVC	120.0	false	1.20	Open	0.00	1,097.68	1,097.68	0.00	0.00
P-21	265.00	3.0	PVC	120.0	false	1.80	Open	0.00	1,097.68	1,097.68	0.00	0.00
P-22	2,193.00	4.0	PVC	120.0	false	1.90	Open	9.78	1,097.68	1,097.42	0.26	0.12
P-23	2,376.00	4.0	PVC	120.0	false	2.60	Open	9.78	1,097.42	1,097.14	0.28	0.12
P-24	1,240.00	3.0	PVC	120.0	false	2.80	Open	1.02e-3	1,097.14	1,097.14	0.00	0.00
P-25	1,326.00	4.0	PVC	120.0	false	1.80	Open	9.78	1,097.14	1,096.98	0.16	0.12
P-26	1,620.00	1.0	PVC	150.0	false	1.80	Open	0.00	1,096.98	1,096.98	0.00	0.00
P-27	1,765.00	4.0	PVC	120.0	false	4.00	Open	9.78	1,096.98	1,096.77	0.21	0.12
P-28	4,540.00	4.0	PVC	120.0	false	5.60	Open	9.78	1,096.77	1,096.23	0.54	0.12
P-29	2,255.00	3.0	PVC	120.0	false	4.20	Open	0.00	1,096.23	1,096.23	0.00	0.00
P-30	3,204.00	4.0	PVC	120.0	false	4.30	Open	9.78	1,096.23	1,095.85	0.38	0.12
P-31	3,055.00	4.0	PVC	120.0	false	4.50	Open	9.78	1,095.85	1,095.49	0.36	0.12
P-32	2,870.00	4.0	PVC	120.0	false	5.00	Open	15.33	1,098.72	1,097.93	0.79	0.27
P-33	2,652.00	4.0	PVC	120.0	false	1.90	Open	15.33	1,097.93	1,097.21	0.72	0.27
P-34	3,229.00	3.0	PVC	120.0	false	4.00	Open	0.00	1,097.21	1,097.21	0.00	0.00
P-35	706.00	3.0	PVC	120.0	false	1.80	Open	0.00	1,095.06	1,095.06	0.00	0.00
P-36	3,120.00	4.0	PVC	120.0	false	4.20	Open	0.00	1,095.06	1,095.06	0.00	0.00
P-37	360.00	3.0	PVC	120.0	false	2.10	Open	0.00	1,095.06	1,095.06	0.00	0.00
P-38	785.00	3.0	PVC	120.0	false	2.60	Open	0.00	1,095.06	1,095.06	0.00	0.00
P-39	4,210.00	4.0	PVC	120.0	false	0.60	Open	15.33	1,097.21	1,096.07	1.14	0.27
P-40	3,073.00	4.0	PVC	120.0	false	3.50	Open	15.33	1,096.07	1,095.23	0.84	0.27
P-41	3,870.00	4.0	PVC	120.0	false	4.00	Open	0.00	1,095.23	1,095.23	0.00	0.00
P-42	2,074.00	4.0	PVC	120.0	false	1.80	Open	0.00	1,095.23	1,095.23	0.00	0.00

Scenario: TANK 1 EMPTY, CONTROL VALVE OPEN, TANK 2 FULL, NO DEMAND (MIN. FLOW)
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-43	4,130.00	4.0	PVC	120.0	false	3.00	Open	0.00	1,095.23	1,095.23	0.00	0.00
P-44	6,181.00	4.0	PVC	120.0	false	6.00	Open	0.00	1,095.23	1,095.23	0.00	0.00
P-45	493.00	3.0	PVC	120.0	false	2.70	Open	0.00	1,095.23	1,095.23	0.00	0.00
P-46	2,002.00	4.0	PVC	120.0	false	4.00	Open	0.00	1,095.23	1,095.23	0.00	0.00
P-47	1,701.00	4.0	PVC	120.0	false	5.00	Open	0.00	1,095.23	1,095.23	0.00	0.00
P-48	5,362.00	4.0	PVC	120.0	false	3.00	Open	15.33	1,095.23	1,093.78	1.46	0.27
P-49	1,426.00	3.0	PVC	120.0	false	2.70	Open	1.02e-3	1,093.78	1,093.78	0.00	0.00
P-50	1,848.00	4.0	PVC	120.0	false	3.00	Open	15.33	1,093.78	1,093.27	0.51	0.27
P-51	3,258.00	4.0	PVC	120.0	false	6.00	Open	15.33	1,093.27	1,092.37	0.90	0.27
P-52	1,989.00	3.0	PVC	120.0	false	3.00	Open	0.00	1,092.37	1,092.37	0.00	0.00
P-53	1,714.00	4.0	PVC	120.0	false	4.00	Open	15.33	1,092.37	1,091.90	0.47	0.28
P-54	1,415.00	4.0	PVC	120.0	false	3.00	Open	0.00	1,091.90	1,091.90	0.00	0.00
P-55	400.00	3.0	PVC	120.0	false	2.90	Open	0.00	1,091.90	1,091.90	0.00	0.00
P-56	1,906.00	3.0	PVC	120.0	false	3.00	Open	0.00	1,091.90	1,091.90	0.00	0.00
P-57	1,943.00	4.0	PVC	120.0	false	2.00	Open	-15.33	1,089.78	1,090.31	0.53	0.27
P-58	1,055.00	3.0	PVC	120.0	false	2.70	Open	0.00	1,090.31	1,090.31	0.00	0.00
P-59	1,919.00	3.0	PVC	120.0	false	2.50	Open	0.00	1,090.31	1,090.31	0.00	0.00
P-60	2,663.00	4.0	PVC	120.0	false	2.00	Open	-15.33	1,090.31	1,091.03	0.72	0.27
P-61	3,179.00	4.0	PVC	120.0	false	4.20	Open	-15.33	1,091.03	1,091.90	0.87	0.27

Scenario: TANK 1 EMPTY, CONTROL VALVE OPEN, TANK 2 FULL, NO DEMAND (MIN. FLOW)
Extended Period Analysis: 1.00 hr / 2.00
Tank Report

Label	Zone	Base Elevation (ft)	Minimum Elevation (ft)	Initial HGL (ft)	Maximum Elevation (ft)	Inactive Volume (ft^3)	Tank Diameter (ft)	Inflow (gpm)	Current Status	Calculated Hydraulic Grade (ft)	Calculated Percent Full (%)
T-1	Zone-1	1,102.21	1,102.22	1,106.00	1,120.01	0.00	27.00	-92.64	Empty	1,102.60	2.2
T-2	Zone-1	1,050.00	1,051.00	1,082.50	1,083.00	0.00	25.00	92.64	Filling	1,081.14	94.2

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Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 FULL, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	896.00	Zone-1	Demand	0.00	MAX. DEMAND	0.00	1,100.51	88.48
J-2	869.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,098.12	99.13
J-3	826.00	Zone-1	Demand	10.00	MAX. DEMAND	5.50	1,095.89	116.77
J-4	796.00	Zone-1	Demand	11.00	MAX. DEMAND	6.05	1,093.30	128.63
J-5	796.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,090.10	127.24
J-6	796.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,088.75	126.66
J-7	800.00	Zone-1	Demand	9.00	MAX. DEMAND	4.95	1,086.97	124.16
J-8	802.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,086.38	123.04
J-9	808.00	Zone-1	Demand	16.00	MAX. DEMAND	8.80	1,084.08	119.45
J-10	802.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,083.66	121.86
J-11	818.00	Zone-1	Demand	18.00	MAX. DEMAND	9.90	1,082.48	114.43
J-12	826.00	Zone-1	Demand	27.00	MAX. DEMAND	14.85	1,081.52	110.55
J-13	863.00	Zone-1	Demand	18.00	MAX. DEMAND	9.90	1,081.14	94.38
J-14	860.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,081.14	95.67
J-15	840.00	Zone-1	Demand	8.00	MAX. DEMAND	4.40	1,087.97	107.28
J-16	819.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,085.69	115.38
J-17	800.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,085.67	123.60
J-18	780.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,085.66	132.25
J-19	800.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,085.67	123.59
J-20	795.00	Zone-1	Demand	12.00	MAX. DEMAND	6.60	1,084.79	125.38
J-21	876.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,084.35	90.14
J-22	860.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,084.29	97.04
J-23	855.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,084.22	99.17
J-24	860.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,082.33	96.19
J-25	865.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,084.16	94.82
J-26	920.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,084.04	70.97
J-27	900.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,084.02	79.62
J-28	860.00	Zone-1	Demand	7.00	MAX. DEMAND	3.85	1,084.04	96.93
J-29	850.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,086.35	102.26
J-30	903.00	Zone-1	Demand	7.00	MAX. DEMAND	3.85	1,083.38	78.04
J-31	934.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,083.24	64.57
J-32	803.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,083.06	121.17
J-33	838.00	Zone-1	Demand	12.00	MAX. DEMAND	6.60	1,082.56	105.81
J-34	870.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,082.55	91.96
J-35	842.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,082.52	104.06
J-36	901.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,080.30	77.57
J-37	909.00	Zone-1	Demand	7.00	MAX. DEMAND	3.85	1,078.45	73.31
J-38	851.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,078.19	98.29
J-39	876.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,078.18	87.47
J-40	820.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,078.16	111.69
J-41	890.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,077.84	81.27
J-42	860.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,077.84	94.25
J-43	900.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,077.79	76.92

Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 FULL, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-44	900.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,077.78	76.92
J-45	920.00	Zone-1	Demand	9.00	MAX. DEMAND	4.95	1,078.34	68.51
J-46	955.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,078.33	53.36
J-47	910.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,078.36	72.84
J-48	858.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,078.43	95.37
J-49	890.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,078.37	81.50
J-50	861.00	Zone-1	Demand	1.00	MAX. DEMAND	0.55	1,078.57	94.13
J-51	878.00	Zone-1	Demand	0.00	MAX. DEMAND	0.00	1,078.52	86.76
J-52	900.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,078.51	77.23
J-53	890.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,078.40	81.51
J-54	868.00	Zone-1	Demand	9.00	MAX. DEMAND	4.95	1,079.89	91.68
J-55	850.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,079.75	99.40
J-56	890.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,079.62	82.04
J-57	900.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,079.24	77.55

Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 FULL, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	2,156.00	8.0	PVC	120.0	false	9.90	Open	179.33	1,102.60	1,100.51	2.10	0.97
P-2	2,650.00	8.0	PVC	120.0	false	3.00	Open	179.33	1,100.51	1,098.12	2.39	0.90
P-3	2,574.00	8.0	PVC	120.0	false	1.50	Open	176.58	1,098.12	1,095.89	2.23	0.87
P-4	3,174.00	8.0	PVC	120.0	false	2.00	Open	171.08	1,095.89	1,093.30	2.59	0.82
P-7	691.00	6.0	PVC	120.0	false	1.80	Open	126.68	1,090.10	1,088.75	1.35	1.96
P-8	1,579.00	6.0	PVC	120.0	false	1.20	Open	95.52	1,088.75	1,086.97	1.78	1.12
P-9	588.00	6.0	PVC	120.0	false	0.30	Open	90.57	1,086.97	1,086.38	0.60	1.01
P-10	2,399.00	6.0	PVC	120.0	false	1.20	Open	87.82	1,086.38	1,084.08	2.30	0.96
P-11	538.00	6.0	PVC	120.0	false	2.10	Open	76.08	1,084.08	1,083.66	0.42	0.77
P-12	2,326.00	6.0	PVC	120.0	false	3.90	Open	61.78	1,083.66	1,082.48	1.18	0.51
P-13	2,615.00	6.0	PVC	120.0	false	4.50	Open	51.88	1,082.48	1,081.52	0.96	0.37
P-14	1,902.00	6.0	PVC	120.0	false	3.60	Open	37.03	1,081.52	1,081.14	0.38	0.20
P-15	3,105.00	6.0	PVC	120.0	false	3.00	Open	2.78	1,081.14	1,081.14	0.01	1.61e-3
P-16	4,769.00	6.0	PVC	120.0	false	18.90	Open	0.03	1,081.14	1,081.14	0.00	0.00
P-6	50.00	4.0	PVC	120.0	false	3.70	Open	165.03	1,092.23	1,090.10	2.12	42.44
P-5	292.00	6.0	PVC	120.0	false	3.30	Open	165.03	1,093.30	1,092.23	1.07	3.67
P-17	6,154.00	6.0	PVC	120.0	false	4.00	Open	29.51	1,088.75	1,087.97	0.78	0.13
P-18	3,355.00	4.0	PVC	120.0	false	2.90	Open	25.11	1,087.97	1,085.69	2.28	0.68
P-19	808.00	4.0	PVC	120.0	false	0.80	Open	3.85	1,085.69	1,085.67	0.02	0.02
P-20	1,617.00	4.0	PVC	120.0	false	1.20	Open	1.65	1,085.67	1,085.66	0.01	4.38e-3
P-21	265.00	3.0	PVC	120.0	false	1.80	Open	1.10	1,085.67	1,085.67	2.2e-3	0.01
P-22	2,193.00	4.0	PVC	120.0	false	1.90	Open	19.06	1,085.69	1,084.79	0.89	0.41
P-23	2,376.00	4.0	PVC	120.0	false	2.60	Open	12.46	1,084.79	1,084.35	0.44	0.19
P-24	1,240.00	3.0	PVC	120.0	false	2.80	Open	2.75	1,084.35	1,084.29	0.06	0.05
P-25	1,326.00	4.0	PVC	120.0	false	1.80	Open	8.61	1,084.35	1,084.22	0.12	0.09
P-26	1,620.00	1.0	PVC	150.0	false	1.80	Open	1.10	1,084.22	1,082.33	1.89	1.17
P-27	1,765.00	4.0	PVC	120.0	false	4.00	Open	5.31	1,084.22	1,084.16	0.07	0.04
P-28	4,540.00	4.0	PVC	120.0	false	5.60	Open	4.21	1,084.16	1,084.04	0.11	0.02
P-29	2,255.00	3.0	PVC	120.0	false	4.20	Open	1.10	1,084.04	1,084.02	0.02	0.01
P-30	3,204.00	4.0	PVC	120.0	false	4.30	Open	0.91	1,084.04	1,084.04	4.76e-3	1.49e-3
P-31	3,055.00	4.0	PVC	120.0	false	4.50	Open	-2.94	1,084.04	1,084.08	0.04	0.01
P-32	2,870.00	4.0	PVC	120.0	false	5.00	Open	35.60	1,090.10	1,086.35	3.76	1.31
P-33	2,652.00	4.0	PVC	120.0	false	1.90	Open	32.85	1,086.35	1,083.38	2.96	1.12
P-34	3,229.00	3.0	PVC	120.0	false	4.00	Open	2.75	1,083.38	1,083.24	0.15	0.05
P-35	706.00	3.0	PVC	120.0	false	1.80	Open	13.20	1,083.66	1,083.06	0.60	0.85
P-36	3,120.00	4.0	PVC	120.0	false	4.20	Open	11.55	1,083.06	1,082.56	0.51	0.16
P-37	360.00	3.0	PVC	120.0	false	2.10	Open	2.20	1,082.56	1,082.55	0.01	0.03
P-38	785.00	3.0	PVC	120.0	false	2.60	Open	2.75	1,082.56	1,082.52	0.04	0.05
P-39	4,210.00	4.0	PVC	120.0	false	0.60	Open	26.25	1,083.38	1,080.30	3.09	0.73
P-40	3,073.00	4.0	PVC	120.0	false	3.50	Open	23.50	1,080.30	1,078.45	1.85	0.60
P-41	3,870.00	4.0	PVC	120.0	false	4.00	Open	7.15	1,078.45	1,078.19	0.26	0.07
P-42	2,074.00	4.0	PVC	120.0	false	1.80	Open	1.65	1,078.19	1,078.18	0.01	4.41e-3

Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 FULL, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-43	4,130.00	4.0	PVC	120.0	false	3.00	Open	2.20	1,078.19	1,078.16	0.03	0.01
P-44	6,181.00	4.0	PVC	120.0	false	6.00	Open	8.80	1,078.45	1,077.84	0.60	0.10
P-45	493.00	3.0	PVC	120.0	false	2.70	Open	1.10	1,077.84	1,077.84	4.27e-3	0.01
P-46	2,002.00	4.0	PVC	120.0	false	4.00	Open	4.40	1,077.84	1,077.79	0.05	0.03
P-47	1,701.00	4.0	PVC	120.0	false	5.00	Open	1.65	1,077.79	1,077.78	0.01	4.45e-3
P-48	5,362.00	4.0	PVC	120.0	false	3.00	Open	3.70	1,078.45	1,078.34	0.10	0.02
P-49	1,426.00	3.0	PVC	120.0	false	2.70	Open	1.10	1,078.34	1,078.33	0.01	0.01
P-50	1,848.00	4.0	PVC	120.0	false	3.00	Open	-2.35	1,078.34	1,078.36	0.02	0.01
P-51	3,258.00	4.0	PVC	120.0	false	6.00	Open	-4.00	1,078.36	1,078.43	0.07	0.02
P-52	1,989.00	3.0	PVC	120.0	false	3.00	Open	2.20	1,078.43	1,078.37	0.06	0.03
P-53	1,714.00	4.0	PVC	120.0	false	4.00	Open	-7.85	1,078.43	1,078.57	0.14	0.08
P-54	1,415.00	4.0	PVC	120.0	false	3.00	Open	4.95	1,078.57	1,078.52	0.05	0.03
P-55	400.00	3.0	PVC	120.0	false	2.90	Open	1.65	1,078.52	1,078.51	0.01	0.02
P-56	1,906.00	3.0	PVC	120.0	false	3.00	Open	3.30	1,078.52	1,078.40	0.12	0.06
P-57	1,943.00	4.0	PVC	120.0	false	2.00	Open	24.35	1,081.14	1,079.89	1.25	0.64
P-58	1,055.00	3.0	PVC	120.0	false	2.70	Open	4.95	1,079.89	1,079.75	0.14	0.14
P-59	1,919.00	3.0	PVC	120.0	false	2.50	Open	3.30	1,079.75	1,079.62	0.12	0.06
P-60	2,663.00	4.0	PVC	120.0	false	2.00	Open	14.45	1,079.89	1,079.24	0.65	0.24
P-61	3,179.00	4.0	PVC	120.0	false	4.20	Open	13.35	1,079.24	1,078.57	0.67	0.21

Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 FULL, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Tank Report

Label	Zone	Base Elevation (ft)	Minimum Elevation (ft)	Initial HGL (ft)	Maximum Elevation (ft)	Inactive Volume (ft^3)	Tank Diameter (ft)	Inflow (gpm)	Current Status	Calculated Hydraulic Grade (ft)	Calculated Percent Full (%)
T-1	Zone-1	1,102.21	1,102.22	1,106.00	1,120.01	0.00	27.00	-179.33	Empty	1,102.60	2.2
T-2	Zone-1	1,050.00	1,051.00	1,082.50	1,083.00	0.00	25.00	0.03	Steady	1,081.14	94.2

Scenario: TANKS @ MID-RANGE, C.V. CLOSED, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	896.00	Zone-1	Demand	0.00	MAX. DEMAND	0.00	1,110.73	92.90
J-2	869.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,110.71	104.57
J-3	826.00	Zone-1	Demand	10.00	MAX. DEMAND	5.50	1,110.69	123.17
J-4	796.00	Zone-1	Demand	11.00	MAX. DEMAND	6.05	1,110.69	136.15
J-5	796.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,026.66	99.79
J-6	796.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,026.71	99.82
J-7	800.00	Zone-1	Demand	9.00	MAX. DEMAND	4.95	1,027.07	98.24
J-8	802.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,027.23	97.45
J-9	808.00	Zone-1	Demand	16.00	MAX. DEMAND	8.80	1,027.98	95.18
J-10	802.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,028.37	97.94
J-11	818.00	Zone-1	Demand	18.00	MAX. DEMAND	9.90	1,030.61	91.99
J-12	826.00	Zone-1	Demand	27.00	MAX. DEMAND	14.85	1,033.70	89.86
J-13	863.00	Zone-1	Demand	18.00	MAX. DEMAND	9.90	1,036.63	75.12
J-14	860.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,045.99	80.47
J-15	840.00	Zone-1	Demand	8.00	MAX. DEMAND	4.40	1,026.45	80.67
J-16	819.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,025.89	89.51
J-17	800.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,025.87	97.72
J-18	780.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,025.87	106.37
J-19	800.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,025.87	97.72
J-20	795.00	Zone-1	Demand	12.00	MAX. DEMAND	6.60	1,025.79	99.85
J-21	876.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,025.80	64.81
J-22	860.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,025.74	71.71
J-23	855.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,025.84	73.91
J-24	860.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,023.94	70.93
J-25	865.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,025.98	69.65
J-26	920.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,026.46	46.06
J-27	900.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,026.44	54.70
J-28	860.00	Zone-1	Demand	7.00	MAX. DEMAND	3.85	1,027.05	72.27
J-29	850.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,025.41	75.89
J-30	903.00	Zone-1	Demand	7.00	MAX. DEMAND	3.85	1,024.55	52.59
J-31	934.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,024.40	39.11
J-32	803.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,027.77	97.25
J-33	838.00	Zone-1	Demand	12.00	MAX. DEMAND	6.60	1,027.26	81.89
J-34	870.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,027.25	68.04
J-35	842.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,027.23	80.14
J-36	901.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,024.00	53.22
J-37	909.00	Zone-1	Demand	7.00	MAX. DEMAND	3.85	1,023.78	49.66
J-38	851.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,023.52	74.64
J-39	876.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,023.51	63.82
J-40	820.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,023.49	88.04
J-41	890.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,023.17	57.62
J-42	860.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,023.17	70.60
J-43	900.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,023.12	53.27

Scenario: TANKS @ MID-RANGE, C.V. CLOSED, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-44	900.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,023.11	53.26
J-45	920.00	Zone-1	Demand	9.00	MAX. DEMAND	4.95	1,024.74	45.32
J-46	955.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,024.73	30.17
J-47	910.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,025.44	49.95
J-48	858.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,026.90	73.08
J-49	890.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,026.84	59.21
J-50	861.00	Zone-1	Demand	1.00	MAX. DEMAND	0.55	1,027.97	72.24
J-51	878.00	Zone-1	Demand	0.00	MAX. DEMAND	0.00	1,027.93	64.87
J-52	900.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,027.92	55.34
J-53	890.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,027.80	59.62
J-54	868.00	Zone-1	Demand	9.00	MAX. DEMAND	4.95	1,033.45	71.58
J-55	850.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,033.30	79.31
J-56	890.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,033.18	61.95
J-57	900.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,030.87	56.62

Scenario: TANKS @ MID-RANGE, C.V. CLOSED, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	2,156.00	8.0	PVC	120.0	false	9.90	Open	14.30	1,110.75	1,110.73	0.02	0.01
P-2	2,650.00	8.0	PVC	120.0	false	3.00	Open	14.30	1,110.73	1,110.71	0.02	0.01
P-3	2,574.00	8.0	PVC	120.0	false	1.50	Open	11.55	1,110.71	1,110.69	0.01	0.01
P-4	3,174.00	8.0	PVC	120.0	false	2.00	Open	6.05	1,110.69	1,110.69	0.01	1.65e-3
P-7	691.00	6.0	PVC	120.0	false	1.80	Open	-22.39	1,026.66	1,026.71	0.05	0.08
P-8	1,579.00	6.0	PVC	120.0	false	1.20	Open	-40.23	1,026.71	1,027.07	0.36	0.23
P-9	588.00	6.0	PVC	120.0	false	0.30	Open	-45.18	1,027.07	1,027.23	0.16	0.28
P-10	2,399.00	6.0	PVC	120.0	false	1.20	Open	-47.93	1,027.23	1,027.98	0.75	0.31
P-11	538.00	6.0	PVC	120.0	false	2.10	Open	-72.99	1,027.98	1,028.37	0.39	0.72
P-12	2,326.00	6.0	PVC	120.0	false	3.90	Open	-87.29	1,028.37	1,030.61	2.25	0.97
P-13	2,615.00	6.0	PVC	120.0	false	4.50	Open	-97.19	1,030.61	1,033.70	3.09	1.18
P-14	1,902.00	6.0	PVC	120.0	false	3.60	Open	-112.04	1,033.70	1,036.63	2.93	1.54
P-15	3,105.00	6.0	PVC	120.0	false	3.00	Open	-162.25	1,036.63	1,045.99	9.36	3.01
P-16	4,769.00	6.0	PVC	120.0	false	18.90	Open	-165.00	1,045.99	1,061.60	15.61	3.27
P-6	50.00	4.0	PVC	120.0	false	3.70	Open	0.00	1,026.66	1,026.66	0.00	0.00
P-5	292.00	6.0	PVC	120.0	false	3.30	Open	0.00	1,110.69	1,110.69	0.00	0.00
P-17	6,154.00	6.0	PVC	120.0	false	4.00	Open	16.19	1,026.71	1,026.45	0.26	0.04
P-18	3,355.00	4.0	PVC	120.0	false	2.90	Open	11.79	1,026.45	1,025.89	0.56	0.17
P-19	808.00	4.0	PVC	120.0	false	0.80	Open	3.85	1,025.89	1,025.87	0.02	0.02
P-20	1,617.00	4.0	PVC	120.0	false	1.20	Open	1.65	1,025.87	1,025.87	0.01	4.38e-3
P-21	265.00	3.0	PVC	120.0	false	1.80	Open	1.10	1,025.87	1,025.87	2.2e-3	0.01
P-22	2,193.00	4.0	PVC	120.0	false	1.90	Open	5.74	1,025.89	1,025.79	0.10	0.04
P-23	2,376.00	4.0	PVC	120.0	false	2.60	Open	-0.86	1,025.79	1,025.80	3.17e-3	1.34e-3
P-24	1,240.00	3.0	PVC	120.0	false	2.80	Open	2.75	1,025.80	1,025.74	0.06	0.05
P-25	1,326.00	4.0	PVC	120.0	false	1.80	Open	-4.71	1,025.80	1,025.84	0.04	0.03
P-26	1,620.00	1.0	PVC	150.0	false	1.80	Open	1.10	1,025.84	1,023.94	1.89	1.17
P-27	1,765.00	4.0	PVC	120.0	false	4.00	Open	-8.01	1,025.84	1,025.98	0.15	0.08
P-28	4,540.00	4.0	PVC	120.0	false	5.60	Open	-9.11	1,025.98	1,026.46	0.47	0.10
P-29	2,255.00	3.0	PVC	120.0	false	4.20	Open	1.10	1,026.46	1,026.44	0.02	0.01
P-30	3,204.00	4.0	PVC	120.0	false	4.30	Open	-12.41	1,026.46	1,027.05	0.59	0.18
P-31	3,055.00	4.0	PVC	120.0	false	4.50	Open	-16.26	1,027.05	1,027.98	0.93	0.31
P-32	2,870.00	4.0	PVC	120.0	false	5.00	Open	19.64	1,026.66	1,025.41	1.25	0.43
P-33	2,652.00	4.0	PVC	120.0	false	1.90	Open	16.89	1,025.41	1,024.55	0.86	0.33
P-34	3,229.00	3.0	PVC	120.0	false	4.00	Open	2.75	1,024.55	1,024.40	0.15	0.05
P-35	706.00	3.0	PVC	120.0	false	1.80	Open	13.20	1,028.37	1,027.77	0.60	0.85
P-36	3,120.00	4.0	PVC	120.0	false	4.20	Open	11.55	1,027.77	1,027.26	0.51	0.16
P-37	360.00	3.0	PVC	120.0	false	2.10	Open	2.20	1,027.26	1,027.25	0.01	0.03
P-38	785.00	3.0	PVC	120.0	false	2.60	Open	2.75	1,027.26	1,027.23	0.04	0.05
P-39	4,210.00	4.0	PVC	120.0	false	0.60	Open	10.29	1,024.55	1,024.00	0.54	0.13
P-40	3,073.00	4.0	PVC	120.0	false	3.50	Open	7.54	1,024.00	1,023.78	0.23	0.07
P-41	3,870.00	4.0	PVC	120.0	false	4.00	Open	7.15	1,023.78	1,023.52	0.26	0.07
P-42	2,074.00	4.0	PVC	120.0	false	1.80	Open	1.65	1,023.52	1,023.51	0.01	4.38e-3

Scenario: TANKS @ MID-RANGE, C.V. CLOSED, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-43	4,130.00	4.0	PVC	120.0	false	3.00	Open	2.20	1,023.52	1,023.49	0.03	0.01
P-44	6,181.00	4.0	PVC	120.0	false	6.00	Open	8.80	1,023.78	1,023.17	0.60	0.10
P-45	493.00	3.0	PVC	120.0	false	2.70	Open	1.10	1,023.17	1,023.17	4.21e-3	0.01
P-46	2,002.00	4.0	PVC	120.0	false	4.00	Open	4.40	1,023.17	1,023.12	0.05	0.03
P-47	1,701.00	4.0	PVC	120.0	false	5.00	Open	1.65	1,023.12	1,023.11	0.01	4.41e-3
P-48	5,362.00	4.0	PVC	120.0	false	3.00	Open	-12.26	1,023.78	1,024.74	0.96	0.18
P-49	1,426.00	3.0	PVC	120.0	false	2.70	Open	1.10	1,024.74	1,024.73	0.01	0.01
P-50	1,848.00	4.0	PVC	120.0	false	3.00	Open	-18.31	1,024.74	1,025.44	0.70	0.38
P-51	3,258.00	4.0	PVC	120.0	false	6.00	Open	-19.96	1,025.44	1,026.90	1.46	0.45
P-52	1,989.00	3.0	PVC	120.0	false	3.00	Open	2.20	1,026.90	1,026.84	0.06	0.03
P-53	1,714.00	4.0	PVC	120.0	false	4.00	Open	-23.81	1,026.90	1,027.97	1.07	0.62
P-54	1,415.00	4.0	PVC	120.0	false	3.00	Open	4.95	1,027.97	1,027.93	0.05	0.03
P-55	400.00	3.0	PVC	120.0	false	2.90	Open	1.65	1,027.93	1,027.92	0.01	0.02
P-56	1,906.00	3.0	PVC	120.0	false	3.00	Open	3.30	1,027.93	1,027.80	0.12	0.06
P-57	1,943.00	4.0	PVC	120.0	false	2.00	Open	40.31	1,036.63	1,033.45	3.18	1.64
P-58	1,055.00	3.0	PVC	120.0	false	2.70	Open	4.95	1,033.45	1,033.30	0.14	0.14
P-59	1,919.00	3.0	PVC	120.0	false	2.50	Open	3.30	1,033.30	1,033.18	0.12	0.06
P-60	2,663.00	4.0	PVC	120.0	false	2.00	Open	30.41	1,033.45	1,030.87	2.58	0.97
P-61	3,179.00	4.0	PVC	120.0	false	4.20	Open	29.31	1,030.87	1,027.97	2.89	0.91

Scenario: TANKS @ MID-RANGE, C.V. CLOSED, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Tank Report

Label	Zone	Base Elevation (ft)	Minimum Elevation (ft)	Initial HGL (ft)	Maximum Elevation (ft)	Inactive Volume (ft^3)	Tank Diameter (ft)	Inflow (gpm)	Current Status	Calculated Hydraulic Grade (ft)	Calculated Percent Full (%)
T-1	Zone-1	1,102.21	1,102.22	1,111.11	1,120.01	0.00	27.00	-14.30	Draining	1,110.75	47.9
T-2	Zone-1	1,050.00	1,051.00	1,066.50	1,083.00	0.00	25.00	-165.00	Draining	1,061.60	33.1

Scenario: TANKS @ MID-RANGE, C.V. CLOSED, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Valve Report

Label	Elevation (ft)	Diameter (in)	Minor Loss Coefficient	Control Status	Discharge (gpm)	From HGL (ft)	To HGL (ft)	Headloss (ft)
TCV-1	796.00	4.0	10.00	Closed	0.00	1,110.69	1,026.66	0.00

Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 EMPTY, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	896.00	Zone-1	Demand	0.00	MAX. DEMAND	0.00	1,100.95	88.67
J-2	869.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,096.66	98.50
J-3	826.00	Zone-1	Demand	10.00	MAX. DEMAND	5.50	1,092.63	115.36
J-4	796.00	Zone-1	Demand	11.00	MAX. DEMAND	6.05	1,087.87	126.28
J-5	796.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,081.78	123.64
J-6	796.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,079.14	122.50
J-7	800.00	Zone-1	Demand	9.00	MAX. DEMAND	4.95	1,075.44	119.17
J-8	802.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,074.16	117.75
J-9	808.00	Zone-1	Demand	16.00	MAX. DEMAND	8.80	1,069.11	112.97
J-10	802.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,067.97	115.07
J-11	818.00	Zone-1	Demand	18.00	MAX. DEMAND	9.90	1,064.14	106.49
J-12	826.00	Zone-1	Demand	27.00	MAX. DEMAND	14.85	1,060.48	101.45
J-13	863.00	Zone-1	Demand	18.00	MAX. DEMAND	9.90	1,058.47	84.57
J-14	860.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,056.54	85.03
J-15	840.00	Zone-1	Demand	8.00	MAX. DEMAND	4.40	1,077.91	102.93
J-16	819.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,074.06	110.35
J-17	800.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,074.05	118.57
J-18	780.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,074.04	127.22
J-19	800.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,074.05	118.57
J-20	795.00	Zone-1	Demand	12.00	MAX. DEMAND	6.60	1,072.33	119.99
J-21	876.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,071.21	84.46
J-22	860.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,071.15	91.35
J-23	855.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,070.78	93.36
J-24	860.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,068.88	90.37
J-25	865.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,070.39	88.86
J-26	920.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,069.56	64.71
J-27	900.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,069.54	73.35
J-28	860.00	Zone-1	Demand	7.00	MAX. DEMAND	3.85	1,069.22	90.52
J-29	850.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,075.38	97.51
J-30	903.00	Zone-1	Demand	7.00	MAX. DEMAND	3.85	1,070.14	72.32
J-31	934.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,070.00	58.84
J-32	803.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,067.37	114.38
J-33	838.00	Zone-1	Demand	12.00	MAX. DEMAND	6.60	1,066.87	99.02
J-34	870.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,066.86	85.17
J-35	842.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,066.83	97.27
J-36	901.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,064.00	70.52
J-37	909.00	Zone-1	Demand	7.00	MAX. DEMAND	3.85	1,060.06	65.36
J-38	851.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,059.80	90.34
J-39	876.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,059.79	79.52
J-40	820.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,059.77	103.74
J-41	890.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,059.45	73.31
J-42	860.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,059.45	86.29
J-43	900.00	Zone-1	Demand	5.00	MAX. DEMAND	2.75	1,059.40	68.96

Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 EMPTY, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-44	900.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,059.39	68.96
J-45	920.00	Zone-1	Demand	9.00	MAX. DEMAND	4.95	1,058.57	59.95
J-46	955.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,058.55	44.80
J-47	910.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,058.36	64.19
J-48	858.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,058.10	86.57
J-49	890.00	Zone-1	Demand	4.00	MAX. DEMAND	2.20	1,058.04	72.70
J-50	861.00	Zone-1	Demand	1.00	MAX. DEMAND	0.55	1,058.06	85.26
J-51	878.00	Zone-1	Demand	0.00	MAX. DEMAND	0.00	1,058.01	77.88
J-52	900.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,058.01	68.36
J-53	890.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,057.89	72.64
J-54	868.00	Zone-1	Demand	9.00	MAX. DEMAND	4.95	1,058.10	82.25
J-55	850.00	Zone-1	Demand	3.00	MAX. DEMAND	1.65	1,057.96	89.97
J-56	890.00	Zone-1	Demand	6.00	MAX. DEMAND	3.30	1,057.83	72.61
J-57	900.00	Zone-1	Demand	2.00	MAX. DEMAND	1.10	1,058.07	68.39

Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 EMPTY, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	2,156.00	8.0	PVC	120.0	false	9.90	Open	245.75	1,104.72	1,100.95	3.77	1.75
P-2	2,650.00	8.0	PVC	120.0	false	3.00	Open	245.75	1,100.95	1,096.66	4.29	1.62
P-3	2,574.00	8.0	PVC	120.0	false	1.50	Open	243.00	1,096.66	1,092.63	4.03	1.56
P-4	3,174.00	8.0	PVC	120.0	false	2.00	Open	237.50	1,092.63	1,087.87	4.76	1.50
P-7	691.00	6.0	PVC	120.0	false	1.80	Open	181.27	1,081.78	1,079.14	2.63	3.81
P-8	1,579.00	6.0	PVC	120.0	false	1.20	Open	141.93	1,079.14	1,075.44	3.70	2.34
P-9	588.00	6.0	PVC	120.0	false	0.30	Open	136.98	1,075.44	1,074.16	1.29	2.19
P-10	2,399.00	6.0	PVC	120.0	false	1.20	Open	134.23	1,074.16	1,069.11	5.05	2.10
P-11	538.00	6.0	PVC	120.0	false	2.10	Open	130.67	1,069.11	1,067.97	1.14	2.12
P-12	2,326.00	6.0	PVC	120.0	false	3.90	Open	116.37	1,067.97	1,064.14	3.83	1.65
P-13	2,615.00	6.0	PVC	120.0	false	4.50	Open	106.47	1,064.14	1,060.48	3.65	1.40
P-14	1,902.00	6.0	PVC	120.0	false	3.60	Open	91.62	1,060.48	1,058.47	2.02	1.06
P-15	3,105.00	6.0	PVC	120.0	false	3.00	Open	69.20	1,058.47	1,056.54	1.93	0.62
P-16	4,769.00	6.0	PVC	120.0	false	18.90	Open	66.45	1,056.54	1,053.67	2.87	0.60
P-6	50.00	4.0	PVC	120.0	false	3.70	Open	231.45	1,085.84	1,081.78	4.07	81.35
P-5	292.00	6.0	PVC	120.0	false	3.30	Open	231.45	1,087.87	1,085.84	2.02	6.93
P-17	6,154.00	6.0	PVC	120.0	false	4.00	Open	37.69	1,079.14	1,077.91	1.23	0.20
P-18	3,355.00	4.0	PVC	120.0	false	2.90	Open	33.29	1,077.91	1,074.06	3.85	1.15
P-19	808.00	4.0	PVC	120.0	false	0.80	Open	3.85	1,074.06	1,074.05	0.02	0.02
P-20	1,617.00	4.0	PVC	120.0	false	1.20	Open	1.65	1,074.05	1,074.04	0.01	4.38e-3
P-21	265.00	3.0	PVC	120.0	false	1.80	Open	1.10	1,074.05	1,074.05	2.2e-3	0.01
P-22	2,193.00	4.0	PVC	120.0	false	1.90	Open	27.24	1,074.06	1,072.33	1.73	0.79
P-23	2,376.00	4.0	PVC	120.0	false	2.60	Open	20.64	1,072.33	1,071.21	1.13	0.47
P-24	1,240.00	3.0	PVC	120.0	false	2.80	Open	2.75	1,071.21	1,071.15	0.06	0.05
P-25	1,326.00	4.0	PVC	120.0	false	1.80	Open	16.79	1,071.21	1,070.78	0.43	0.32
P-26	1,620.00	1.0	PVC	150.0	false	1.80	Open	1.10	1,070.78	1,068.88	1.89	1.17
P-27	1,765.00	4.0	PVC	120.0	false	4.00	Open	13.49	1,070.78	1,070.39	0.38	0.22
P-28	4,540.00	4.0	PVC	120.0	false	5.60	Open	12.39	1,070.39	1,069.56	0.84	0.18
P-29	2,255.00	3.0	PVC	120.0	false	4.20	Open	1.10	1,069.56	1,069.54	0.02	0.01
P-30	3,204.00	4.0	PVC	120.0	false	4.30	Open	9.09	1,069.56	1,069.22	0.33	0.10
P-31	3,055.00	4.0	PVC	120.0	false	4.50	Open	5.24	1,069.22	1,069.11	0.11	0.04
P-32	2,870.00	4.0	PVC	120.0	false	5.00	Open	47.42	1,081.78	1,075.38	6.40	2.23
P-33	2,652.00	4.0	PVC	120.0	false	1.90	Open	44.67	1,075.38	1,070.14	5.24	1.97
P-34	3,229.00	3.0	PVC	120.0	false	4.00	Open	2.75	1,070.14	1,070.00	0.15	0.05
P-35	706.00	3.0	PVC	120.0	false	1.80	Open	13.20	1,067.97	1,067.37	0.60	0.85
P-36	3,120.00	4.0	PVC	120.0	false	4.20	Open	11.55	1,067.37	1,066.87	0.51	0.16
P-37	360.00	3.0	PVC	120.0	false	2.10	Open	2.20	1,066.87	1,066.86	0.01	0.03
P-38	785.00	3.0	PVC	120.0	false	2.60	Open	2.75	1,066.87	1,066.83	0.04	0.05
P-39	4,210.00	4.0	PVC	120.0	false	0.60	Open	38.07	1,070.14	1,064.00	6.15	1.46
P-40	3,073.00	4.0	PVC	120.0	false	3.50	Open	35.32	1,064.00	1,060.06	3.94	1.28
P-41	3,870.00	4.0	PVC	120.0	false	4.00	Open	7.15	1,060.06	1,059.80	0.26	0.07
P-42	2,074.00	4.0	PVC	120.0	false	1.80	Open	1.65	1,059.80	1,059.79	0.01	4.41e-3

Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 EMPTY, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-43	4,130.00	4.0	PVC	120.0	false	3.00	Open	2.20	1,059.80	1,059.77	0.03	0.01
P-44	6,181.00	4.0	PVC	120.0	false	6.00	Open	8.80	1,060.06	1,059.45	0.60	0.10
P-45	493.00	3.0	PVC	120.0	false	2.70	Open	1.10	1,059.45	1,059.45	4.15e-3	0.01
P-46	2,002.00	4.0	PVC	120.0	false	4.00	Open	4.40	1,059.45	1,059.40	0.05	0.03
P-47	1,701.00	4.0	PVC	120.0	false	5.00	Open	1.65	1,059.40	1,059.39	0.01	4.45e-3
P-48	5,362.00	4.0	PVC	120.0	false	3.00	Open	15.52	1,060.06	1,058.57	1.49	0.28
P-49	1,426.00	3.0	PVC	120.0	false	2.70	Open	1.10	1,058.57	1,058.55	0.01	0.01
P-50	1,848.00	4.0	PVC	120.0	false	3.00	Open	9.47	1,058.57	1,058.36	0.21	0.11
P-51	3,258.00	4.0	PVC	120.0	false	6.00	Open	7.82	1,058.36	1,058.10	0.26	0.08
P-52	1,989.00	3.0	PVC	120.0	false	3.00	Open	2.20	1,058.10	1,058.04	0.06	0.03
P-53	1,714.00	4.0	PVC	120.0	false	4.00	Open	3.97	1,058.10	1,058.06	0.04	0.02
P-54	1,415.00	4.0	PVC	120.0	false	3.00	Open	4.95	1,058.06	1,058.01	0.05	0.03
P-55	400.00	3.0	PVC	120.0	false	2.90	Open	1.65	1,058.01	1,058.01	0.01	0.02
P-56	1,906.00	3.0	PVC	120.0	false	3.00	Open	3.30	1,058.01	1,057.89	0.12	0.06
P-57	1,943.00	4.0	PVC	120.0	false	2.00	Open	12.53	1,058.47	1,058.10	0.36	0.19
P-58	1,055.00	3.0	PVC	120.0	false	2.70	Open	4.95	1,058.10	1,057.96	0.14	0.14
P-59	1,919.00	3.0	PVC	120.0	false	2.50	Open	3.30	1,057.96	1,057.83	0.12	0.06
P-60	2,663.00	4.0	PVC	120.0	false	2.00	Open	2.63	1,058.10	1,058.07	0.03	0.01
P-61	3,179.00	4.0	PVC	120.0	false	4.20	Open	1.53	1,058.07	1,058.06	0.01	3.8e-3

Scenario: TANK 1 EMPTY, C.V. OPEN, TANK 2 EMPTY, MAX. DEMAND
Extended Period Analysis: 1.00 hr / 2.00
Tank Report

Label	Zone	Base Elevation (ft)	Minimum Elevation (ft)	Initial HGL (ft)	Maximum Elevation (ft)	Inactive Volume (ft^3)	Tank Diameter (ft)	Inflow (gpm)	Current Status	Calculated Hydraulic Grade (ft)	Calculated Percent Full (%)
T-1	Zone-1	1,102.21	1,102.22	1,109.00	1,120.01	0.00	27.00	-245.75	Draining	1,104.72	14.0
T-2	Zone-1	1,050.00	1,050.10	1,054.00	1,083.00	0.00	25.00	66.45	Filling	1,053.67	10.8

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Scenario: TANK 1 FULL, TANK 2 EMPTY, NO DEMAND (MAX. FLOW INTO #2)
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	896.00	Zone-1	Demand	0.00	ZERO DEMAND	0.00	1,113.51	94.11
J-2	869.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,111.42	104.88
J-3	826.00	Zone-1	Demand	10.00	ZERO DEMAND	0.00	1,109.41	122.62
J-4	796.00	Zone-1	Demand	11.00	ZERO DEMAND	0.00	1,106.93	134.53
J-5	796.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,103.67	133.11
J-6	796.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,102.06	132.42
J-7	800.00	Zone-1	Demand	9.00	ZERO DEMAND	0.00	1,099.28	129.48
J-8	802.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,098.25	128.17
J-9	808.00	Zone-1	Demand	16.00	ZERO DEMAND	0.00	1,094.04	123.76
J-10	802.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,092.76	125.80
J-11	818.00	Zone-1	Demand	18.00	ZERO DEMAND	0.00	1,087.41	116.56
J-12	826.00	Zone-1	Demand	27.00	ZERO DEMAND	0.00	1,081.40	110.50
J-13	863.00	Zone-1	Demand	18.00	ZERO DEMAND	0.00	1,077.01	92.59
J-14	860.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,067.15	89.62
J-15	840.00	Zone-1	Demand	8.00	ZERO DEMAND	0.00	1,101.76	113.25
J-16	819.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,100.57	121.82
J-17	800.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,100.57	130.04
J-18	780.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,100.57	138.70
J-19	800.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,100.57	130.04
J-20	795.00	Zone-1	Demand	12.00	ZERO DEMAND	0.00	1,099.80	131.87
J-21	876.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,098.96	96.47
J-22	860.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,098.96	103.39
J-23	855.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,098.49	105.35
J-24	860.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,098.49	103.18
J-25	865.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,097.86	100.75
J-26	920.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,096.26	76.26
J-27	900.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,096.26	84.91
J-28	860.00	Zone-1	Demand	7.00	ZERO DEMAND	0.00	1,095.12	101.73
J-29	850.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,101.32	108.73
J-30	903.00	Zone-1	Demand	7.00	ZERO DEMAND	0.00	1,099.17	84.87
J-31	934.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,099.17	71.46
J-32	803.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,092.76	125.36
J-33	838.00	Zone-1	Demand	12.00	ZERO DEMAND	0.00	1,092.76	110.22
J-34	870.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,092.76	96.38
J-35	842.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,092.76	108.49
J-36	901.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,095.78	84.27
J-37	909.00	Zone-1	Demand	7.00	ZERO DEMAND	0.00	1,093.27	79.73
J-38	851.00	Zone-1	Demand	6.00	ZERO DEMAND	0.00	1,093.27	104.82
J-39	876.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,093.27	94.00
J-40	820.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,093.27	118.23
J-41	890.00	Zone-1	Demand	6.00	ZERO DEMAND	0.00	1,093.27	87.95
J-42	860.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,093.27	100.93
J-43	900.00	Zone-1	Demand	5.00	ZERO DEMAND	0.00	1,093.27	83.62

Scenario: TANK 1 FULL, TANK 2 EMPTY, NO DEMAND (MAX. FLOW INTO #2)
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-44	900.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,093.27	83.62
J-45	920.00	Zone-1	Demand	9.00	ZERO DEMAND	0.00	1,088.93	73.09
J-46	955.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,088.93	57.95
J-47	910.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,087.42	76.76
J-48	858.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,084.75	98.10
J-49	890.00	Zone-1	Demand	4.00	ZERO DEMAND	0.00	1,084.75	84.26
J-50	861.00	Zone-1	Demand	1.00	ZERO DEMAND	0.00	1,083.34	96.20
J-51	878.00	Zone-1	Demand	0.00	ZERO DEMAND	0.00	1,083.34	88.84
J-52	900.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,083.34	79.32
J-53	890.00	Zone-1	Demand	6.00	ZERO DEMAND	0.00	1,083.34	83.65
J-54	868.00	Zone-1	Demand	9.00	ZERO DEMAND	0.00	1,078.59	91.11
J-55	850.00	Zone-1	Demand	3.00	ZERO DEMAND	0.00	1,078.59	98.90
J-56	890.00	Zone-1	Demand	6.00	ZERO DEMAND	0.00	1,078.59	81.59
J-57	900.00	Zone-1	Demand	2.00	ZERO DEMAND	0.00	1,080.75	78.20

Scenario: TANK 1 FULL, TANK 2 EMPTY, NO DEMAND (MAX. FLOW INTO #2)
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	2,156.00	8.0	PVC	120.0	false	9.90	Open	166.89	1,115.34	1,113.51	1.83	0.85
P-2	2,650.00	8.0	PVC	120.0	false	3.00	Open	166.89	1,113.51	1,111.42	2.09	0.79
P-3	2,574.00	8.0	PVC	120.0	false	1.50	Open	166.89	1,111.42	1,109.41	2.01	0.78
P-4	3,174.00	8.0	PVC	120.0	false	2.00	Open	166.89	1,109.41	1,106.93	2.48	0.78
P-7	691.00	6.0	PVC	120.0	false	1.80	Open	139.25	1,103.67	1,102.06	1.61	2.33
P-8	1,579.00	6.0	PVC	120.0	false	1.20	Open	121.64	1,102.06	1,099.28	2.78	1.76
P-9	588.00	6.0	PVC	120.0	false	0.30	Open	121.64	1,099.28	1,098.25	1.03	1.75
P-10	2,399.00	6.0	PVC	120.0	false	1.20	Open	121.64	1,098.25	1,094.04	4.21	1.75
P-11	538.00	6.0	PVC	120.0	false	2.10	Open	139.25	1,094.04	1,092.76	1.28	2.38
P-12	2,326.00	6.0	PVC	120.0	false	3.90	Open	139.25	1,092.76	1,087.41	5.35	2.30
P-13	2,615.00	6.0	PVC	120.0	false	4.50	Open	139.25	1,087.41	1,081.40	6.01	2.30
P-14	1,902.00	6.0	PVC	120.0	false	3.60	Open	139.25	1,081.40	1,077.01	4.39	2.31
P-15	3,105.00	6.0	PVC	120.0	false	3.00	Open	166.88	1,077.01	1,067.15	9.86	3.18
P-16	4,769.00	6.0	PVC	120.0	false	18.90	Open	166.88	1,067.15	1,051.21	15.94	3.34
P-6	50.00	4.0	PVC	120.0	false	3.70	Open	166.89	1,105.84	1,103.67	2.17	43.36
P-5	292.00	6.0	PVC	120.0	false	3.30	Open	166.89	1,106.93	1,105.84	1.10	3.75
P-17	6,154.00	6.0	PVC	120.0	false	4.00	Open	17.62	1,102.06	1,101.76	0.30	0.05
P-18	3,355.00	4.0	PVC	120.0	false	2.90	Open	17.62	1,101.76	1,100.57	1.18	0.35
P-19	808.00	4.0	PVC	120.0	false	0.80	Open	0.00	1,100.57	1,100.57	0.00	0.00
P-20	1,617.00	4.0	PVC	120.0	false	1.20	Open	0.00	1,100.57	1,100.57	0.00	0.00
P-21	265.00	3.0	PVC	120.0	false	1.80	Open	0.00	1,100.57	1,100.57	0.00	0.00
P-22	2,193.00	4.0	PVC	120.0	false	1.90	Open	17.62	1,100.57	1,099.80	0.77	0.35
P-23	2,376.00	4.0	PVC	120.0	false	2.60	Open	17.62	1,099.80	1,098.96	0.84	0.35
P-24	1,240.00	3.0	PVC	120.0	false	2.80	Open	0.00	1,098.96	1,098.96	0.00	0.00
P-25	1,326.00	4.0	PVC	120.0	false	1.80	Open	17.62	1,098.96	1,098.49	0.47	0.35
P-26	1,620.00	1.0	PVC	150.0	false	1.80	Open	1.02e-3	1,098.49	1,098.49	0.00	0.00
P-27	1,765.00	4.0	PVC	120.0	false	4.00	Open	17.62	1,098.49	1,097.86	0.63	0.36
P-28	4,540.00	4.0	PVC	120.0	false	5.60	Open	17.62	1,097.86	1,096.26	1.61	0.35
P-29	2,255.00	3.0	PVC	120.0	false	4.20	Open	1.02e-3	1,096.26	1,096.26	0.00	0.00
P-30	3,204.00	4.0	PVC	120.0	false	4.30	Open	17.61	1,096.26	1,095.12	1.13	0.35
P-31	3,055.00	4.0	PVC	120.0	false	4.50	Open	17.61	1,095.12	1,094.04	1.08	0.35
P-32	2,870.00	4.0	PVC	120.0	false	5.00	Open	27.64	1,103.67	1,101.32	2.35	0.82
P-33	2,652.00	4.0	PVC	120.0	false	1.90	Open	27.64	1,101.32	1,099.17	2.15	0.81
P-34	3,229.00	3.0	PVC	120.0	false	4.00	Open	1.02e-3	1,099.17	1,099.17	0.00	0.00
P-35	706.00	3.0	PVC	120.0	false	1.80	Open	3.06e-3	1,092.76	1,092.76	0.00	0.00
P-36	3,120.00	4.0	PVC	120.0	false	4.20	Open	2.04e-3	1,092.76	1,092.76	0.00	0.00
P-37	360.00	3.0	PVC	120.0	false	2.10	Open	1.02e-3	1,092.76	1,092.76	0.00	0.00
P-38	785.00	3.0	PVC	120.0	false	2.60	Open	1.02e-3	1,092.76	1,092.76	0.00	0.00
P-39	4,210.00	4.0	PVC	120.0	false	0.60	Open	27.64	1,099.17	1,095.78	3.40	0.81
P-40	3,073.00	4.0	PVC	120.0	false	3.50	Open	27.64	1,095.78	1,093.27	2.50	0.81
P-41	3,870.00	4.0	PVC	120.0	false	4.00	Open	2.04e-3	1,093.27	1,093.27	0.00	0.00
P-42	2,074.00	4.0	PVC	120.0	false	1.80	Open	1.02e-3	1,093.27	1,093.27	0.00	0.00

Scenario: TANK 1 FULL, TANK 2 EMPTY, NO DEMAND (MAX. FLOW INTO #2)
Extended Period Analysis: 1.00 hr / 2.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-43	4,130.00	4.0	PVC	120.0	false	3.00	Open	1.02e-3	1,093.27	1,093.27	0.00	0.00
P-44	6,181.00	4.0	PVC	120.0	false	6.00	Open	9.14e-4	1,093.27	1,093.27	0.00	0.00
P-45	493.00	3.0	PVC	120.0	false	2.70	Open	0.00	1,093.27	1,093.27	0.00	0.00
P-46	2,002.00	4.0	PVC	120.0	false	4.00	Open	0.00	1,093.27	1,093.27	0.00	0.00
P-47	1,701.00	4.0	PVC	120.0	false	5.00	Open	0.00	1,093.27	1,093.27	0.00	0.00
P-48	5,362.00	4.0	PVC	120.0	false	3.00	Open	27.63	1,093.27	1,088.93	4.34	0.81
P-49	1,426.00	3.0	PVC	120.0	false	2.70	Open	0.00	1,088.93	1,088.93	0.00	0.00
P-50	1,848.00	4.0	PVC	120.0	false	3.00	Open	27.63	1,088.93	1,087.42	1.51	0.82
P-51	3,258.00	4.0	PVC	120.0	false	6.00	Open	27.63	1,087.42	1,084.75	2.67	0.82
P-52	1,989.00	3.0	PVC	120.0	false	3.00	Open	1.02e-3	1,084.75	1,084.75	0.00	0.00
P-53	1,714.00	4.0	PVC	120.0	false	4.00	Open	27.63	1,084.75	1,083.34	1.41	0.82
P-54	1,415.00	4.0	PVC	120.0	false	3.00	Open	2.04e-3	1,083.34	1,083.34	0.00	0.00
P-55	400.00	3.0	PVC	120.0	false	2.90	Open	0.00	1,083.34	1,083.34	0.00	0.00
P-56	1,906.00	3.0	PVC	120.0	false	3.00	Open	0.00	1,083.34	1,083.34	0.00	0.00
P-57	1,943.00	4.0	PVC	120.0	false	2.00	Open	-27.63	1,077.01	1,078.59	1.58	0.81
P-58	1,055.00	3.0	PVC	120.0	false	2.70	Open	1.02e-3	1,078.59	1,078.59	0.00	0.00
P-59	1,919.00	3.0	PVC	120.0	false	2.50	Open	1.02e-3	1,078.59	1,078.59	0.00	0.00
P-60	2,663.00	4.0	PVC	120.0	false	2.00	Open	-27.63	1,078.59	1,080.75	2.16	0.81
P-61	3,179.00	4.0	PVC	120.0	false	4.20	Open	-27.63	1,080.75	1,083.34	2.59	0.82

Scenario: TANK 1 FULL, TANK 2 EMPTY, NO DEMAND (MAX. FLOW INTO #2)
Extended Period Analysis: 1.00 hr / 2.00
Tank Report

Label	Zone	Base Elevation (ft)	Minimum Elevation (ft)	Initial HGL (ft)	Maximum Elevation (ft)	Inactive Volume (ft^3)	Tank Diameter (ft)	Inflow (gpm)	Current Status	Calculated Hydraulic Grade (ft)	Calculated Percent Full (%)
T-1	Zone-1	1,102.21	1,102.22	1,120.00	1,120.01	0.00	27.00	-166.89	Draining	1,115.34	73.8
T-2	Zone-1	1,050.00	1,051.00	1,051.10	1,083.00	0.00	25.00	166.88	Filling	1,051.21	0.6

Scenario: FLUSHING @ J-46, TANKS FULL, C.V. CLOSED
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	896.00	Zone-1	Demand	0.00	RESIDUAL RESIDENTAL DEMAND	0.00	1,119.63	96.76
J-2	869.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,119.63	108.44
J-3	826.00	Zone-1	Demand	10.00	RESIDUAL RESIDENTAL DEMAND	1.10	1,119.63	127.04
J-4	796.00	Zone-1	Demand	11.00	RESIDUAL RESIDENTAL DEMAND	1.21	1,119.63	140.02
J-5	796.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,066.54	117.05
J-6	796.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,066.64	117.09
J-7	800.00	Zone-1	Demand	9.00	RESIDUAL RESIDENTAL DEMAND	0.99	1,066.86	115.46
J-8	802.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,066.94	114.63
J-9	808.00	Zone-1	Demand	16.00	RESIDUAL RESIDENTAL DEMAND	1.76	1,067.30	112.19
J-10	802.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,067.43	114.84
J-11	818.00	Zone-1	Demand	18.00	RESIDUAL RESIDENTAL DEMAND	1.98	1,068.06	108.19
J-12	826.00	Zone-1	Demand	27.00	RESIDUAL RESIDENTAL DEMAND	2.97	1,068.82	105.05
J-13	863.00	Zone-1	Demand	18.00	RESIDUAL RESIDENTAL DEMAND	1.98	1,069.44	89.32
J-14	860.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,072.40	91.90
J-15	840.00	Zone-1	Demand	8.00	RESIDUAL RESIDENTAL DEMAND	0.88	1,066.64	98.06
J-16	819.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,066.64	107.14
J-17	800.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,066.64	115.36
J-18	780.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,066.64	124.02
J-19	800.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,066.64	115.36
J-20	795.00	Zone-1	Demand	12.00	RESIDUAL RESIDENTAL DEMAND	1.32	1,066.66	117.54
J-21	876.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,066.71	82.51
J-22	860.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,066.70	89.43
J-23	855.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,066.74	91.61
J-24	860.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,066.65	89.41
J-25	865.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,066.80	87.31
J-26	920.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,066.97	63.59
J-27	900.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,066.97	72.24
J-28	860.00	Zone-1	Demand	7.00	RESIDUAL RESIDENTAL DEMAND	0.77	1,067.12	89.61
J-29	850.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,063.78	92.49
J-30	903.00	Zone-1	Demand	7.00	RESIDUAL RESIDENTAL DEMAND	0.77	1,061.33	68.50
J-31	934.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,061.33	55.09
J-32	803.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,067.40	114.40
J-33	838.00	Zone-1	Demand	12.00	RESIDUAL RESIDENTAL DEMAND	1.32	1,067.38	99.24
J-34	870.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,067.38	85.40
J-35	842.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,067.38	97.51
J-36	901.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,057.79	67.84
J-37	909.00	Zone-1	Demand	7.00	RESIDUAL RESIDENTAL DEMAND	0.77	1,055.27	63.28
J-38	851.00	Zone-1	Demand	6.00	RESIDUAL RESIDENTAL DEMAND	0.66	1,055.26	88.37
J-39	876.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,055.26	77.56
J-40	820.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,055.26	101.78
J-41	890.00	Zone-1	Demand	6.00	RESIDUAL RESIDENTAL DEMAND	0.66	1,055.24	71.49
J-42	860.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,055.24	84.47
J-43	900.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,055.24	67.16

Scenario: FLUSHING @ J-46, TANKS FULL, C.V. CLOSED
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-44	900.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,055.24	67.16
J-45	920.00	Zone-1	Demand	9.00	RESIDUAL RESIDENTAL DEMAND	0.99	1,051.98	57.10
J-46	955.00	Zone-1	Demand	55.00	Fixed	55.00	1,035.04	34.63
J-47	910.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,053.99	62.30
J-48	858.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,057.61	86.36
J-49	890.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,057.60	72.51
J-50	861.00	Zone-1	Demand	1.00	RESIDUAL RESIDENTAL DEMAND	0.11	1,059.60	85.93
J-51	878.00	Zone-1	Demand	0.00	RESIDUAL RESIDENTAL DEMAND	0.00	1,059.60	78.57
J-52	900.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,059.60	69.05
J-53	890.00	Zone-1	Demand	6.00	RESIDUAL RESIDENTAL DEMAND	0.66	1,059.59	73.38
J-54	868.00	Zone-1	Demand	9.00	RESIDUAL RESIDENTAL DEMAND	0.99	1,066.78	86.00
J-55	850.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,066.77	93.79
J-56	890.00	Zone-1	Demand	6.00	RESIDUAL RESIDENTAL DEMAND	0.66	1,066.76	76.48
J-57	900.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,063.50	70.74

Scenario: FLUSHING @ J13, TANKS FULL, C.V. CLOSED
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	896.00	Zone-1	Demand	0.00	RESIDUAL RESIDENTAL DEMAND	0.00	1,119.63	96.76
J-2	869.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,119.63	108.44
J-3	826.00	Zone-1	Demand	10.00	RESIDUAL RESIDENTAL DEMAND	1.10	1,119.63	127.04
J-4	796.00	Zone-1	Demand	11.00	RESIDUAL RESIDENTAL DEMAND	1.21	1,119.63	140.02
J-5	796.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,019.24	96.59
J-6	796.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,019.25	96.59
J-7	800.00	Zone-1	Demand	9.00	RESIDUAL RESIDENTAL DEMAND	0.99	1,019.26	94.87
J-8	802.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,019.27	94.00
J-9	808.00	Zone-1	Demand	16.00	RESIDUAL RESIDENTAL DEMAND	1.76	1,019.31	91.42
J-10	802.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.33	94.03
J-11	818.00	Zone-1	Demand	18.00	RESIDUAL RESIDENTAL DEMAND	1.98	1,019.44	87.16
J-12	826.00	Zone-1	Demand	27.00	RESIDUAL RESIDENTAL DEMAND	2.97	1,019.60	83.76
J-13	863.00	Zone-1	Demand	220.00	Fixed	220.00	1,019.75	67.82
J-14	860.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,040.69	78.18
J-15	840.00	Zone-1	Demand	8.00	RESIDUAL RESIDENTAL DEMAND	0.88	1,019.23	77.55
J-16	819.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,019.21	86.62
J-17	800.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.20	94.84
J-18	780.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,019.20	103.49
J-19	800.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.20	94.84
J-20	795.00	Zone-1	Demand	12.00	RESIDUAL RESIDENTAL DEMAND	1.32	1,019.20	97.00
J-21	876.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.20	61.96
J-22	860.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,019.20	68.88
J-23	855.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,019.20	71.04
J-24	860.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.11	68.84
J-25	865.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.21	66.72
J-26	920.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,019.23	42.93
J-27	900.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.23	51.59
J-28	860.00	Zone-1	Demand	7.00	RESIDUAL RESIDENTAL DEMAND	0.77	1,019.26	68.91
J-29	850.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,019.18	73.20
J-30	903.00	Zone-1	Demand	7.00	RESIDUAL RESIDENTAL DEMAND	0.77	1,019.14	50.25
J-31	934.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,019.13	36.83
J-32	803.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,019.30	93.58
J-33	838.00	Zone-1	Demand	12.00	RESIDUAL RESIDENTAL DEMAND	1.32	1,019.27	78.43
J-34	870.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,019.27	64.58
J-35	842.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,019.27	76.70
J-36	901.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,019.11	51.10
J-37	909.00	Zone-1	Demand	7.00	RESIDUAL RESIDENTAL DEMAND	0.77	1,019.10	47.63
J-38	851.00	Zone-1	Demand	6.00	RESIDUAL RESIDENTAL DEMAND	0.66	1,019.08	72.72
J-39	876.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,019.08	61.91
J-40	820.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,019.08	86.13
J-41	890.00	Zone-1	Demand	6.00	RESIDUAL RESIDENTAL DEMAND	0.66	1,019.07	55.84
J-42	860.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.07	68.82
J-43	900.00	Zone-1	Demand	5.00	RESIDUAL RESIDENTAL DEMAND	0.55	1,019.06	51.51

Scenario: FLUSHING @ J13, TANKS FULL, C.V. CLOSED
Extended Period Analysis: 1.00 hr / 2.00
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-44	900.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,019.06	51.51
J-45	920.00	Zone-1	Demand	9.00	RESIDUAL RESIDENTAL DEMAND	0.99	1,019.15	42.90
J-46	955.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.15	27.75
J-47	910.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,019.18	47.24
J-48	858.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,019.26	69.77
J-49	890.00	Zone-1	Demand	4.00	RESIDUAL RESIDENTAL DEMAND	0.44	1,019.25	55.92
J-50	861.00	Zone-1	Demand	1.00	RESIDUAL RESIDENTAL DEMAND	0.11	1,019.31	68.49
J-51	878.00	Zone-1	Demand	0.00	RESIDUAL RESIDENTAL DEMAND	0.00	1,019.31	61.14
J-52	900.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,019.31	51.62
J-53	890.00	Zone-1	Demand	6.00	RESIDUAL RESIDENTAL DEMAND	0.66	1,019.30	55.94
J-54	868.00	Zone-1	Demand	9.00	RESIDUAL RESIDENTAL DEMAND	0.99	1,019.59	65.58
J-55	850.00	Zone-1	Demand	3.00	RESIDUAL RESIDENTAL DEMAND	0.33	1,019.58	73.37
J-56	890.00	Zone-1	Demand	6.00	RESIDUAL RESIDENTAL DEMAND	0.66	1,019.57	56.06
J-57	900.00	Zone-1	Demand	2.00	RESIDUAL RESIDENTAL DEMAND	0.22	1,019.46	51.68

CAMP M