KENT COUNTY WATER AUTHORITY

SPECIAL BOARD MEETING MINUTES

February 7, 2008

The Board of Directors of the Kent County Water Authority held a special meeting in the Joseph D. Richard Board Room at the office of the Authority on February 7, 2008.

Chairman, Robert B. Boyer opened the meeting at 3:30 p.m. Board Members, Mr. Gallucci, Mrs. Graham and Mr. Masterson were present together with the General Manager, Timothy J. Brown, Technical Service Director, John Duchesneau, System Engineer, Kevin J. Fitta, Arthur Williams, Finance Director, Legal Counsel, Joseph J. McGair, and other interested parties. Mr. Inman was excused due to a previous commitment.

Center of New England Request, Caito Corporation Letter, January 16, 2008

Robert Raposa, CNE Vice President, Scott Nelson, CNE Construction Manager, Jeffrey Hanson, PE and Ben Caito, PE of Caito Engineering appeared before the Board.

The Chairman preliminarily stated that the CNE master meter issue has yet to be addressed and it has been far too long and it must be addressed. Ben Caito stated water has been sized and comments to the Kent County Water Authority are to be submitted and calculations are being run as well.

The General Manager stated that the March 9, 2006 water service activation extension approval by this Board was never executed and Legal Counsel , Joseph J. McGair, handed two related extension letters dated October 15, 2007 and December 12, 2007 written by Legal Counsel to CNE attached as "**A**" and "**B**" to Mr. Rapoza which were never responded to. Mr. Raposa stated that CNE previous counsel had not answered them and is no longer engaged and he assured the Board that the letters would be addressed immediately.

The General Manager also stated that with regard to Hopkins Hill, the 18 month extension is running out and there has been no design submitted. Mr. Raposa stated that master meter parts have been ordered and will be installed within 60 days. A general discussion followed.

Service connections for CARMAX , automobile dealership

Ben Caito, PE stated that there is an agreement with CARMAX, a national used car chain, which would require a daily water demand of 8,200 g/p/d and would tie in to a water main within CNE Boulevard. Vice President Raposa stated there would be no need for any water until Spring 2009 when construction should be completed. The

Chairman also stated that there needs to be a stipulation that the master meter must be operational prior to service being installed.

Board Member Masterson moved and it was seconded by Board Member Gallucci to approve the request for water service supply for CARMAX CNE commercial site for high service gradient subject to the conditions as follows:

1. The Kent County Water Authority (KCWA) is not a guarantor of water supply for this or any other approval and KCWA can only supply water reasonably available to it and therefore any applicant/customer of KCWA understands that any third party commitments made by an applicant/customer are subject to the reasonable availability of water supply and limits of the existing infrastructure to support service.

2. A deficient condition associated with accelerated commercial and residential development exists in the area serviced by the KCWA. The KCWA is in the process of planning for additional water supply and therefore delays or diminution in service may occur if the water supply is unavailable or unable to produce water sufficient to service the customers of KCWA.

3. Ventures, commitments or agreements are at the applicant's sole risk if supply or existing infrastructure is found to be insufficient to support service. The applicant may afford the Authority with system improvements to facilitate adequate service.

4. The applicant shall file a formal application with the necessary design drawings, flow calculations, including computer hydraulic modeling to fully evaluate this project supply availability and the potential impact on the existing public water supply system. The applicant/customer understands that any undetected error in any calculation or drawing or an increase or change in demand as proposed, which materially affects the ability to supply water to the project, will be the responsibility of the applicant/customer and not the KCWA.

5. Only conservation-wise plumbing fixtures are to be installed, including, but not limited to low flow shower heads, low flow toilets and low flow aerators on faucets.

6. If irrigation systems are installed, they must be supplied by a private well. Xeriscape landscaping technique and/or proper planting bed (high water holding capacity) soil preparation shall be employed throughout the project.

7. Water service to the CARMAX Development property cannot be activated until after installation and activation of the Center of New England master meter at the proposed location in the vicinity of the intersection of New London Turnpike and Center of New England Boulevard is completed and in service.

And it was unanimously

VOTED: To approve the request for water service supply for CARMAX CNE commercial site for high service gradient subject to the conditions as follows:

1. The Kent County Water Authority (KCWA) is not a guarantor of water supply for this or any other approval and KCWA can only supply water reasonably available to it and therefore any applicant/customer of KCWA understands that any third party commitments made by an applicant/customer are subject to the reasonable availability of water supply and limits of the existing infrastructure to support service.

2. A deficient condition associated with accelerated commercial and residential development exists in the area serviced by the KCWA. The KCWA is in the process of planning for additional water supply and therefore delays or diminution in service may occur if the water supply is unavailable or unable to produce water sufficient to service the customers of KCWA.

3. Ventures, commitments or agreements are at the applicant's sole risk if supply or existing infrastructure is found to be insufficient to support service. The applicant may afford the Authority with system improvements to facilitate adequate service.

4. The applicant shall file a formal application with the necessary design drawings, flow calculations, including computer hydraulic modeling to fully evaluate this project supply availability and the potential impact on the existing public water supply system. The applicant/customer understands that any undetected error in any calculation or drawing or an increase or change in demand as proposed, which materially affects the ability to supply water to the project, will be the responsibility of the applicant/customer and not the KCWA.

5. Only conservation-wise plumbing fixtures are to be installed, including, but not limited to low flow shower heads, low flow toilets and low flow aerators on faucets.

6. If irrigation systems are installed, they must be supplied by a private well. Xeriscape landscaping technique and/or proper planting bed (high water holding capacity) soil preparation shall be employed throughout the project.

7. Water service to the CARMAX Development property cannot be activated until after installation and activation of the Center of New England master meter at the proposed location in the vicinity of the intersection of New London Turnpike and Center of New England Boulevard is completed and in service.

Service connection for the Highlands at Hopkins Hill

Ben Caito, PE stated that this project was previously as planned to be composed of multi-family detached units, however, they are now investigating 320 Town House units.

Mr. Caito stated that his data demonstrated that there would be 1.7 people per two bedroom unit and 56,000 gallons per day average daily demand. The General Manager stated that the calculations do not meet the Kent County Water Authority rules and regulations of four people per two bedroom of 256,000 gallons per day. The Chairman and Board Member Masterson expressed concern in regard to fire protection especially the hydrants. Ben Caito stated that hydrant fees would be paid by CNE. The General Manager said there had been no information for the fire services provided to Kent County Water Authority and that Town and Fire Districts have approved the same without Kent County Water Authority input.

The General Manager reminded that there can be no wells on the Kent County Water Authority system. Mr. Raposa explained that the well development is now before the Department of Environmental Management in permitting and that CNE will probably abandon the wells but he does not know when Department of Environmental Management action will be taken. CNE does have a DOH approval but not Department of Environmental Management.

Board Member Masterson reminded all that at a PUC community meeting at Coventry High School, Mr. Cambio emphatically stated that he would get well water "no matter what". The General Manager again stated that he was under the assumption that Coventry had approved the project for wells and fire protection and suddenly at this late date there is an issue with demand albeit Kent Count Water Authority was not consulted or provided documentation for any CNE plans.

The Chairman stated there is a need to provide material lists, flow calculations and plans regarding the thousands of feet that have not been inspected which is of great concern for the Authority. The General Manager stated that this is not for the good of Kent County Water Authority system and he is not willing to recommend any commitment until more information is forthcoming and fully reviewed.

Installation of insulated shallow water system, The Village Green

Ben Caito, PE explained by use of a hand-out attached as "**C**" that drainage and sewer are in place and approved by the Town of Coventry. Model units are open and CNE desires a shallow water main in that the water line can not maintain 18 inch difference with sewer where they cross. CNE wants the water line to go over the sewer which was put in earlier without regard to Kent County Water Authority regulations and would be a 4 inch differential at the worse case.

He proposes to insulate the waterline where the inverted "u" goes over the pipe to prevent freezing. The General Manager stated that this was a significant problem in that the placement of water pipe above the frost line is only being requested since the sewer pipe was incorrectly put in below the frost line without regard to Kent County Water Authority regulations and was installed at their own risk and instead of correcting the problem, CNE comes before the Board with a cost-savings plan for its benefit, alone, which is not in keeping with sound engineering principles.

Ben Caito admitted that the laying of the pipe was based on anticipation of wells and at the time saved construction costs. He said that the state of the art sleeving should allay the fears of freezing pipes. The General Manager gave a history about early meetings with engineers and the current problem. The Chairman said two wrongs don't make a right and that CNE should salvage the manholes and rip up the old pipe.

Board Member Graham stated that she is not happy about this predicament, especially with the plumbing codes being flaunted and Kent County Water Authority regulations as well. The General Manager stated there have been at least three meetings to discuss the various options but his recommendation to CNE have been apparently rejected by CNE and he has looked at all options.

The General Manager prepared a memo dated February 5, 2008 attached as "**D**" and stated that faulty installation by the developer is the sole reason that we have to deal with this. Board Member Masterson stated that it is obvious that compliance with the KCWA regulations is necessary. The General Manager reminded that the issue is that CNE installed utilities prior to Kent County Water Authority approvals. Board Member Graham added that in trying to make something right which can not be made right, makes no sense.

The General Manager reminded the Board that it does not have the option to approve this proposal pursuant to his February 5, 2008 memo previously attached as "**D**". Board Member Gallucci stated that CNE is attempting to correct their problem in defiance of the codes and regulations which can not be waived as it would be a precedent and CNE will need to find another alternative.

Review of Rate Case and Direction for Filing

Christopher Woodcock, Kent County Water Authority Rate Consultant, appeared before the Board. The General Manager gave an overview of the 2005 rate filing. He explained the current status of the recent pass through from recent PWSB PUC rate filing and Kent County Water Authority led the intervenors who assisted the KCWA with the costs of presenting the intervenor case which saved considerable amount of money for the customers and that the Chairman commended Kent County Water Authority for its presentation. Mr. Woodcock covered many rate filing indicia including:

1. Materials and energy costs are more expensive.

2. 1.6 million in the Restricted Receipt Account has not been met because of revenue shortfalls.
3. Labor and benefit costs have increased.
4. Purchases are to be updated.
5. Debt services (Bonds) must be continued to be met.
6. $6 million IFR plan requirement for funding must be met.
7. Seasonal rates (July, August, September)/operating revenues and changes in calendar year are options.
8. Costs of personnel will increase.
9. Treatment costs.
10. GIS operation increases.
11. Field inspection increases.
12. CIP needs updating.

His recommendation is that a rate filing is necessary for the integrity of the system and should be filed soon. Mr. Woodcock gave rough numbers to the Board which were for discussion only.

Board Member Gallucci reminded the Board that he agrees with conservation and the need for a rate hike but the Kent County Water Authority/Warwick residents pay higher rates than Warwick water customers and it is wrong and it should be addressed statewide to prevent this.

The General Manager stated that a formal vote would be presented at the Board meeting on February 21, 2008 in order to commence a rate filing. Board Member Masterson urged that it is imperative to have a rate filing as soon as possible. Board Member Gallucci hopes that the media will understand that this would be a $10/month increase rather than 33% which leads to sensationalism.

Distribution Storage Tank Hydraulic Evaluation, Execution Summary

Russell Houde of C & E Engineering Partners, Inc. and he handed out presentation attached as "**E**" and the executive summary attached as "**F**". He delivered a lengthy presentation regarding the hydraulic model and followed with a general discussion with the Board and the General Manager. The Chairman commented that it was one of the best presentations on the Kent County Water Authority system he has heard.

IFR Program 2008 (Combination 2006B and 2007) Approval

The General Manager recommended the combination of 2006B and 2007 IFR Programming as one contract for bidding this year as the construction costs have come down considerably due to the economy. This will be combined without the Apponaug Veteran's Memorial connector which would be set aside until the Department of Transportation decides to reroute and reconnect this section which has been planned

for many years. Included with this will be the changes to the Fairview Avenue Bridge water line as a bid item. It is expected that this will be bid late winter, early spring to take advantage of the cost savings with the consensus of the Board to proceed immediately with the recombination and bidding.

IFR 2006A Task Order No. 9 Approval

The General Manager stated that it was his recommendation that pipe near the Fairview Avenue bridge must be replaced and it is a most important connection crossing the river that was installed in the 1800's. The General Manager stated that he considers this to be an emergency replacement. It needs to be designed as soon as possible and in the amount of $25,990 for James J. Geremia & Associates, Inc. as evidenced and attached as "**G**".

It was moved by Board Member Graham and seconded by Board Member Gallucci to authorize the Chairman to sign Task Order No. 9 of James J. Geremia & Associates, Inc. in the amount of $25,990 as evidenced and attached as "**G**" and it was unanimously,

> VOTED: To authorize the Chairman to sign Task Order No. 9 of James J. Geremia & Associates, Inc. in the amount of $25,990 as evidenced and attached as "**G**".

Board Member Graham made a Motion to adjourn, seconded by Board Member Masterson and it was unanimously,

> VOTED: To adjourn the meeting at 6:45 p.m.

_____
Secretary Pro Tempore

EXHIBIT A

February 7, 2008

PETRARCA and McGAIR, INC. ATTORNEYS

797 BALD HILL ROAD
WARWICK, RI 02886

401-821-1330
FAX 401-823-0970
E-MAIL: jjm@petrarcamcgair.com
www.petrarcamcgair.com

October 15, 2007

SENT VIA FACSIMILE
ONLY (823-7329)

Beth A. Azero, Esq.
Director of Legal Administration
Universal Properties Group, Inc.
207 Quaker Lane, Suite 300
West Warwick, RI 02893

RE: KCWA / CNE

Dear Attorney Azero:

Enclosed herewith please find form of Amendment to Stipulated Approval for Water Service Activation with changes highlighted in bold print with attachments.

Upon your review of the same, please contact me.

Very truly yours,

Maryanne Pezzullo, Esq.

MP:ld
Enclosures
Cc: Timothy J. Brown, P.E. (KCWA)

AMENDMENT TO STIPULATED APPROVAL FOR WATER SERVICE ACTIVATION

WHEREAS, Kent County Water Authority (hereinafter KCWA) executed and issued to Centre of New England and its entitles (hereinafter CNE) Stipulated Approval for Water Service Activation dated March 9, 2006 which said approval was assented to by CNE on March 9, 2006 **and is attached hereto and incorporated herein by this reference;** and

WHEREAS, CNE requests of KCWA a one (1) year extension with respect to some of the stipulations set forth in said Approval to wit, clauses numbered 1, 3 and 4; and

WHEREAS, the parties have agreed that CNE shall not intermix its private water system with the KCWA water system and this provision shall be included in the subject approval of March 9, 2006; and

NOW THEREFORE, the undersigned, by this instrument, do hereby amend the Stipulated Approval for Water Service Activation dated March 9, 2006 as follows:

Clause 1 of said Approval shall be amended to read as follows:

1) Receipt of approval by the appropriate governmental bodies for the private system of CNE for exclusive water supply via wells to the entire CNE real property or the private water system via wells must be operational to support water supply no later than ~~one and one half years from the date of this approval~~. **September 8, 2008**.

Clause 3 of said Approval shall be amended to read as follows:

3) That if the CNE private water system via wells is in effect ~~within the period of time as stated in (1) above~~, **by September 8, 2008**, then the stipulations of October **19,** 2005 **memorialized in Water Service Conditional Approval dated November 9, 2005** (**attached hereto and incorporated herein by this reference)** by KCWA for water service approval for projects within the CNE real property shall no longer be necessary regarding as-built drawings and

easements, application, design, inspection and material requirements of the KCWA Rules and Regulations.

Clause 4 of ~~said~~ **the March 9, 2006** Approval shall be amended to read as follows:

4) That in the event that the CNE private water system via wells ~~is not approved by the appropriate governmental bodies or~~ is not operational ~~within one and one half years from the date of this approval~~ **by September 8, 2008**, then the master metering of the water system at New London Turnpike (KCWA Connection Point) and Hopkins Hill Road (KCWA Connection Point) shall be installed within 90 days of that event utilizing KCWA water at the two connection points stated and CNE shall notify KCWA no later than thirty (30) days of the approval or non-approval by the appropriate governmental bodies. The cost of said master meters and installation shall be the sole responsibility of CNE. If the master meters are not installed within 90 days of service or non-approval of governmental entities as stated in condition (3) above, service shall be terminated without notice.

In addition, CNE shall not intermix or supplement its private water system supply with the water supply of the KCWA public water system.

In all other respects other than as modified in this AMENDMENT TO STIPULATED APPROVAL FOR WATER SERVICE ACTIVATION to the STIPULATED APPROVAL FOR WATER SERVICE ACTIVATION dated March 9, 2006, we herewith re-affirm and re-acknowledge the aforesaid STIPULATED APPROVAL FOR WATER SERVICE ACTIVATION.

KENT COUNTY WATER AUTHORITY

_____ By:_____
Witness Robert B. Boyer, Chairman

Dated:_____

CENTRE OF NEW ENGLAND

_____ By:_____
Witness

Dated:_____

KCWA

Kent County Water Authority

March 9, 2006

Mr. Nicholas Cambio
Universal Properties, LLC/Centre of New England
207 Quaker Lane, Suite 300
West Warwick, RI 02893

Re: Centre of New England and all of its entities (hereafter CNE)

Dear Mr. Cambio:

At the behest of your legal counsel, John A. Pagliarini, Jr., Esq., the Kent County Water Authority reviewed your request for a resolution regarding the activation of water service to the following projects within the above referenced site:

Grandville at Greenwich, LP (Lecesse Development: WG, A. P. 1, Lot 3-1);
Shivai Nehal Realty, LLC (Wingate Hotel, Coventry, A. P. 7, Lot 2.1);
Commerce Park Associates 13, LLC (Pad A, Coventry, A. P. 7, Lot 2.3);
Commerce Park Associates 13, LLC (Pad B, Coventry, A. P. 7, Lot 2.10); and
Wal-Mart Real Estate Business Trust (Wal-Mart, Coventry, A. P. 6, Lot 1)

During the February 27, 2006 Special Board Meeting, the Board voted to allow water service activation to the above referenced entities located in the Centre of New England under the stipulations as follows:

1) Receipt of approval by the appropriate governmental bodies for the private system of CNE for exclusive water supply via wells to the entire CNE real property or the private water system via wells must be operational to support water supply no later than one and one half years from the date of this approval.

2) With the exception of irrigation, all entities located within the CNE real property shall be serviced to one water supply system that being the CNE private supply or master meter connection to KCWA supply.

3) That if the CNE private water system via wells is in effect within the period of time as stated in (1) above, then the stipulations of October 2005 by KCWA for water service approval for projects within the CNE real property shall no longer be necessary regarding as-built drawings and easements, application, design, inspection and material requirements of the KCWA Rules and Regulations.

4) That in the event that the CNE private water system via wells is not approved by the appropriate governmental bodies or is not operational within one and one half years from the date of this approval then the master metering of the water system at New London Turnpike (KCWA Connection Point) and Hopkins Hill Road (KCWA Connection Point) shall be installed within 90

days of that event utilizing KCWA water at the two connection points stated and CNE shall notify KCWA no later than thirty (30) days of the approval or non-approval by the appropriate governmental bodies. The cost of said master meters and installation shall be the sole responsibility of CNE. If the master meters are not installed within 90 days of service or non-approval of governmental entities as stated in condition (3) above, service shall be terminated without notice.

5) CNE shall be responsible while being serviced by KCWA for the operation and maintenance of its system from the 16" valve on New London Turnpike (KCWA Connection Point) and the 16" valve on Hopkins Hill Road (KCWA Connection Point) and that if there is any internal operational malfunction and/or contamination identified, the KCWA shall shut off service at the 16" valves as described above until such time as all requirements of KCWA and the Rhode Island Department of Health are met to reactivate service at the 16" valve and CNE shall immediately notify KCWA of any such event.

6) CNE must comply with all Rules and Regulations of the KCWA and as subsequently amended including, but not limited to, application, design, inspection and installation of infrastructure and operation and maintenance of infrastructure until such time as its private water system is activated and the KCWA system has been disconnected and physically separated from the development infrastructure at the connection point in Hopkins Hill Road and New London Turnpike.

7) All future extensions shall be applied for as required in the KCWA Regulations and subject to the approval of the KCWA until such time as the full project water system producing water via wells is operational and the connections to the KCWA system that being the 16" valve on New London Turnpike and the 16" valve on Hopkins Hill Road have been deactivated and a physical separation between the valve and pipe is completed. This separation of service between the KCWA connection and CNE piping system shall be at the sole cost of CNE.

8) The KCWA shall have the right to enter upon all real property of CNE and its successors and assigns to terminate the service for any business entity located within the CNE which has not paid its water bill and in connection with any malfunction and/or contamination as stated in 5) above.

9) CNE accepts and shall comply with the above stipulations by executing the acknowledgement prior to activation of the approved service connections.

The owner and applicant must review and execute the acknowledgements and receipt of these stipulations and return the fully executed stipulated approval to the KCWA within 20 days in order to be effective.

Very truly yours,
KENT COUNTY WATER AUTHORITY

Francis J. Perry, Jr., P.E.
Chairman

Applicant Acknowledgment of Authorized Signature

Signature

3-9-2006
Date

By execution of this stipulated approval for water service activation, applicant/owner, its successors and assigns shall fulfill all of the requirements/stipulations contained in this approval and conveyed to said applicant in this correspondence.

KCWA

Kent County Water Authority

November 9, 2005

Mr. Jeffrey C. Hanson, P.E.
John P. Caito Corporation
25 Sharpe Drive
Cranston, RI 02920

Re: Water Service Conditional Approval in lieu of Moratorium
Retail Development Pad B
Center of New England Boulevard
Coventry, Rhode Island

Dear Mr. Hanson:

As you are aware through your attendance at the Kent County Water Authority Board meeting on October 19, 2005 that accelerated development has caused a deficient condition in the high service gradient that supplies water to this project. The Authority has been studying potential initiatives to increase water supply but these initiatives will take at least three to five years to be operative as long as adequate funding can be made available and construction can move forward without any delays including permitting. After considering these factors, the Kent County Water Authority Board has reviewed your request for service and all pertinent data presented at the October 19, 2005 Board meeting and based upon representations made by you and/or your representative at the Board Meeting and by certain findings by the Board at the October 19, 2005 Board meeting the Kent County Water Authority voted to conditionally approve your request for water supply to service the above commercial site with the following conditions in lieu of a moratorium:

1. The Kent County Water Authority (KCWA) is not a guarantor of water supply for this or any other approval and KCWA can only supply water reasonably available to it and therefore any applicant/customer of KCWA understands that any third party commitments made by a applicant/customer are subject to the reasonable availability of water supply and limits of the existing infrastructure to support service.

2. A deficient condition associated with accelerated commercial and residential development exists in the area serviced by the KCWA, the KCWA is in the process of planning for additional water supply and therefore delays or diminution in service may occur if the water supply is unavailable or unable to produce water sufficient to service the customers of KCWA.

3. Ventures, commitments or agreements are at the applicant's sole risk if supply or existing infrastructure is found to be insufficient to support service. The applicant may afford the Authority with system improvements to facilitate adequate service.

4. The applicant shall file a formal application with the necessary design drawings, flow calculations, including computer hydraulic modeling to fully evaluate this project supply availability and the potential impact on the existing public water supply system. The applicant/customer understands that any undetected error in any calculation or drawing or an increase or change in demand as proposed, which materially affects the ability to supply water to the project, will be the responsibility of the applicant/customer and not the KCWA.

5. Only conservation-wise plumbing fixtures are to be installed including but not limited to low flow shower heads, low flow toilets and low flow aerators on faucets.

6. If irrigation systems are installed, they must be supplied by a private well. Xeriscape landscaping technique and/or proper planting bed (high water holding capacity) soil preparation shall be employed throughout the project.

7. Provide outstanding as-built drawings by December 31, 2005.

8. Provision of an easement acceptable to Kent County Water Authority attorney.

Very truly yours,
Kent County Water Authority

Francis J. Perry, Jr., P.E.
Chairman

cc: Joseph McGair, Attorney at Law
Board Members

FP/lms

EXHIBIT B

February 7, 2008

PETRARCA and McGAIR, INC.
•ATTORNEYS•

797 BALD HILL ROAD
WARWICK, RI 02886

401-821-1330
FAX 401-823-0970
E-MAIL: jjm@petrarcamcgair.com
www.petrarcamcgair.com

December 12, 2007

Beth A. Azero, Esq.
Director of Legal Administration
Universal Properties Group, Inc.
207 Quaker Lane, Suite 300
West Warwick, RI 02893

RE: KCWA / CNE

Dear Attorney Azero:

Attached please find duplicate copy of Amendment to Stipulated Approval for Water Service Activation previously forwarded to you on October 15, 2007. Please contact me as to the status of your review of the Amendment.

Very truly yours,

Maryanne Pezzullo, Esq.

MP:ld
Enclosures
Cc: Timothy J. Brown, P.E. (KCWA)
(w/o enclosures)

AMENDMENT TO STIPULATED APPROVAL FOR WATER SERVICE ACTIVATION

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WHEREAS, CNE requests of KCWA a one (1) year extension with respect to some of the stipulations set forth in said Approval to wit, clauses numbered 1, 3 and 4; and

WHEREAS, the parties have agreed that CNE shall not intermix its private water system with the KCWA water system and this provision shall be included in the subject approval of March 9, 2006; and

NOW THEREFORE, the undersigned, by this instrument, do hereby amend the Stipulated Approval for Water Service Activation dated March 9, 2006 as follows:

Clause 1 of said Approval shall be amended to read as follows:

1) Receipt of approval by the appropriate governmental bodies for the private system of CNE for exclusive water supply via wells to the entire CNE real property or the private water system via wells must be operational to support water supply no later than ~~one and one half years from the date of this approval~~. September 8, 2008.

Clause 3 of said Approval shall be amended to read as follows:

3) That if the CNE private water system via wells is in effect ~~within the period of time as stated in (1) above~~, by September 8, 2008, then the stipulations of October 19, 2005 memorialized in Water Service Conditional Approval dated November 9, 2005 (attached hereto and incorporated herein by this reference) by KCWA for water service approval for projects within the CNE real property shall no longer be necessary regarding as-built drawings and

easements, application, design, inspection and material requirements of the KCWA Rules and Regulations.

Clause 4 of ~~said~~ the March 9, 2006 Approval shall be amended to read as follows:

4) That in the event that the CNE private water system via wells ~~is not approved by the appropriate governmental bodies or~~ is not operational ~~within one and one-half years from the date of this approval~~ by September 8, 2008, then the master metering of the water system at New London Turnpike (KCWA Connection Point) and Hopkins Hill Road (KCWA Connection Point) shall be installed within 90 days of that event utilizing KCWA water at the two connection points stated and CNE shall notify KCWA no later than thirty (30) days of the approval or non-approval by the appropriate governmental bodies. The cost of said master meters and installation shall be the sole responsibility of CNE. If the master meters are not installed within 90 days of service or non-approval of governmental entities as stated in condition (3) above, service shall be terminated without notice.

In addition, CNE shall not intermix or supplement its private water system supply with the water supply of the KCWA public water system.

In all other respects other than as modified in this AMENDMENT TO STIPULATED APPROVAL FOR WATER SERVICE ACTIVATION to the STIPULATED APPROVAL FOR WATER SERVICE ACTIVATION dated March 9, 2006, we herewith re-affirm and re-acknowledge the aforesaid STIPULATED APPROVAL FOR WATER SERVICE ACTIVATION.

KENT COUNTY WATER AUTHORITY

_____ By:_____
Witness Robert B. Boyer, Chairman

Dated:_____

CENTRE OF NEW ENGLAND

_____ By:_____
Witness

Dated:_____

KCWA

Kent County Water Authority

March 9, 2006

Mr. Nicholas Cambio
Universal Properties, LLC/Centre of New England
207 Quaker Lane, Suite 300
West Warwick, RI 02893

Re: Centre of New England and all of its entities (hereafter CNE)

Dear Mr. Cambio:

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Shivai Nehal Realty, LLC (Wingate Hotel, Coventry, A. P. 7, Lot 2.1);
Commerce Park Associates 13, LLC (Pad A, Coventry, A. P. 7, Lot 2.3);
Commerce Park Associates 13, LLC (Pad B, Coventry, A. P. 7, Lot 2.10); and
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During the February 27, 2006 Special Board Meeting, the Board voted to allow water service activation to the above referenced entities located in the Centre of New England under the stipulations as follows:

1) Receipt of approval by the appropriate governmental bodies for the private system of CNE for exclusive water supply via wells to the entire CNE real property or the private water system via wells must be operational to support water supply no later than one and one half years from the date of this approval.

2) With the exception of irrigation, all entities located within the CNE real property shall be serviced to one water supply system that being the CNE private supply or master meter connection to KCWA supply.

3) That if the CNE private water system via wells is in effect within the period of time as stated in (1) above, then the stipulations of October 2005 by KCWA for water service approval for projects within the CNE real property shall no longer be necessary regarding as-built drawings and easements, application, design, inspection and material requirements of the KCWA Rules and Regulations.

4) That in the event that the CNE private water system via wells is not approved by the appropriate governmental bodies or is not operational within one and one half years from the date of this approval then the master metering of the water system at New London Turnpike (KCWA Connection Point) and Hopkins Hill Road (KCWA Connection Point) shall be installed within 90

days of that event utilizing KCWA water at the two connection points stated and CNE shall notify KCWA no later than thirty (30) days of the approval or non-approval by the appropriate governmental bodies. The cost of said master meters and installation shall be the sole responsibility of CNE. If the master meters are not installed within 90 days of service or non-approval of governmental entities as stated in condition (3) above, service shall be terminated without notice.

5) CNE shall be responsible while being serviced by KCWA for the operation and maintenance of its system from the 16" valve on New London Turnpike (KCWA Connection Point) and the 16" valve on Hopkins Hill Road (KCWA Connection Point) and that if there is any internal operational malfunction and/or contamination identified, the KCWA shall shut off service at the 16" valves as described above until such time as all requirements of KCWA and the Rhode Island Department of Health are met to reactivate service at the 16" valve and CNE shall immediately notify KCWA of any such event.

6) CNE must comply with all Rules and Regulations of the KCWA and as subsequently amended including, but not limited to, application, design, inspection and installation of infrastructure and operation and maintenance of infrastructure until such time as its private water system is activated and the KCWA system has been disconnected and physically separated from the development infrastructure at the connection point in Hopkins Hill Road and New London Turnpike.

7) All future extensions shall be applied for as required in the KCWA Regulations and subject to the approval of the KCWA until such time as the full project water system producing water via wells is operational and the connections to the KCWA system that being the 16" valve on New London Turnpike and the 16" valve on Hopkins Hill Road have been deactivated and a physical separation between the valve and pipe is completed. This separation of service between the KCWA connection and CNE piping system shall be at the sole cost of CNE.

8) The KCWA shall have the right to enter upon all real property of CNE and its successors and assigns to terminate the service for any business entity located within the CNE which has not paid its water bill and in connection with any malfunction and/or contamination as stated in 5) above.

9) CNE accepts and shall comply with the above stipulations by executing the acknowledgement prior to activation of the approved service connections.

The owner and applicant must review and execute the acknowledgements and receipt of these stipulations and return the fully executed stipulated approval to the KCWA within 20 days in order to be effective.

Very truly yours,
KENT COUNTY WATER AUTHORITY

Francis J. Perry, Jr., P.E.
Chairman

Applicant Acknowledgment of Authorized Signature

Signature

3-9-2006
Date

By execution of this stipulated approval for water service activation, applicant/owner, its successors and assigns shall fulfill all of the requirements/stipulations contained in this approval and conveyed to said applicant in this correspondence.

KCWA

Kent County Water Authority

November 9, 2005

Mr. Jeffrey C. Hanson, P.E.
John P. Caito Corporation
25 Sharpe Drive
Cranston, RI 02920

Re: Water Service Conditional Approval in lieu of Moratorium
Retail Development Pad B
Center of New England Boulevard
Coventry, Rhode Island

Dear Mr. Hanson:

As you are aware through your attendance at the Kent County Water Authority Board meeting on October 19, 2005 that accelerated development has caused a deficient condition in the high service gradient that supplies water to this project. The Authority has been studying potential initiatives to increase water supply but these initiatives will take at least three to five years to be operative as long as adequate funding can be made available and construction can move forward without any delays including permitting. After considering these factors, the Kent County Water Authority Board has reviewed your request for service and all pertinent data presented at the October 19, 2005 Board meeting and based upon representations made by you and/or your representative at the Board Meeting and by certain findings by the Board at the October 19, 2005 Board meeting the Kent County Water Authority voted to conditionally approve your request for water supply to service the above commercial site with the following conditions in lieu of a moratorium:

1. The Kent County Water Authority (KCWA) is not a guarantor of water supply for this or any other approval and KCWA can only supply water reasonably available to it and therefore any applicant/customer of KCWA understands that any third party commitments made by a applicant/customer are subject to the reasonable availability of water supply and limits of the existing infrastructure to support service.

2. A deficient condition associated with accelerated commercial and residential development exists in the area serviced by the KCWA, the KCWA is in the process of planning for additional water supply and therefore delays or diminution in service may occur if the water supply is unavailable or unable to produce water sufficient to service the customers of KCWA.

3. Ventures, commitments or agreements are at the applicant's sole risk if supply or existing infrastructure is found to be insufficient to support service. The applicant may afford the Authority with system improvements to facilitate adequate service.

4. The applicant shall file a formal application with the necessary design drawings, flow calculations, including computer hydraulic modeling to fully evaluate this project supply availability and the potential impact on the existing public water supply system. The applicant/customer understands that any undetected error in any calculation or drawing or an increase or change in demand as proposed, which materially affects the ability to supply water to the project, will be the responsibility of the applicant/customer and not the KCWA.

5. Only conservation-wise plumbing fixtures are to be installed including but not limited to low flow shower heads, low flow toilets and low flow aerators on faucets.

6. If irrigation systems are installed, they must be supplied by a private well. Xeriscape landscaping technique and/or proper planting bed (high water holding capacity) soil preparation shall be employed throughout the project.

7. Provide outstanding as-built drawings by December 31, 2005.

8. Provision of an easement acceptable to Kent County Water Authority attorney.

Very truly yours,
Kent County Water Authority

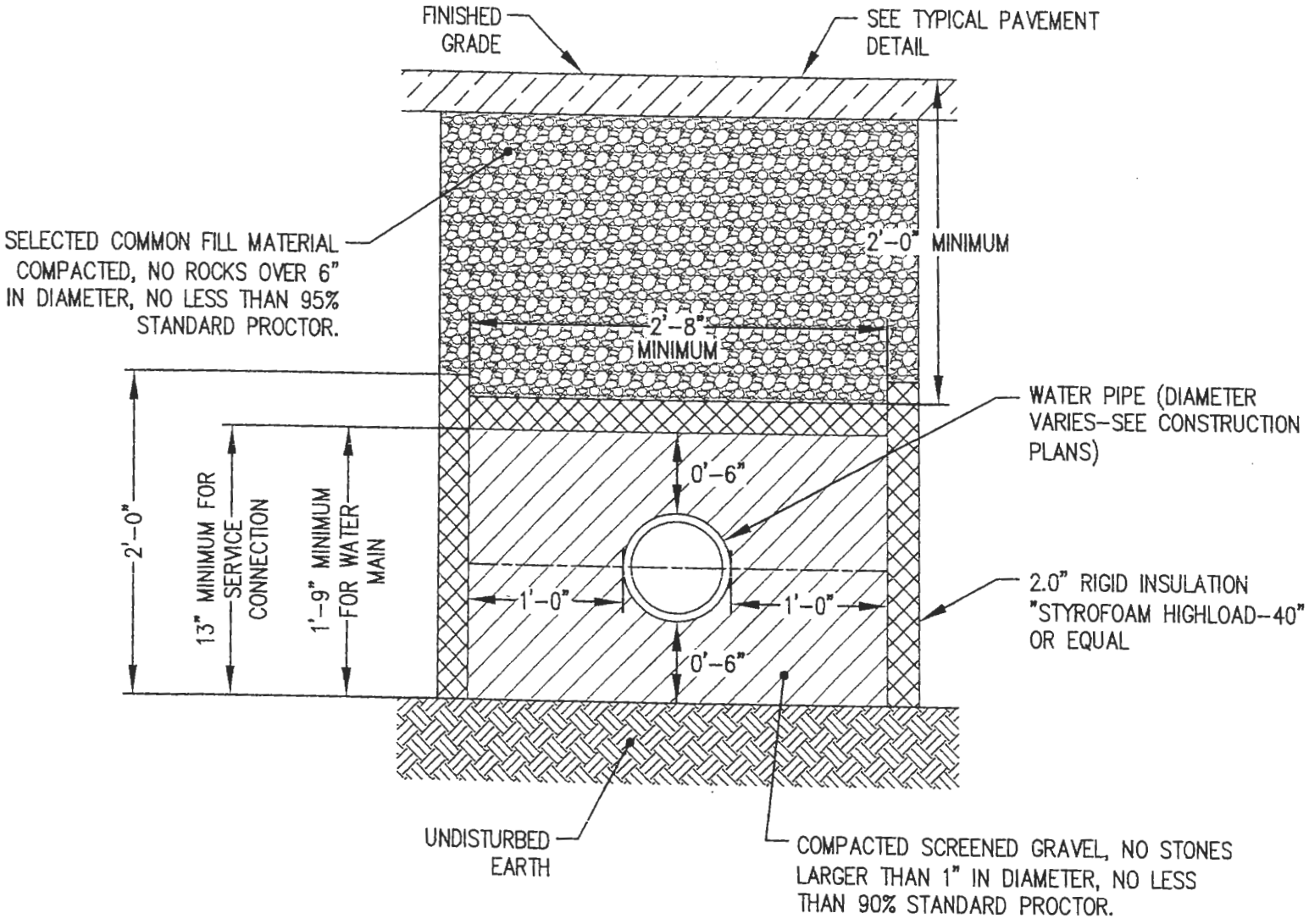
Francis J. Perry, Jr., P.E.
Chairman

cc: Joseph McGair, Attorney at Law
Board Members

FP/lms

EXHIBIT C

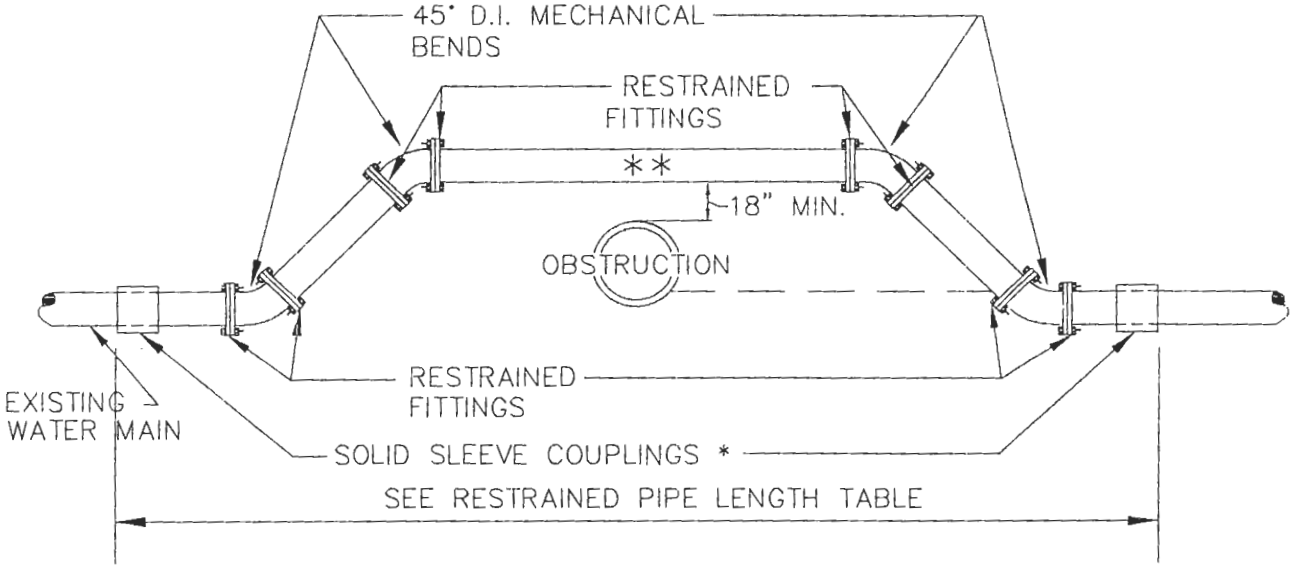
February 7, 2008

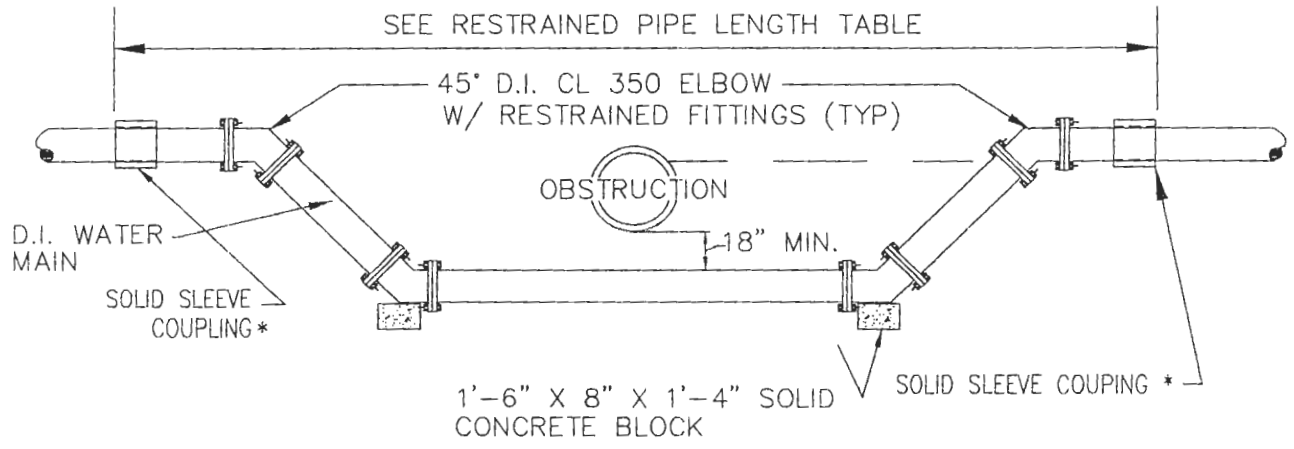


NOTE:
REFER TO "TRENCH INSTALLATION IN ROCK AND SOIL" DETAIL BY THE KENT COUNTY WATER AUTHORITY DATED 09/2006.

INSULATED WATER PIPE DETAIL

NOT TO SCALE





* TRANSITION COUPLING, DRESSER STYLE, TO BE USED ONLY WHEN EXISTING WATER MAIN IS OF DIFFERENT MATERIAL OTHER THAN DUCTILE IRON.

* SOLID SLEEVE TO BE RESTRAINED WITH APPROVED RESTRAINT FITTINGS

* ONLY TO BE USED WHEN CALCULATED FRICTION LOSS WILL NOT ADVERSELY EFFECT DISTRIBUTION PRESSURE AND FLOW

** MINIMUM DEPTH OF COVER SHALL BE 2'-0". THE WATER PIPE SHALL BE CLASS 54 AND INSULATED WITH 2" FOAMGLASS INSULATION W/ PITT WRAP OR EQUAL WHERE THE WATER PIPE HAS LESS THAN 5' OF COVER

KCWA
"proudly serving"

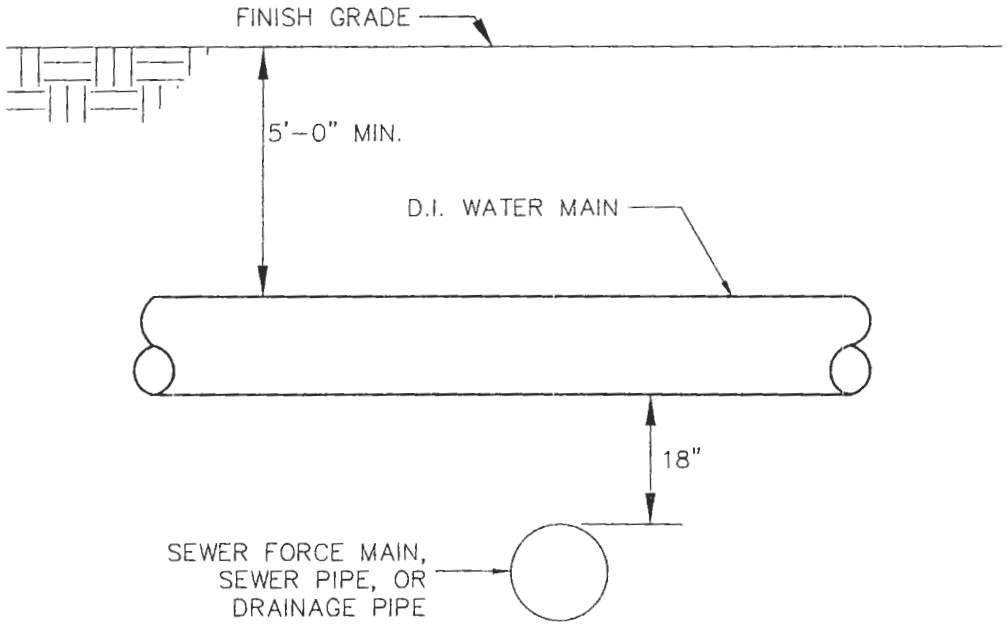
KENT COUNTY WATER AUTHORITY

WATER MAIN HORIZONTAL OR VERTICAL RELOCATION

NOT TO SCALE

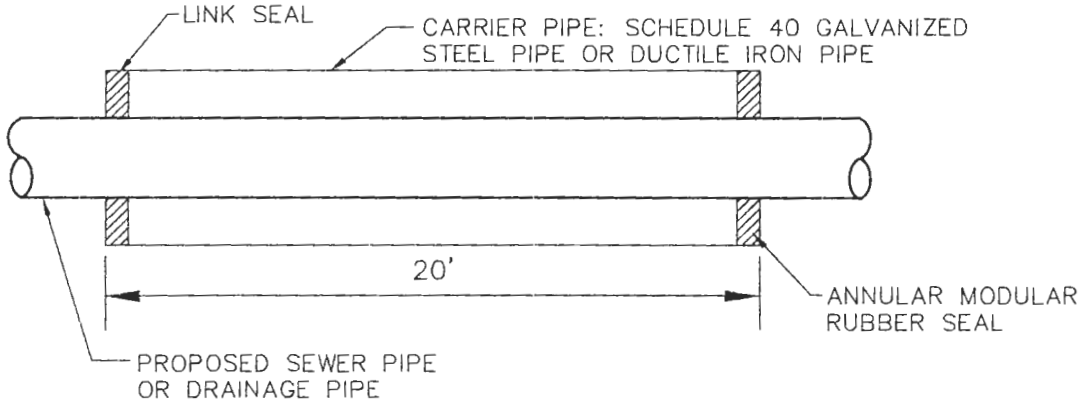
DATE: 09/2006

WMCROSV1.DWG



NOTES:

1. THE VERTICAL SEPARATION BETWEEN THE WATER MAIN AND THE PROPOSED UTILITY SHALL BE A MINIMUM OF 18 INCHES.
2. THE HORIZONTAL SEPARATION BETWEEN THE WATER MAIN AND THE PROPOSED UTILITY SHALL BE A MINIMUM OF 10 FEET.
3. IF 1 OR 2 CANNOT BE MAINTAINED THE PROPOSED UTILITY SHALL BE INSTALLED WITHIN A CARRIER PIPE UPON WRITTEN APPROVAL BY THE KCWA.
4. SEWER MAIN AND SERVICES ARE NOT ALLOWED TO CROSS OVER THE TOP OF WATER MAIN.
5. CONCRETE ENCASEMENT IS NOT ALLOWED.



CARRIER PIPE DETAIL

KENT COUNTY WATER AUTHORITY

KCWA
"proudly serving"

UTILITY SEPERATION

NOT TO SCALE

DATE: 09/2006

UTILSEPD.DWG

2.5.2 Single Unit Residential Meter Pits:

Residential meter pit or chamber shall be used for all services that exceed 200 feet in length measured along the service pipe from the curb box to the entry point in the building foundation.

2.5.3 Master Metering Optional:

2.5.3.1 Private development project infrastructure determined by the Kent County Water Authority to be of a benefit to the Authority's overall system operation may be given the option of master metering of the development or transferring the water lines to Kent County Water Authority together with ownership and maintenance. The owners of the property must provide a letter of obligation from the local fire district or government office, accepting responsibility for payment of the annual hydrant fees in all cases where the water lines will be offered to the Kent County Water Authority. Kent County Water Authority shall, solely, determine whether to assume maintenance responsibility and ownership.

2.5.3.2 Easements are required for access along private roads up to and including the curb stop or curb valve. Easements will be in a form acceptable to the Kent County Water Authority's legal counsel. Reasonable legal fees/costs are to be paid to the Authority as reimbursement by the owner/developer.

2.5.3.3 All water infrastructure designs and construction will be in full compliance with the current standards of the Kent County Water Authority and all subsequent amendments. If the developer or contractor chooses not to accept the option, then master metering shall be required of the private development in accordance with these regulations.

2.5.3.4 If flow is required to pass through a development from one existing distribution line to another existing distribution line within the system, master metering shall not be allowed. In such case the water main, after design approval by Kent County Water Authority, is to be constructed under observation by the Kent County Water Authority. Upon construction completion and acceptance approval by Kent County Water Authority, the installed property will be considered as part of the operating infrastructure. The developer shall warranty all material/workmanship of the water main and appurtenances for a period of one year from the date of construction acceptance by the Kent County Water Authority. During the warranty period the developer shall be solely responsible for any repairs or replacement of defective materials. Title to the property shall immediately transfer to Kent County Water Authority upon termination of the warranty period, and Kent County Water Authority will accept the same as part of its water system.

RULES

And

REGULATIONS

Of the

KENT COUNTY WATER AUTHORITY

EFFECTIVE
SEPTEMBER 20, 2006

$5.00 PER BOOK

EXHIBIT D

February 7, 2008

OFFICE MEMO

To: Board Members

From: Timothy Brown

Subject: Sewer Water Conflict, Village Green Condominiums, Center of New England

Date: February 5, 2008

On January 7, 2008 Kent County Water Authority received a third submission from Caito Corporation regarding proposed water infrastructure installation for the above referenced project. The cover letter ostensibly indicates that the developer installed the sewer infrastructure at a shallow elevation prior to submitting an application design to the KCWA for the proposed water infrastructure installation. The engineer now proposes to install the water infrastructure above the previously installed sewer infrastructure at a depth of cover that would allow for the water main and services to be installed not less than 2 feet, 8 inches from finished grade. This is a violation of the Kent County Water Authority Regulations which requires five feet minimum to finished grade. Therefore his submission was rejected, letter January 22, 2008.

The Kent County Water Authority regulations are based on water industry design standards and state and federal regulatory requirements that in conjunction are intended to maintain the long term integrity of the water system infrastructure and water quality for public consumption.

- Rhode Island (International) Plumbing Code, Section 305.6 states that water service shall be installed below recorded frost penetration, but not less than 4 feet, 6 inches below grade.

- National Fire Protection Association (NFPA) Section 10.4 indicates the depth of cover of a water pipe shall be determined by the maximum depth of frost penetration under locality where the pipe is laid and that the top of the pipe shall be buried not less than 1 foot below the frost line for the locality (generally this is because fire

systems do not usually experience flow consistent with typical distribution mains). This section states that in those locations where frost is not a factor the depth of cover shall not be less than 2 ½ feet to prevent mechanical damage (insulation would not be a factor of concern in trench stability). This also clarifies that pipe under driveway shall be buried a minimum of 3 feet.

- AWWA Ductile Iron Pipe and Fittings Manual of Water Supply Practices M41 indicates that special design considerations should be used for pipe under roads and highways with less than 2.5 feet of cover because of the possibility of high dynamic loading. This loading could result in damage to the pavement or pipes. Section 11.10 of this manual indicates that installations that require special attention, techniques and materials such as pipe insulation have not been considered in the M41 technical considerations. This is interpreted to mean that the reference to special design consideration for pipe under roads and highways with less than 2 ½ feet of cover does not include the affects of insulation and that this water industry design standard only pertains to standard proctor compact trench gravel.

- Ductile Iron Pipe Research Association technical bulletin, Truck Loads on Pipe Buried at Shallow Depth, states that depths of cover of less than 2 ½ feet is generally not recommended under roads and highways due to the possibility of dynamic loads. Such loads could result in damage to the pavement and pipes. This technical sheet did not discuss insulated pipe, but set the basis on uniform load distribution over the affect of pipe length for standard trench materials.

KCWA water and sewer separation requirements were not fully considered by the engineer in the initial public water design/application submission. This has been purported by the engineer to be primarily because the developer moved forward with the installation of the sewer before receiving approval from the KCWA and was hoping for a variance to the requirements. The long term protection of water quality as it relates to public health and safety is a paramount consideration of which responsibility lies solely with the licensed operator of the water system.

- Federal law makes the water system responsible for water quality to the last running tap.

- Rhode Island Department of Health (RIDOH) Regulation's 9 states that any person maintaining a public water system shall operate and maintain the water supply facilities so that the water furnished for public is safe and potable. Section 10 Correction of Unsafe Conditions states that when the water from the public water system is not safe or subject to contamination as determined by the director, the person maintaining such public water system shall take immediate action to correct sanitary defects, improve operation, provide necessary water treatment or make any other changes or additions deemed necessary by the Director to provide safe water. This section also indicates that any person maintaining a water system who is aware of an unsafe condition that the water is not safe or is subject to contamination shall notify the Director immediately.

- Kent County Water Authority Regulations require that sewer mains be installed below the water main similarly to the requirements of the plumbing code, RIDEM Regulations, Ten State Standards and AWWA Standards.

The premise for these standards and regulatory mandates is to assure that the public water supplier ensure that these public health and safety water quality considerations are fully incorporated into project design considerations that will ultimately receive public water supply. These types of design considerations provide a measure of certainty that should a leak occur in the sewer system the effluent discharge will not contaminate the soils in close proximity to the water main. Or should a coincident casualty, such as a main break result, vulnerability of the exposed water system would be greatly reduced by compliance with the separation regulation. RIDOH Regulations require the licensed operator to assure safety in public supply and mandates the corrections of unsafe conditions on the water supplier. The Kent County Water Authority could not approve or accept this type of a design. By doing so, the Kent County Water Authority would be responsible to correct the unsafe conditions resultant from noncompliance with the industry standards for installation. In this most recent submission the engineer now proposes to

install the water main above the sewer in the roadways at a depth of cover less than that prescribed in the aforementioned water industry and state regulatory code and standards. Doing this would subject the water main to the influences of frost penetration along with truck loads which could not only compromise the integrity of the pipe, but the surrounding pavement. There is also concern regarding the small service pipe that must connect from the water main to the homeowner's service. The gooseneck at the tap for these small service pipes pushes them closer to finished grade than the crown of the pipe. KCWA has experienced many frozen service complaints from shallow installations throughout the system. The frequency of occurrences varies depending on the climatic conditions. Approving designs that proliferate future problems and increases vulnerability to water quality concerns is in grave contrast to the regulatory mandates. Therefore, the Authority has no alternative except to have the system installed properly.

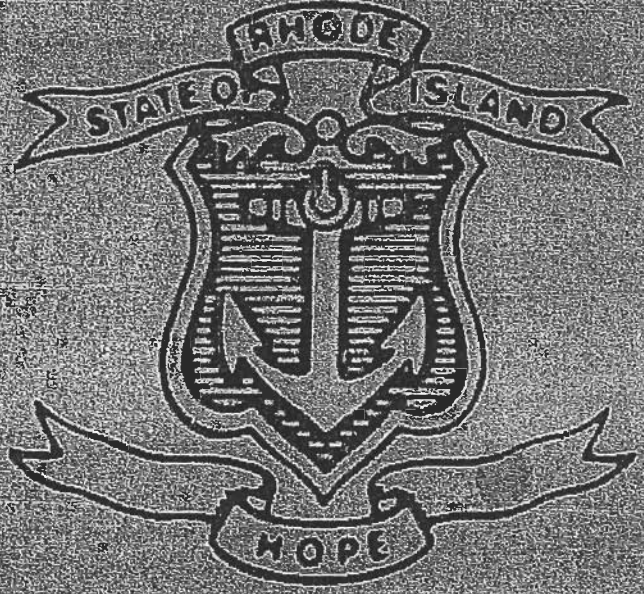
RULES AND REGULATIONS PERTAINING TO PUBLIC DRINKING WATER

[R 46-13-DWQ]

SEPTEMBER 1977

AS AMENDED

January 1983
September 1989 (E)
December 1990
May 1991 (E)
July 1991
August 1991 (E)
November 1991 (E)
February 1992
February 1992 (E)
July 1992 (E)
December 1992 (E)
March 1993 (T)
April 1993 (E)
June 1993
September 1993
March 1994
July 1994
January 1995
February 1996 (E)
June 1996 (E)
August 1996
September 1999
April 2000 (T)
June 2001
January 2002 (re-filing in accordance with the provisions of section 42-35-4.1 of the Rhode Island General Laws, as amended)
January 2003
January 2005



RHODE ISLAND DEPARTMENT OF HEALTH

OFFICE OF DRINKING WATER QUALITY

Section 8.0 (Reserved)

Section 9.0 *Assurance of Safety in Public Supply*

9.1 Any person maintaining a public water system shall operate and maintain the water supply facilities so that the water furnished the public is safe and potable.

9.2 *Contamination of Tanks*

Connected to Unsafe Supplies

(a) Any person who maintains a public water system connection to a tank which is also supplied with water from a water system found by the Director to be unsafe shall maintain the tank open to atmospheric pressure, and the public water supply pipe shall terminate at least two pipe diameters above the maximum level of water in the tank. The tank overflow shall be of adequate size to fix definitely the maximum level.

Avoidance of Contamination in Tanks

(b) Any person who is furnished water from a public water system and maintains a tank supplied only by such water shall have such tank so constructed and maintained to prevent contaminants from gaining access to the tank interior.

9.3 *Connections Between Distribution Systems*

(a) No person shall maintain a physical connection joining a public water system with any other water system, unless such connection is approved by the Director.

(b) It is the responsibility of the public water system to register all existing or proposed connections between the PWS and any other water supply with the Director on or before January 1, 1992 or as they are proposed or discovered, whichever is later.

Section 10.0 *Correction of Unsafe Conditions*

10.1 When the water from a public water system is not safe or is subject to contamination, as determined by the Director, the person maintaining such public water system shall take immediate action to correct sanitary defects, improve operation, provide necessary water treatment, or make any other changes or additions deemed necessary by the Director to provide safe water.

10.2 Any person maintaining a water system who is aware of an unsafe condition, that the water is not safe or is subject to contamination, shall notify the Director immediately.

Section 11.0 *Reports as to Public Supplies*

11.1 Any person maintaining a public water system shall submit or cause to be submitted by operating personnel such reports of operation pertaining to the sanitary quality, treatment and

RHODE ISLAND
STATE BUILDING CODE

Regulation SBC-3 - 2004
State Plumbing Code
July 1, 2004

Replaces Regulation SBC-3
Dated September 1, 2002

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Administration
BUILDING CODE STANDARDS COMMITTEE
One Capitol Hill
Providence, RI 02908-5859
(401) 222-3033
FAX NO. (401) 222-2599

8TH edition

RI plumbing code

Chapter 3

General Regulations

Add the following section to IPC section 301.4

301.4.1 Prohibited Connections. The use of potable water as an open loop, single pass heat exchange fluid for the refrigeration cycle of HVAC equipment is prohibited.

Delete IPC section 305.6 and substitute the following:

305.6 Freezing: Water service shall be installed below recorded frost penetration but not less than four feet six inches below grade. In climates with freezing temperatures, plumbing piping in exterior building walls or areas subjected to freezing temperatures. shall be protected against freezing by insulation or heat or both.

Delete IPC section 305.6.1 and substitute the following

305.6.1 Sewer Depth: Building sewers that connect to private sewage disposal systems shall meet the requirements of the Department of Environmental Management's Regulations for Individual Sewage Disposal Systems. Building sewers connecting to a public sewer shall be a minimum of 36" inches below grade.

Delete IPC section 312.1 and substitute the following:

312.1. Required Tests: The permit holder shall make the applicable tests prescribed in Sections 312.2 through 312.9 to determine compliance with the provisions of this code. The permit holder shall give reasonable advance notice to the code official when the plumbing work is ready for tests. The equipment, material, power and labor necessary for the inspection and test shall be furnished by the permit holder and the permit holder shall be responsible for determining that the work will withstand the test pressure prescribed in the following tests. All plumbing system piping shall be tested with either water or air in accordance with sections 312.3 or 312.5. Under no circumstances is plastic to be tested with air pressure above 5 psi. After the plumbing fixtures have been set and their traps filled with water, the entire drainage system shall be submitted to final tests. The code official shall require the removal of any cleanouts if necessary to ascertain whether the pressure has reached all parts of the system.

Ductile-Iron Pipe and Fittings

MANUAL OF WATER SUPPLY PRACTICES

M41

Second Edition

American Water Works Association

Advocacy
Communications
Conferences
Education and Training
▸ **Science and Technology**
Sections

The Authoritative Resource for Safe Drinking Water℠

4.3 TRUCK LOADS ON PIPE BURIED AT SHALLOW DEPTHS[7]

4.3.1 Introduction

Special design considerations should be used for pipe under roads and highways with less than 2.5 ft (0.76 m) of cover because of the possibility of high dynamic loading. This loading could result in damage to the pavements or the pipes. Also, if the impact factor is anticipated to be greater than 1.5, then a higher value should be applied. An impact factor, *F*, of 1.5 is consistent with American Society of Civil Engineers (ASCE) Manual No. 37.[8] For any given project, the ultimate responsibility for the proper use of the equations and other data provided rests with the design engineer.

4.3.2 Procedure

The procedure for calculating truck loads on buried ductile-iron pipe is provided in ANSI/AWWA Standard C150/A21.50. This procedure is based on the teachings of Spangler and others, and it employs the same procedures used in the design standard ANSI A21.1[9] for cast-iron pipe. The design method is based on the following two assumptions:

- a single concentrated wheel load at the surface
- uniform load distribution over an effective pipe length of 3 ft (0.914 m)

The truck load on pipe buried under flexible pavement is given by Eq 4-2.

The surface load factor, *C*, is a measure of how the wheel load at the surface is transmitted and distributed through the soil to the pipe. *C* is given by Eq 4-3.

This equation is derived from Holl's integration of the Boussinesq formula for vertical unit pressure, assuming the load is to be determined on a 3-ft (0.9-m) section of pipe directly under the point load.

Regarding the point load assumption, the following Boussinesq equation (Eq 4-7) gives the vertical stress at any point in an elastic medium when a point load is exerted at the surface.

$$\sigma_z = \left(\frac{3P}{2\pi}\right)\left(\frac{H^3}{R_1^5}\right) \qquad (4\text{-}7)$$

Where:

σ_z = vertical stress, psi (kPa)
P = point load at surface, lb (kN)
H = depth, in. (m)
R_1 = distance from the point load to the point at which the stress is to be determined, in. (m) (Figure 4-3)

Integration of the Boussinesq equation (Eq 4-7) over the rectangular area over the pipe (as shown in Figure 4-3) results in the total load on a 3-ft (0.914-m) section of pipe as a result of the point load, *P*, at the surface. Equation 4-3 is a function of this integration. The quantity *bD* in the denominator of Eq 4-2 yields the desired units of pounds per square inch in expressing the truck load. The result thus represents an "average" pressure on the 3-ft (0.914-m) length of pipe centered under the load.

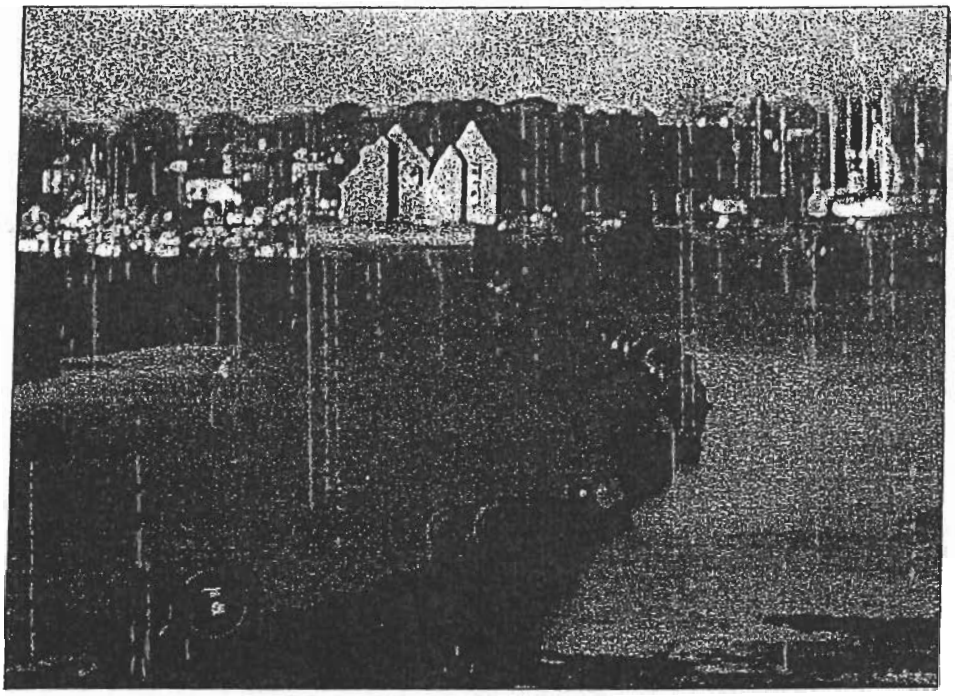


Figure 11-17 Subaqueous pipe being floated into position

Another method of installation is to assemble the pipeline on shore and either float it into position by means of barrels or floats attached to the pipe (Figure 11-17), which are punctured or released in a controlled fashion when the pipe reaches the desired position, or drag it into position along the bottom. Joints should not be allowed to become overly deflected or subjected to excessive beam load during the installation process.

A somewhat similar method is to assemble the pipe on shore, attach floats, and pull the pipe down skids into the water as each length is connected. The line extends further into the water as each successive length is laid and the finished line is submerged in the manner described previously.

Subaqueous lines laid in navigable streams must be placed in trenches and covered to protect them from damage or displacement by ship or boat traffic. Where applicable, procedures should conform to appropriate governmental regulations.

11.10 OTHER INSTALLATIONS

Installations that require special attention, techniques, and materials have not been considered in this section. These installations require special considerations based on many influencing factors. This is best accomplished by competent engineering design in consultation with representatives of the materials manufacturers. Such installations include the following:

- piping through rigid walls
- certain piping on supports aboveground or underground (see chapter 4 of this manual and Figure 11-18 and Figure 11-19)

- piping requiring insulation
- treatment plant or pumping station piping (Figure 11-20)
- pipe in unstable soil (Figure 11-21)
- industrial piping
- piping through geologically hazardous areas
- piping in high-density stray current environments
- piping across bridges
- trenchless installations (sliplining of larger mains, horizontal directional drillings, microtunneling, pipe bursting, etc.)

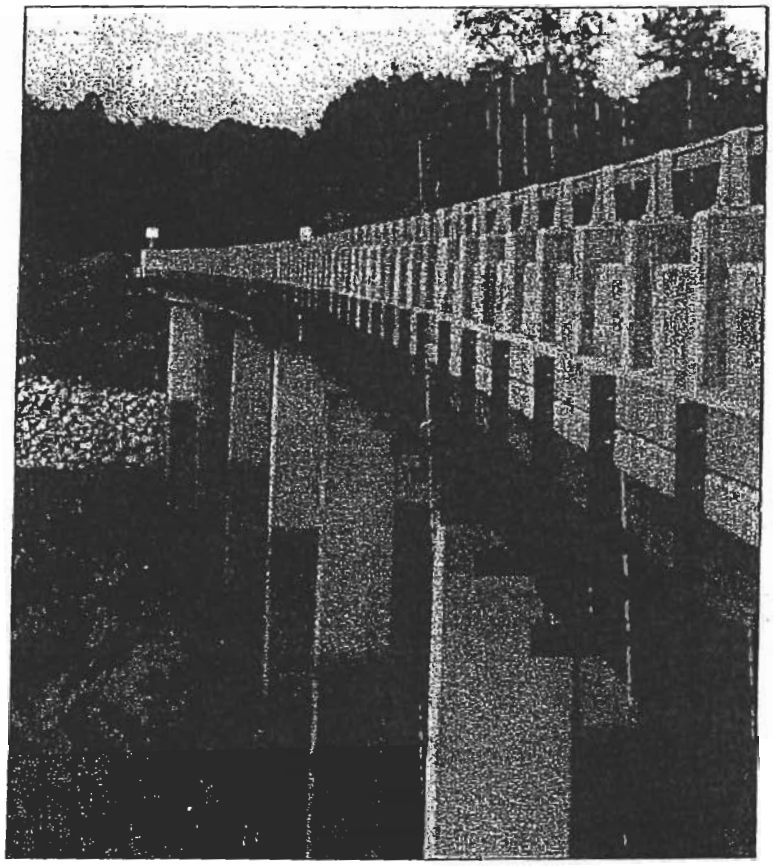
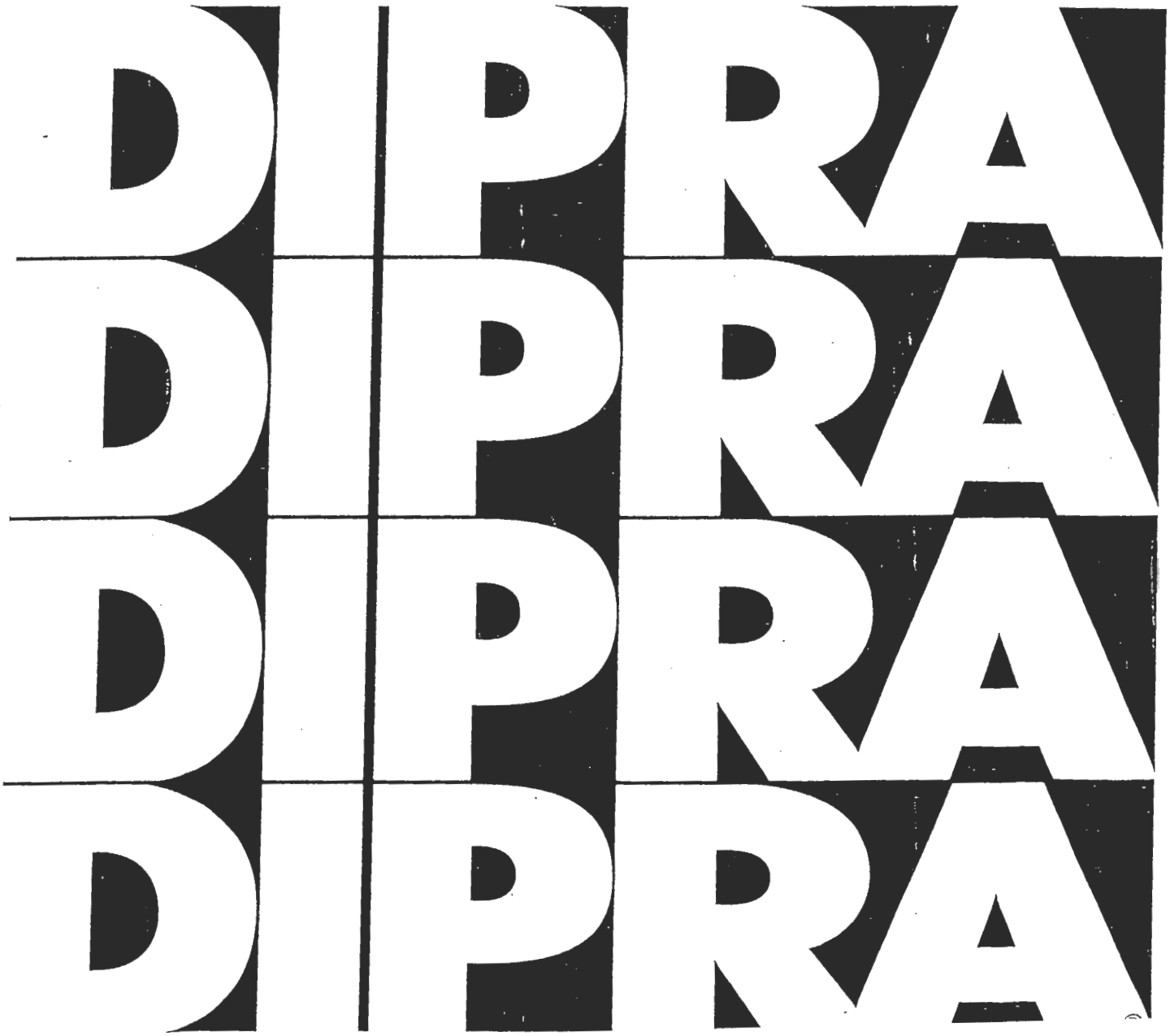


Figure 11-18 Ductile-iron pipe installed on a bridge

TRUCK LOADS ON PIPE BURIED AT SHALLOW DEPTHS



TRUCK LOADS ON PIPE BURIED AT SHALLOW DEPTHS

By
Richard W. Bonds, P.E.
DIPRA Research/Technical Director

Depth of cover less than 2½ feet is generally not recommended under roads and highways due to the possibility of high dynamic loading. Such loadings could result in damage to the pavements and/or the pipes. If impact factors higher than 1.5 (which is used in this paper) are anticipated, then such should be employed. For any given project, the ultimate responsibility for the proper use of the equations and other data provided in this paper rests with the design engineer. Call DIPRA with questions before applying this paper.

The procedure for calculating truck loads on buried Ductile Iron pipe is provided in ANSI/AWWA Standard C150/A21.50.[1] This procedure is based on the teachings of Merlin Spangler and others and utilizes the same procedures used in the venerable design standard ANSI A21.1[2] for Cast Iron pipe. The design method is based on two assumptions:

1. A single concentrated wheel load at the surface, and
2. Uniform load distribution over an effective pipe length of 3 feet.

The truck load on pipe buried under flexible pavement is given by Equation 5 in ANSI/AWWA C150/A21.50. It is shown below as Equation 1.

Equation 1

$$P_t = RF\,\frac{CP}{bD}$$

where

- P_t = Truck load in pounds per square inch
- R = Reduction factor (see Table 4 in C150/A21.50). This factor takes account of the fact that the part of the pipe directly below the wheels receives the truck superload in its full intensity but is aided in carrying the load by adjacent parts of the pipe that receive little or no load from the truck.
- F = Impact factor of 1.5 (this is consistent with ASCE Manual No. 37)[3]
- C = Surface load factor
- P = Wheel load in pounds (for design purposes, 16,000 lbs., for a single AASHTO H-20 truck on unpaved road or flexible pavement)
- b = Effective pipe length of 36 inches
- D = Outside diameter of the pipe in inches

The surface load factor, C, is a measure of how the wheel load at the surface is transmitted and distributed through the soil to the pipe. C is given by Equation 6 in C150/A21.50 and is shown here as Equation 2

where

- H = Depth of cover in feet
- A = Outside radius of the pipe in feet

This equation for the surface load factor, C, is derived from Holl's integration of the Boussinesq formula for vertical unit pressure, assuming the load is to be determined on a 3-foot section of pipe directly under the point load.[4]

Equation 2

$$C = 1 - \frac{2}{\pi}\,ARCSIN\left[H\sqrt{\frac{A^2+H^2+1.5^2}{(A^2+H^2)(1.5^2+H^2)}}\right] + \frac{2}{\pi}\left(\frac{1.5\,AH}{\sqrt{A^2+H^2+1.5^2}}\right)\left[\frac{1}{A^2+H^2}+\frac{1}{1.5^2+H^2}\right]$$

NOTE: Angles are in radians.

Regarding the point load assumption, the following Boussinesq equation (Equation 3) gives the vertical stress at any point in an elastic medium when a point load is exerted at the surface,

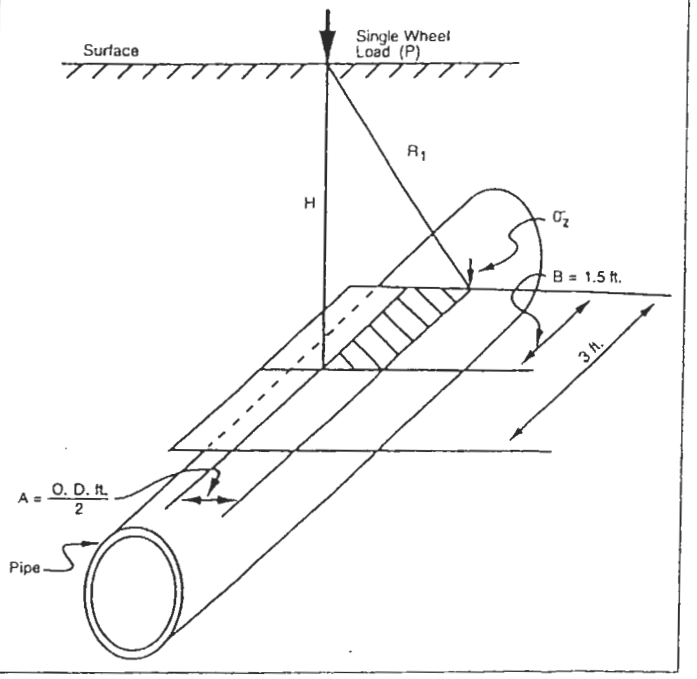
Equation 3

$$\sigma_z = \left(\frac{3P}{2\pi}\right)\left(\frac{H^3}{R_1^5}\right)$$

where

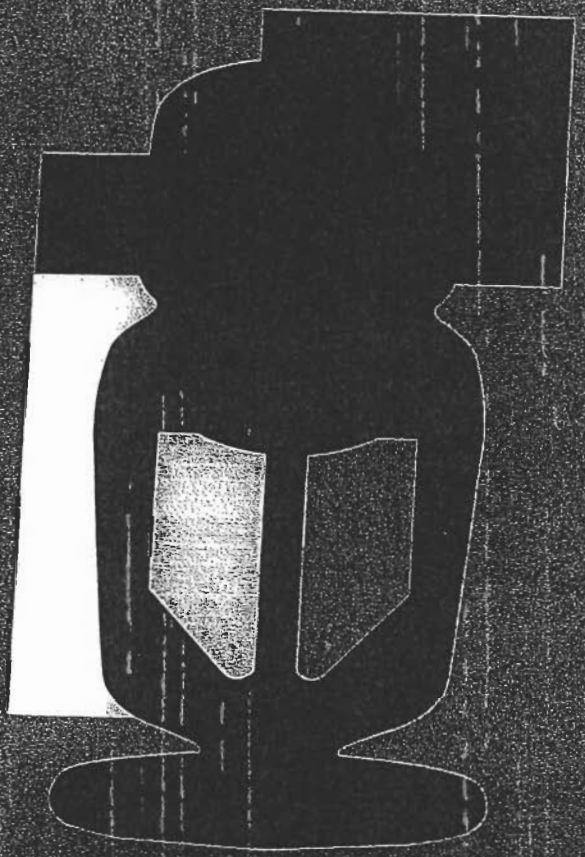
- σ_z = Vertical stress in pounds per square inch
- P = Point load at surface in pounds
- H = Depth in inches
- R_1 = Distance from the point load to the point at which the stress is to be determined in inches (See Figure 1)

Figure 1
SINGLE WHEEL LOAD



NFPA 13

Installation of Sprinkler Systems



2002 EDITION

NFPA INTERNATIONAL

[illegible] fittings shall be permitted for [illegible] in their listings, but not less than [illegible]

10.2.4 Buried Joints. Joints shall be approved.

10.2.5 Buried Fittings. Fittings shall be of an approved type [illegible] pressure class ratings compatible with the pipe [illegible]

10.3 Joining of Pipe and Fittings.

10.3.1 Threaded Pipe and Fittings. All threaded steel pipe and fittings shall have threads cut in accordance with ASME B1.20.1, *Pipe Threads, General Purpose (Inch).*

10.3.2 Welded Pipe and Fittings. Welding methods that comply with the applicable requirements of AWS B2.1, *Specification for Welding Procedure and Performance Qualification*, shall be permitted as means of joining steel piping.

10.3.3 Groove Joining Methods. Pipes joined with grooved fittings shall be joined by a listed combination of fittings, gaskets, and grooves.

10.3.4 Brazed and Pressure Fitting Methods. Joints for the connection of copper tube shall be brazed or joined using pressure fittings as specified in Table 10.2.1(a).

10.3.5 Other Joining Methods. Other joining methods listed for this service shall be permitted where installed in accordance with their listing limitations.

10.3.6 Pipe Joint Assembly.

10.3.6.1 Joints shall be assembled by persons familiar with the particular materials being used and in accordance with the manufacturer's instructions and specifications.

10.3.6.2 All bolted joint accessories shall be cleaned and thoroughly coated with asphalt or other corrosion-retarding material after installation.

10.4 Depth of Cover.

10.4.1* The depth of cover over water pipes shall be determined by the maximum depth of frost penetration in the locality where the pipe is laid.

10.4.2 The top of the pipe shall be buried not less than 1 ft (0.3 m) below the frost line for the locality.

10.4.3 In those locations where frost is not a factor, the depth of cover shall be not less than 2½ ft (0.8 m) to prevent mechanical damage.

10.4.4 Pipe under driveways shall be buried a minimum of 3 ft (0.9 m).

10.4.5 Pipe under railroad tracks shall be buried at a minimum of 4 ft (1.2 m).

10.4.6 The depth of cover shall be measured from the top of the pipe to finished grade, and due consideration shall always be given to future or final grade and nature of soil.

10.5 Protection Against Freezing.

10.5.1* Where it is impracticable to bury pipe, pipe shall be permitted to be laid aboveground, provided the pipe is protected against freezing and mechanical damage.

10.5.2 Pipe shall be buried below the frost line where entering streams and other bodies of water.

10.5.3 Where pipe is laid in water raceways or shallo streams, care shall be taken that there will be sufficient depu of running water between the pipe and the frost line during al seasons of frost; a safer method is to bury the pipe 1 f (0.3048 m) or more under the bed of the waterway.

10.5.4 Pipe shall be located at a distance from stream bank and embankment walls that prevents danger of freezing through the side of the bank.

10.6 Protection Against Damage.

10.6.1 Pipe shall not be run under buildings.

10.6.2 When pipe must be run under buildings, special precautions shall be taken, including the following:

(1) Arching the foundation walls over the pipe
(2) Running pipe in covered trenches
(3) Providing valves to isolate sections of pipe under buildings

10.6.3 Fire service mains shall be permitted to enter the building adjacent to the foundation.

10.6.4 Where adjacent structures or physical conditions make it impractical to locate risers immediately inside an exterior wall, such risers shall be permitted to be located as close as practical to exterior walls to minimize underground piping under the building.

10.6.5 Where a riser is close to building foundations, underground fittings of proper design and type shall be used to avoid pipe joints being located in or under the foundations.

10.6.6 Mains shall be subjected to an evaluation of the following specific loading conditions and protected, if necessary:

(1) Mains running under railroads carrying heavy cargo
(2) Mains running under large piles of heavy commodities
(3) Mains located in areas that subject the main to heavy shock and vibrations

10.6.7* When it is necessary to join metal pipe with pipe of dissimilar metal, the joint shall be insulated against the passage of an electric current using an approved method.

10.6.8 In no case shall pipe specified in 10.6.7 be used for grounding of electrical services.

10.7 Requirement for Laying Pipe.

10.7.1 Pipes, valves, hydrants, and fittings shall be inspected for damage when received and shall be inspected prior to installation.

10.7.2 The torquing of bolted joints shall be checked.

10.7.3 Pipe, valves, hydrants, and fittings shall be clean inside.

10.7.4 When work is stopped, the open ends of pipe, valves, hydrants, and fittings shall be plugged to prevent stones and foreign materials from entering.

10.7.5 All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench using appropriate equipment and carefully examined for cracks or other defects while suspended above the trench.

10.7.6 Plain ends shall be inspected for signs of damage prior to installation.

10.7.7 Under no circumstances shall water main materials be dropped or dumped.

MEETING MINUTES

Subject:	**Master Meter for CNE, Village Shoppes & Hotel, Village Green and Potential for a car max development on the N. E. Turnpike side.**
Attendees:	**CNE Representatives Rober Rapoza, Benjamin Caito, Jeffery Hanson & Construction Manager Ray, KCWA Representatives Timothy Brown & John Duchesneau**
Date:	**December 7, 2007**

The following items were discussed:

1. Master Meter for Center of New England – Ben Caito indicated that C & E Engineering recommend a 10 inch meter for the master meter connection. Caito Corporation will be reviewing the installation of two backflow preventers to increase flow in this type of configuration. The master meter location will be in the vicinity of Wendy's on the New London Turnpike side. There was also talk of installation of a master meter on the Hopkins Hill Side. This was considered by the developer so that at some point the water main could be connected through the development with a master meter on each end. The thought was that water supply from both sides through the development would help benefit overall flow within the development. Backflows on each side would facilitate this type of configuration.

2. Village Shoppes and Hotel – Mr. Rapoza requested the ability to install a tap and sleeve and bring the main across Center of New England Boulevard to temporarily liven up hydrants. Universal Properties would pay the hydrant rental fees on a temporary basis until the master meter connection is made at the Wendy's site. Universal Properties would ensure that pressure testing and disinfection are properly completed prior to activation of the hydrants for this temporary period. No domestic water will be taken until the master meter is installed.

3. Village Green – The overall utility infrastructure installation was discussed. It was noted that the sewer design showed a conflict with Kent County Water Authority Regulations

regarding water and sewer separation. Mr. Rapoza indicated that Universal Properties originally was developing the site with the intention of wells and that the sewer was designed with wells in mind. Upon granting approval for water supply by the Board, they attempted to design the water infrastructure to fit in with the sewer infrastructure that had already been installed. The Kent County Water Authority will not allow the installation of the water infrastructure in conflict with its Regulations, Rhode Island Department of Health Regulations and Rhode Island Department of Environmental Management Regulations. The engineer is to reevaluate the design for relocation of the conflicting sewer to accommodate the separation requirements. Kent County Water Authority authorized installation of some of the water main that currently does not present conflict with the sewer so that the project developer could move forward at their own risk.

4. Mr. Rapoza mentioned the potential for a car max development on the New England Turnpike side and a residential component on the Hopkins Hill side both with the intent of being fed through the master metered mains.

THE CENTRE
OF NEW ENGLAND

December 10, 2007

KCWA
Timothy Brown, PE
1072 Main Street
West Warwick, RI 02893

Dear Tim,

As per the issues discussed at our meeting of December 7, 2007, I am relaying to you the following information regarding Village Green Condominium project location at the Centre of New England:

It is my understanding that we may proceed, at our own risk, with the installation of the water main on the entrance road to the Village Green as this portion of the project is not affected by the modifications to the plans currently being prepared by Caito Engineering as a result of our meeting on Friday, December 7, 2007.

Sincerely,

Robert J. Rapoza
Director of Real Estate

OFFICE MEMO

To: File

Subject: Village Greene, Center of New England

Date: December 12, 2007

Kent County Water Authority representatives John Duchesneau and Timothy Brown met with Benjamin Caito and Jeff Hanson and Scott from Universal Properties Construction to discuss the Village Green sewer/water conflict resolution. Ben presented a plan that entailed lowering the entire sewer to correct the situation. This was amenable to the Kent County Water Authority. Caito Corporation will submit revised infrastructure plans for the site on behalf of Universal Properties.

MEETING MINUTES

Subject: **Center of New England, Village Greene Condominiums Re: Sewer and Water conflicts in the design.**

Attendees: **John Caito, Ben Caito, Construction Manager Scott, Timothy Brown & John Duchesneau**

Date: **January 3, 2008**

John Caito indicated there were two options. 1. Re-lay the sewer line and 2. Lay the water at a shallow depth and insulate it. He indicated two foot, eight inch depth of bury to the crown of the water pipe. Some problems discussed with this revolved around frost heaves and that it violates Kent County Water Authority Regulations. Mr. Caito indicated they were reluctant to re-lay the sewer. The option of wells was discussed and Mr. Caito said that they did still have the option to install wells if they chose to. Mr. Caito indicated they were requesting relief from the depth of bury requirements of the Kent County Water Authority Regulations. It was his opinion that his proposal could be compliant with the DEM Regulations if he didn't have to install the water at the proper depth. Discussion also included that at the last meeting Caito Corporation and the developer's representative indicated that they would re-lay the sewer line to resolve the matter and that Caito Corporation would submit a new design plan reflecting this. Mr. Caito indicated that they didn't want to do this and he felt that he could provide an engineered solution by installing the water at a shallower depth, using the sewer pipe as installed. Mr. Caito indicated that in a master meter situation they should be allowed to lay the water at a shallow depth because it is their responsibility in the end. It was discussed that the ultimate responsibility for water quality by federal law lies with the Kent County Water Authority and that even though a master meter provides more flexibility for the developer all of the standards and requirements of the Kent County Water Authority must be followed as it pertains to the water installation. The Kent County Water Authority's concern is with contamination issues which fall solely on the responsibility of the Kent County Water Authority should that occur. It was indicated that the developer has the option to submit whatever design they preferred for review, but the potential existed to reject the submission if it did not comply with the Kent County Water Authority Regulations as this was a complete new installation. Mr. Caito indicated that Caito Corporation would be making a submission that with the design showing the water at a shallower depth and that was about the end of the meeting.

KCWA

Kent County Water Authority

January 22, 2008

Mr. Benjamin J. Caito
John P. Caito Corporation
141 James P. Murphy Highway
West Warwick, RI 02893

Re: Phase 6a and J
Village Green
Center of New England Boulevard
January 7, 2008 Correspondence

Dear Mr. Caito:

We have reviewed the information contained in your submission and provide the following comments:

1. The installation of the water main with less than 5 feet of cover is inconsistent with the requirements contained in the Kent County Water Authority Regulations. AWWA, and Ductile Iron Pipe Research Standards do not recommend shallow depths of bury under roadways as suggested in your design. This is due to the possibility of dynamic loading and potential for mechanical failure. The installation of insulation in the shallow trench only further exacerbates this situation. Rhode Island Plumbing Code requires the pipe to be installed six inches below the record frost penetration and not less than 4' 6". Industry Standards do not support the methodology in the design as submitted.
2. The sewer and water main separation requirements contained in the Kent County Water Authority Regulations must be incorporated into the design. The installation of infrastructure prior to receiving approval by the Kent County Water Authority is at the developer's own risk. In order to provide public water service to this development the developer must redesign the sewer in such a manner that it complies with the separation requirements contained in the Kent County Water Authority Regulations. This will require relocation of any conflict sewer infrastructure.

We await your revised submission so we may continue the review process. A copy of the Kent County Water Authority Regulations can be obtained at our office or online at www.kentcountywater.org. Please feel free to call us if you have any questions regarding this matter.

Very truly yours,
Kent County Water Authority

Timothy J. Brown, P.E.
General Manager Chief Engineer

TB/lms

PO Box 192
West Warwick, RI 02893-0192
401-821-9300

EXHIBIT E

February 7, 2008

KENT COUNTY WATER AUTHORITY
DISTRIBUTION STORAGE TANK HYDRAULIC EVALUATION
FEBRUARY 7, 2008

PRESENTATION AGENDA

SCOPE OF STUDY

- Existing Tank Facilities / Adequacy / New Tanks
- Existing & Future Consumer Demands – Impact on Tank / Modeling & Regulatory
- Executive Summary & Five Stand Alone Technical Memorandums

TECHNICAL MEMORANDUM 1 – DATA & STUDY REVIEW

- Review Existing Data / WSSMP / Studies / Town Comp Plans / Planners
- 20 Year Change in Population in Service Territory - Increase 7.8 percent (4,667 persons)

TECHNICAL MEMORANDUM 2A – WATER SYSTEM EVALUATION CRITERIA

- Figure 1 – Storage Tank Components (Operational, Equalization, Emergency, Fire, Dead)
- Nominal vs. Effective Storage at 20 psi; Equalization Storage at 35 psi
- Equalization and 25% ADD Ratio, Emergency Equal to ADD (recommended guide)

TECHNICAL MEMORANDUM 2B – EXISTING WATER STORAGE FACILITIES

- Field Survey of Existing Tanks (Tiogue and Read School Tank Not Done)
- All Tanks Within +/- 0 – 0.7 Feet Except West Street (- 2.5 feet)

TECHNICAL MEMORANDUM 3A – EXISTING AND FUTURE WATER DEMANDS

Scenario	Existing Demands	Future Demands (population change & 10% factor)
ADD	10.97 MGD	13.37 MGD
MDD	21.12 MGD	25.66 MGD
PH	25.26 MGD	30.78 MGD

- Overall 22% Demand Increase – Greatest in C, EG & WG

TECHNICAL MEMORANDUM 3B – SYSTEM ANALYSIS CRITERIA

- Steady State (SS) & Extended Period (EP) Hydraulic Analysis Simulations (ADD & MDD)
- Diurnal Flow Curve (PH during MDD); Fire Flow Analysis – EP on MDD

TECHNICAL MEMORANDUM 4A – STORAGE ANALYSIS - EXISTING DEMAND

- Maximum Customer Service Elevations for Water System (35 psi criteria)
  - Low Service - 244 feet; High Service & RSHR (new tank) - 405 feet
- Figure 2 - Existing System "Low" Pressure Locations
- Effect of Clinton Avenue PS on Customers and Tanks
- Issues & Recommendations for Fiskeville, West Street and Wakefield Street Tanks
- Low Service Tanks (without Fiskeville) 15% of existing ADD as Equalization – Not Adverse
- High Service Tanks 26% of existing ADD as Equalization
- Read School House Tank 150% of existing ADD as Equalization
- System Emergency Storage Less Than ½ ADD – Multiple Supply Source = Better Benefit

TECHNICAL MEMORANDUM 4B – EXISTING DEMAND FIRE FLOW ANALYSIS

- Hydraulic Model to Predict Fire Flow in System - MDD (500 – 3500 gpm)
- Context of Model Fire Flow Results (20 psi minimum, existing low pressure and MDD)
- Figure 3 – Color Coded Map of Available Fire Flow and Service Elevations (244, 405)
- Figure 4 – Color Coded Map of Available Fire Flow and 6 Inch Water Main Diameter

TECHNICAL MEMORANDUM 5A – STORAGE ANALYSIS – FUTURE DEMAND

- Fiskeville Removed; High Service and RSHR Interconnected at 500 feet
- Low Service (Hope Road & Reduced) Demands (excludes Oaklawn)
  ADD = 8.61 MGD MDD = 16.54 MGD PH = 19.15 MGD
- High Service Gradient (Tiogue, RSHR & Reduced)
  ADD = 4.35 MGD MDD = 8.28 MGD PH = 10.67 MGD

- Totals ADD = 12.96 MGD MDD = 24.82 MGD PH = 29.82 MGD

- Storage Tank Facility "Turn Over" and Cycle – Regulations & Effects (Cl, color, taste, etc.)
- Need to Balance Tank Volume (increase) vs. Turnover
- Turnover - ADD 6 – 14 Days (RSHR & Carr); MDD 3 – 14 Days (Carr)

- Future System ADD from 10.61 to 12.96 MGD or 22 percent increase
- Future Low Service ADD from 7.27 to 8.61 MGD - 18 percent increase
- Future High Service ADD from 3.34 to 4.35 MGD - 30 percent increase

- West Street & Wakefield Continue Problematic Under Future Demand & Clinton Avenue PS

- High Service Pressure Gradient
  - Ratio of Equalization to ADD of 31% vs. guide of 25%
  - No Additional Storage Capacity Required -- All Components of Storage Adequate

- Low Service Pressure Gradient
  - Tanks Effectively Meet Future Demands – Clinton Avenue PS & West / Wakefield
  - Any New Storage to Consider Clinton Avenue PS and Other System Tanks
  - No New Tanks in Low Service (at this time) Other Than Planned Mishnock Tank

- Mishnock Treatment and Storage Project – System Storage Analysis / Benefits
  - Greater Usable Storage Volume for LS & HS (Effective Storage Increase)
  - No Detrimental Effect from Clinton Avenue PS
  - Existing LS Tanks Not Adversely Affected
  - Stabilize Pressure Across Low Service During High Demand (Johnson Boulevard PS)
  - Area in System Where Future Growth Likely to Occur
  - Ease Demand on Frenchtown Road Tank - "stressed" in the summer
  - Ratio of Equalization to ADD in Low Service Increase From 13% to 17% with Tank.

TECHNICAL MEMORANDUM 5B – FUTURE DEMAND FIRE FLOW ANALYSIS

- Hydraulic Model to Predict Fire Flow in System - MDD (500 – 3500 gpm) – similar to 4B

EXHIBIT F

February 7, 2008

EXECUTIVE SUMMARY

This project related to utilizing the updated computerized hydraulic model of the Kent County Water Authority to complete a detailed hydraulic study and evaluation of the entire supply and distribution system for the next twenty (20) year planning period. This included the entire Kent County Water Authority service area of approximately 390 miles of water main, 27,800 services and all water producing, storage and wholesale distribution facilities. The evaluation considered the system demand for both the existing and the projected planning period and an evaluation of the ability of water system infrastructure components to effectively meet these demands. This included consideration of: supply capability, storage capacity, storage location, transmission and distribution capacity, pressure and flow limitations, and the ability of the water system to effectively meet distribution system demand including fire flow for the planning period.

The need for this project stemmed from concerns related to operation of the existing water storage facilities including their ability to provide adequate supply under various demand conditions and to effectively "turn-over" an adequate volume of water in the storage facility on a routine basis. Water "turn over" has been determined to be critical to ensure that water quality in the storage facilities is not compromised. Stagnant water conditions are considered a potential threat to water quality including loss of disinfectant residual, taste and odors. C&E evaluated the water storage facilities and provides recommendations for water storage facility improvements to eliminate these stagnant conditions.

The evaluation considered what existing facilities are viable and what, if any, new facilities would be necessary to meet future projected water demands and ensure a high level of water quality and supply reliability. Areas within the distribution system that realize substandard pressures when the supply and transmission pump stations are off line were identified and reviewed. Solutions for these conditions were examined. The evaluation determined the viability and effectiveness of existing facilities and provides recommendation for either upgrade or new facilities that may be necessary to meet future demands to ensure a high level of water quality and supply reliability.

The format of the study included preparation of five (5) Technical Memorandums each of which includes a specific task evaluation related to the project. The goal was to provide stand-alone documents which detail the various subtasks that comprised the evaluation. A summary description of the scope for each of the Technical Memorandums follows along with the significant findings and conclusions.

Technical Memorandum 1 – Data Collection, Review and Existing Water System Analysis
The information gathered as part of this task provided the basis and foundation for evaluation and analysis of this study and ultimately for development of recommendations and conclusions. The policies and goals of the Authority and anticipated future growth within the service community which would impact water demand were critical factors. This included a review of the Authority's Strategic Plan and Goals, the Water Supply System Management Plan, Hydraulic Model Study and Update, latest Capital Improvement Program, various task orders associated with water supply availability in

the High Service Gradient and Comprehensive Community Plans of the Cities and Towns serviced by the Authority.

This also included meeting with local City and Town Planning Officials to determine planned or projected population changes and significant economic development. A review of the existing model studies was conducted to ensure that conclusions and recommendations were still valid. A review of the Capital Improvement Program was completed to quantify those projects that have been completed or are currently in progress or are to be undertaken in the future. The data was reviewed to ensure that current and planned improvements continued to meet the strategic supply, storage and transmission goals of the Authority. Finally, a meeting with Authority staff was conducted to review current system operations and to identify system problems and deficiencies.

Overall population growth within the customer service territory through the year 2020 is projected to increase by 7.8 percent (4,667 persons). This included service population changes of (-0.7%) for Warwick, (+4.6%) for West Warwick, (+12.2%) for Coventry, (+28.8%) for West Greenwich, and (+13.2%) for East Greenwich. No projections for Cranston, North Kingstown or Scituate were completed as these comprise a relatively insignificant customer base and the Authority has no intention on increasing its service territory within these communities. It must be noted that these projections represent changes in customer services based on existing service territory and may not reflect total change in population within the particular community. For example, the City of Warwick is served in part by the Authority and by the City water system.

Identification of existing deficiencies and problematic areas in the service system were both specific (i.e. known areas of low pressure and flow) and general (i.e. elimination of dead ends, loop water mains and increase flushing). Specific areas of concern, which primarily related to areas of low pressure, were identified within each community and were considered in subsequent portions of the evaluation.

Technical Memorandum 2A – Development of Water System Evaluation Criteria
The criteria by which the existing and any proposed water storage facilities were evaluated and if necessary sized was developed and reviewed as part of this evaluation. This included development of criteria to be utilized to evaluate the water supply and distribution system and the design of any proposed improvements which is summarized below.

- The volume of effective storage is that which provides a minimum pressure of 20 psi in the distribution system.

- The volume of equalization storage is that which provides a minimum required 35 psi in the distribution system up to the tank overflow elevation.

- The measure by which the adequacy of total equalization storage is premised upon achieving 25% of the system average day demand.

- The final method of determining a reliable and reasonable equalization storage volume will be through use of the hydraulic model including examining the system under an extended period simulation.

- The fire flow volume is that volume which provides a minimum of 20 psi residual pressure up to the bottom of the equalization storage.

- A diagram of each tank facility in the system with each of the various storage components identified along with a total of each storage component by pressure zone.

These criteria were utilized to evaluate existing tank facilities in the system in order to gauge their effectiveness for the immediate and long term planning goals. These criteria would also be the basis for any new storage facilities that may be required for the planning period.

An overview of the various types of storage facilities (ground storage reservoir, standpipe and elevated storage) was completed which also included a description and cataloging of the ten (10) existing water storage facilities. There exist two tank facilities at the Fiskeville Tank site.

Low Service Gradient Storage Facilities

- Crompton (Setian Lane) Ground Storage Reservoir – 3,000,000 gallons
- Fiskeville (Seven Mile Road) Underground Storage Reservoirs – 1,500,000 gallons aggregate
- Frenchtown Road Ground Storage Reservoir – 1,500,000 gallons
- Wakefield Street Ground Storage Reservoir – 1,500,000 gallons
- West Street Ground Storage Reservoir (off line) – 1,000,000 gallons

High Service Gradient Storage Facilities

- Carr Pond Standpipe Storage – 3,000,000 gallons
- Technology Park Elevated Storage – 1,500,000 gallons

Tiogue Tank Service Gradient Storage Facility (to be re-serviced from High Service Gradient)

- Tiogue Avenue Ground Storage Reservoir – 771,000 gallons

The following is a description of each of the various components of storage for tank facilities.

The water levels in a storage tank above which a minimum distribution system pressure of 35 psi can be maintained are comprised of two distinct components. These include the *operational* and *equalization storage. Operational storage* is defined by the upper portion of the tank volume below the overflow and above the water level where the supply / booster pumps are set to routinely operate. This is the volume in the tanks that is set to routinely cycle on a daily basis.

Directly below the *operational storage* is the *equalization storage*, which is that volume of tank storage that meets water system demands that are in excess of the pumping or supply capacity of the water system. This storage component is located below the *operational storage* and above the *emergency and fire storage*.

The bottom of the *operational storage* volume is also defined by the water level in the tank at which 35 psi would be available at the highest service elevation. Storage located below the *equalization storage* zone is referred to as *emergency and fire storage* and provides at minimum a pressure of 20 psi at the highest service elevation within the distribution system. The water volume that is dedicated to *emergency and fire storage* should always be available in the tank and is only utilized during emergency purposes as would occur during a fire.

Any water in the tank below the *emergency and fire storage* zone is considered ineffective or *dead storage*. Water in this zone cannot effectively supply the entire distribution system with a minimum pressure of 20 psi.

Additional classification of storage volumes includes *effective storage* which is that water volume below the *operational storage* zone and above the *dead storage* zone. Theoretically, this volume of water is always available to the water system to meet peak hour, fire and emergency needs. Therefore, the total *nominal storage* volume of a tank does not provide a true indication of the available *effective storage* volume that would be readily available for use in the water system under all demand conditions.

Technical Memorandum 2B – Existing Water Storage Facilities
A field survey of eight of the existing facilities was completed in order to verify elevation set points for the base and overflow elevations of the Authority's existing storage tanks. Two facilities, the Read School House Road Tank and Tiogue Avenue Tank, were not included as these facilities would be replaced by a new tank and demolished due to re-servicing, respectively.

Specific efforts associated with this task included verification of the base and overflow elevations of the existing storage facilities by a registered professional surveyor, setting bounds at each of the tank sites to identify and benchmark a site elevation at each tank site, locating tanks and taking measurements necessary for height determination at base and overflow elevations and installing benchmark bounds at each tank site where granite bound property markers do not exist.

STORAGE TANK FACILITY OVERFLOW ELEVATIONS

STORAGE TANK FACILITY	SURVEYED OVERFLOW ELEVATION (FEET)	GRADIENT OVERFLOW ELEVATION (FEET)
Technology Park Tank	500.69	500
Carr Pond Tank	500.1	500
Frenchtown Road Tank	334.03	334
Setian Lane (Crompton) Tank	334.6	334
Wakefield Street Tank	333.7	334
West Street Tank	331.5	334
Seven Mile (Fiskeville) Tank 1	334.6	334
Seven Mile (Fiskeville) Tank 2	334.6	334

Technical Memorandum 3A – Existing and Future System Demands
This Technical Memorandum established consumer water demands for the current (2006) and future (2025) planning period including average day, maximum day and peak hour demand conditions for use in computer hydraulic modeling scenarios. Demands were tabulated by community and by pressure gradient and entered into the model database. In addition system wide diurnal flow curves were developed which predict the variation in water use throughout the system at certain times of the day. These flow curves are critical for extended period simulation (EPS) model analysis. These curves allow the model to gauge and predict how the water system responds to periods of increased demand especially during peak hour periods and under fire flow conditions.

The following table represents the current (2006) water demands for each of the various demand scenarios as presented in the hydraulic model.

CONSUMER DEMAND BY PRESSURE ZONE (2006)

PRESSURE ZONE	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
Low Service (334') Gradient	5.393	10.237	11.844
Tiogue Tank (350') Gradient	0.086	0.176	0.200
Intermediate High (430') Gradient (RSHR)	0.397	0.811	0.924
High Service (500') Gradient	2.323	4.379	5.828
Low Service Reduced (334') Gradient	1.871	3.727	4.320
High Service (500') Reduced Gradient	0.528	1.035	1.274
Warwick Wholesale Interconnection (232') Gradient	0.006	0.010	0.011
Hope Road (510') Gradient	0.006	0.013	0.014
Oaklawn (231') Gradient	0.361	0.736	0.847
TOTALS	**10.97 MGD**	**21.12 MGD**	**25.26 MGD**

Future water demands for the 20-year planning period were predicated upon a projection of population change to the year 2025, planned development in the service area and an additional 10% factor for growth which would account for unplanned growth and potential "in fill" development. This was consistent with the demand projection period provided in the 2007 update to the Authority's Water Supply System Management Plan.

The following includes the significant factors which contributed to the future demand estimates.

- All High Service Pressure Gradient developments that were previously approved and all planned development projects known to the Authority which have yet to be approved were included.

- Based on the anticipated increase in service population by community previously, water demand was proportionally increased by this amount for each community. For example, the service population is expected to increase by 4.6% in West Warwick. Therefore, water demands are projected to increase in West Warwick by an equal amount.

- The specific area of future development and growth is not quantifiable. Future consumer demands were distributed globally across the particular community in which they are projected to occur.

- In order to account for unanticipated growth (i.e. growth that would result in water demand increase), a conservative estimate of a 10% increase in water demand was allocated across the entire service territory for the planning period.

- A change in the anticipated demand usage for large users which includes Amgen, ON Semiconductor and Centre of New England was considered.

CONSUMER DEMAND BY PRESSURE ZONE (2025)

PRESSURE ZONE	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
Low Service (334') Gradient	6.357	12.055	13.950
New (500') Read School House Gradient	0.498	1.016	1.159
High Service (500') Gradient*	3.170	5.935	7.872
Low Service Reduced (334') Gradient	2.246	4.474	5.187
High Service (500') Reduced Gradient	0.679	1.331	1.636
Warwick Wholesale Interconnection (232') Gradient	0.006	0.011	0.013
Hope Road (510') Gradient	0.007	0.014	0.016
Oaklawn (231') Gradient	0.404	0.824	0.948
TOTALS	**13.37 MGD**	**25.66 MGD**	**30.78 MGD**

The total system demand for the planning period for all three demand scenarios is anticipated to increase by approximately 22%. The most significant increase is expected to occur within the existing 500 foot High Service Gradient (31%). The communities with the greatest increase in demand by percentage include Coventry (25%), West Greenwich (46%) and East Greenwich (27%). In terms of overall greatest volume increase, the Low Service Gradient is anticipated to increase by approximately 1.34 MGD or roughly 18%.

Technical Memorandum 3B – Existing and Future Water System Capabilities
This Technical Memorandum established the various steady state and extended period hydraulic model simulations that were conducted to determine fill and draw rates of the existing water storage

Steady state simulations at 2006 and 2025 demands:

- Average Day Demands
- Maximum Day Demands
- Peak Hour Demands (during Maximum Day)
- Maximum Day Demand Plus Fire Flow

Extended period simulations at 2006 and 2025 demands:

- Maximum Day Demands at 48 hour time period

Technical Memorandum 4A – Existing Storage Facility Analysis (Existing Demand Conditions)
This Technical Memorandum evaluated the existing water storage facilities within the distribution system including their ability to meet existing system demands, provide adequate system pressure, and provide fire flow reserve which was based on previously developed criteria. The hydraulic model was utilized to determine the capability of the water system under average and peak demand (maximum day) conditions as well as fire flow conditions while reviewing storage and supply capacities to ensure that they meet operational and regulatory requirements. Each of the storage facilities was evaluated in order to assess their effectiveness in meeting existing system demands. The operation of the existing storage tanks under various demand conditions was reviewed and recommendations were presented.

Current consumer demands for the Authority's service territory were categorized for each of the major pressure zones as depicted in the following table. This table excludes the Oaklawn Service Gradient which is supplied directly from Providence Water and not interconnected to any of the Authority Service Gradients.

CURRENT CONSUMER DEMANDS BY PRESSURE GRADIENT

PRESSURE ZONE	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
Low Service (334') Gradient	7.27	13.98	16.18
High Service (500') Gradient	2.94	5.59	7.30
Read School House Road (500') Gradient	0.40	0.81	0.92
TOTALS	**10.61 MGD**	**20.38 MGD**	**24.40 MGD**

The storage tank facilities in each of the major pressure zones were evaluated with regard to components of storage and associated volume totals were developed for each tank facility. The storage volume component assessment was based on maintaining a water elevation in the storage tank that would supply a minimum pressure of 35 psi (Authority Standard) at the highest customer service elevation and a minimum pressure of 20 psi (AWWA and NFPA standard) at any location within the distribution system for fire flow and emergency condition. This was also premised on maintaining adequate storage volumes in the storage tank(s) that would ensure sufficient capacity to meet normal daily (operational storage) and peak system demands (equalization storage). The maximum customer serviceable elevations were determined to be as follows.

MAXIMUM CUSTOMER SERVICEABLE ELEVATION BY PRESSURE GRADIENT

PRESSURE ZONE	35 PSI SERVICE ELEVATION	TANK(S) OVERFLOW ELEVATION
Low Service (334') Gradient[1]	244 feet	334 feet
High Service (500') Gradient[2]	405 feet	500 feet
Read School House Road (500') Gradient	405 feet	500 feet

[1]Includes Low Service Reduced Gradient and Hope Road Gradient
[2]Includes High Service Reduced Gradient and Tiogue Tank Service Area

There exist certain locations within the pressure gradients, which are above these identified service elevations and have pressures below 35 psi. These include areas that have marginal pressure (20 psi and less) as well as areas that have pressures below the 35 psi regulatory standard of the Authority Regulations when Clinton Avenue Pump Station is in operation. The operation of the Clinton Avenue Pump Station is instrumental in maintaining pressure at some of these locations.

All the identified low pressure locations may not directly impact service customers as these locations also occur at high points along transmission mains with no services, areas around storage reservoirs, on the suction side of booster pump stations and upstream side of PRV stations. These locations were depicted on a system map.

It was determined that operation of the Clinton Avenue Pump Station on a near continual basis creates difficulties with several storage tanks in the Low Service Gradient. This relates to the inability of these storage tank facilities to "turn over" and they routinely remain in a "locked up" condition due to the pump head from the pump station, which is above the overflow of these tanks. However, it is also

recognized that there is an inherent need to operate Clinton Avenue in this mode primarily due to the necessity to maintain adequate pressures at higher customer service elevations, to provide upwards of 70% of water supply to the water system, the need to replenish distant water storage tanks in the Low Service Gradient and to provide supply to booster pump stations and PRV stations that supply other pressure gradients that rely on the Low Service Gradient as the primary source of supply.

Recommendations regarding the various storage facilities in the distribution system are as follows.

- The Fiskeville Reservoirs in the Low Service Gradient should be permanently removed from service as these storage facilities are maintained in a continued "locked up" condition due to their proximity to the Clinton Avenue Pump Station. Due to their location at the extreme northern end of the system and the inherent problems associated with maintaining sanitary conditions for below grade structures, it is not considered practical to maintain these facilities in operational service. Additionally, these facilities predated the construction of the Clinton Avenue Pump Station and have become "obsolete" over the years as the distribution system and customer service area has grown and expanded. The general service area surrounding these reservoirs will be re-serviced from the High Service Gradient to alleviate low pressures in this portion of the system.

- The West Street and Wakefield Street Tanks are routinely maintained in a "locked up" condition due to their proximity to the Clinton Avenue Pump Station.

  The West Street Tank was constructed in 1956 and was rehabilitated in 2002. Due to its "locked up" condition, it is not considered significant to the daily water system operations. It is considered significant in terms of fire and emergency storage due in part to its location in the system which includes proximity to densely populated urban areas and mill complexes.

  The Wakefield Street Tank was constructed in 1990 and is in good condition. This tank is beneficial in supplying daily peak system demands and fire and emergency storage. With the addition of new pipeline infrastructure associated with the new Providence Water emergency connection, it is anticipated that this tank will remain in a "locked up" condition on a frequent basis. These new pipelines will increase the flow of water from Clinton Avenue Pump Station to the general area and the pump head will influence the tank.

  Due to the critical nature of these tank facilities, it was recommended that alternatives be evaluated to maintain these facilities in operation while promoting tank cycling or turnover. Potential methods include booster pump stations (West Street Tank) and valve stations to isolate the tank (Wakefield Street Tank). These methods will be further evaluated in the CIP.

On the basis of the established customer service elevations, the volumes for the various storage components for each of the storage tanks were calculated. Figures for each tank facility were developed which detailed the storage components and critical elevations in each tank. The various components of storage are summarized for each pressure zone which included removing the Fiskeville Reservoirs from service.

SYSTEM STORAGE TANKS – TOTAL COMPONENT VOLUMES

PRESSURE GRADIENT	EFFECTIVE STORAGE (MG)	OPERATIONAL STORAGE (MG)	EQUALIZATION STORAGE (MG)	FIRE & EMERGENCY STORAGE (MG)	"DEAD" STORAGE (MG)
Low Service (334') Gradient	5.295	1.123	1.123	4.172	1.046
High Service (500') Gradient	2.748	0.350	0.770	2.173	1.171
Read School House Road (500') Gradient	0.900	0.300	0.600	0.600	0

A review of the available historical tank charts indicate that the Authority has been able to maintain an adequate water level in each of the storage tanks within the ranges as indicated for maintaining an adequate consumer system pressure of 35 psi and a fire flow pressure of 20 psi for the serviceable elevations in each pressure zone.

The measure of the sufficiency of the volume of the equalization storage component was determined as the capability to maintain 25 percent of the average day demand. This is a general standard and was also reviewed with additional evaluations such as extended period hydraulic modeling and tank charts to ensure that the storage tanks fill and drain at acceptable rates and maintain adequate water elevation under all demand conditions. Maintaining equal or greater than 25 percent volume of average day demand in equalization storage does not in of itself ensure that a particular storage facility is sufficient in size or capacity. Similarly, maintaining less than 25 percent volume of average day demand in equalization storage does not necessarily indicate that a particular tank is insufficient in size or capacity.

- The Low Service Gradient tanks in total (without Fiskeville Reservoirs) provide 15 percent of the existing average day demand. In terms of the recommended standard of 25 percent, this is considered deficient in that the storage tanks do not provide the recommended 25 percent of average day demand.

- The High Service Gradient tanks in total provide 26 percent of the existing average day demand. In terms of the recommended standard of 25 percent, this is considered adequate in that the storage tanks provide the recommended 25 percent of average day demand.

- The Read School House Road Gradient tank provides 150 percent of the existing average day demand. In terms of the recommended standard of 25 percent, this is considered adequate in that the storage tank provide the recommended 25 percent of average day demand.

Extended period model simulations for average and maximum day (with peak hour demand) indicate that all of the distribution system storage tanks operate within a range as defined for operational and equalization storage. There were no scenarios under which the dedicated volume for fire and emergency storage protection was depleted.

It is concluded that the Low Service Gradient storage tanks while only providing 15 percent of the recommended 25 percent volume average day demand in equalization storage are not adversely affected in this regard.

In addition, each of the distribution system storage tanks in all the pressure gradients (excluding Fiskeville Reservoirs) has adequate fire reserve at an elevation such that 20 psi minimum is maintained for a theoretical fire flow rate of 3,500 gpm for a duration of three hours which equates to a total volume of 630,000 gallons.

The combination of all storage tanks in the system provides a total emergency storage volume of 2.57 MGD, which is approximately 24% of the overall average day system demand of 10.61 MGD. This is premised on maintaining the fire flow volume of 630,000 gallons within each tank and does not include "dead" storage, which is not available to the system at a minimum of 20 psi. The volume of emergency storage that a particular water system maintains is usually a function of the perceived "emergency". A general rule is that a water system without a sufficient redundant source of supply should maintain at minimum one day's volume of average day demand. Water systems with backup or redundant sources of supply often rely on a considerable less volume for emergency storage.

The Authority relies upon the wholesale connection with Providence Water at Clinton Avenue Pump Station to supply the majority (70 percent) of water supply to the system. Disruption of this supply connection will severely hamper the supply capability of the water system. There are however alternate existing sources of supply available to the Authority, which could be relied upon to provide water to the system in an emergency situation and assuming that water use restrictions would be put in place. These include well facilities (East Greenwich, Spring Lake and Mishnock) and the Quaker Lane Pump Station (wholesale supply from Warwick Water) which collectively would have the ability to meet average day system demands. Additionally, the new emergency connection at Providence Water will temporarily back up Clinton Avenue Pump Station during non peak demand periods.

It is therefore considered that the Authority has emergency supply source capability, which has a greater value on a day-to-day basis in the case of emergency than a distinct volume of water in storage tanks, which would be readily depleted in an emergency. It was concluded that the Authority has a greater benefit in redundant supply sources than any available emergency storage in the tanks and that the 24 percent volume of emergency storage to average day demand is sufficient.

Technical Memorandum 4B – Available Fire Flow Analysis (Existing Demand Conditions)
An analysis of the entire water distribution system under current demand maximum day conditions was performed utilizing the hydraulic model in order to determine available fire flow rates throughout the water system. This included performing an evaluation to determine the fire flow rate in gallons per minute (gpm) that would be available for each of the various water main segments in the hydraulic model and developing a color-coded map depicting the various ranges of available fire flow rates at each water main within the water system.

The criteria to determine available fire flow rates included specifying a minimum fire flow of 500 gpm and a maximum fire flow of 3,500 gpm. These rates correspond to the upper and lower ranges in the model for the purposes of this analysis and are typical for a service territory such as the Authority's that consists of a mixed use of urban, suburban, commercial and industrial uses. All fire flow rates were determined based upon a minimum residual pressure of 20 psi at the fire flow location and a minimum system pressure of 0 psi. It was necessary to establish the minimum system pressure at 0 psi due to the fact that there exist locations within the distribution system that routinely experience pressures below 20 psi during non fire flow conditions.

In order to locate specific areas of calculated available fire flow rates on a system wide basis, the results were color coded on a system map. As a means to compare available fire flow rates to conditions in the system, which could adversely affect fire flows, two additional maps were prepared. These included a color-coded map of all pipelines in the system which are 6 inches in diameter and smaller and a contour map of previously determined customer service elevations in the Low and High Service Gradients.

This allows a comparison of areas within the system that contain pipelines less than 6 inches in diameter with areas in the system with available fire flows of less than 1,000 gpm. If an area has a calculated fire flow of less than 1,000 gpm, the pipeline diameter map can be used to indicate if this same area also has pipelines that are less than 6 inches in diameter. Generally, pipelines 6 inches in diameter and less are inadequate in capacity to support fire flows of 1,000 gpm or higher and could in part be contributing to a "low" calculated fire flow.

Similarly, a contour map of the entire distribution system was developed which depicts those areas in the Low and High Service Gradients that are above the "serviceable" elevations. The serviceable elevation for the Low Service was determined to be 244 feet and the serviceable elevation for the High Service was determined to be 405 feet. If a particular area has calculated fire flows of less than 1,000 gpm, the contour map can be used to indicate if this same area has high elevations, which may indicate low pressures. High elevations could in part be contributing to a "low" calculated fire flow.

Technical Memorandum 5A – Storage Facility Analysis (Future Demand Conditions)
This Technical Memorandum evaluated the existing water storage facilities within the distribution system including their ability to meet future projected consumer demands for the planning period, provide adequate system pressure and provide fire flow reserve based on previously developed criteria. This criterion was presented in Technical Memorandum 2A along with the future consumer

demands developed in Technical Memorandums 1 and 3. The hydraulic model was utilized to determine the capability of the water system under future average and peak demand (maximum day) conditions as well as fire flow conditions while reviewing storage and supply capacities to ensure that they meet operational and regulatory requirements under the future planning period. Each of the storage facilities was evaluated in order to assess their effectiveness in meeting future (20-year planning period) system demands. The operation of the existing storage tanks utilizing the future projected consumer demands under various demand conditions was reviewed and recommendations were provided.

Projected consumer demands for the project-planning period (2025) of the Authority's service territory were categorized for each of the major pressure zones as depicted in the following tables. This table excludes the Oaklawn Service Gradient which is supplied directly from Providence Water and not interconnected to any of the Authority Service Gradients.

LOW SERVICE GRADIENT (334') FUTURE (20 YEAR) CONSUMER DEMANDS

PRESSURE ZONE	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
Low Service (334') Gradient	6.357	12.055	13.950
Low Service Reduced (334') Gradient	2.246	4.474	5.187
Hope Road (510') Gradient	0.007	0.014	0.016
TOTALS	**8.61 MGD**	**16.54 MGD**	**19.15 MGD**

HIGH SERVICE GRADIENT (500') FUTURE (20 YEAR) CONSUMER DEMANDS

PRESSURE ZONE	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
High Service (500') Gradient*	3.668	6.951	9.031
High Service (500') Reduced Gradient	0.679	1.331	1.636
TOTALS	**4.35 MGD**	**8.28 MGD**	**10.67 MGD**

* Includes consumer demands from the Read School House Road Gradient and former Tiogue Tank Gradient.

The maximum customer serviceable elevations in each of the primary gradients were presented in Technical Memorandum 4A and are as follows.

MAXIMUM CUSTOMER SERVICEABLE ELEVATION BY PRESSURE GRADIENT

PRESSURE ZONE	35 PSI SERVICE ELEVATION	TANK(S) OVERFLOW ELEVATION
Low Service (334') Gradient[1]	244 feet	334 feet
High Service (500') Gradient[2]	405 feet	500 feet

[1] Includes Low Service Reduced Gradient and Hope Road Gradient
[2] Includes new Read School House Road Gradient tank, High Service Reduced Gradient and Tiogue Tank service area (Tiogue tank volume is discounted)

The following recommendations with regard to the various storage facilities in the distribution system were concluded.

Technical Memorandum 4A recommended that the Fiskeville Reservoirs in the Low Service Pressure Gradient be permanently removed from service as these storage facilities are maintained in a continued "locked up" condition due to their proximity (less than 1 mile) to the Clinton Avenue Pump Station. It was also recommended that the West Street and Wakefield Street Tanks be maintained in operation while examining options to promote tank cycling and turnover. These include booster

pump stations (West Street Tank) and valve stations to isolate the tank (Wakefield Street Tank). These options are to be further evaluated in the CIP.

Based on previously established customer service elevations, the volumes for the various storage components for each of the storage tanks were calculated. The various components of storage are summarized for each pressure zone as follows. Note that the Fiskeville Reservoirs are considered removed from service and are not included in this table.

SYSTEM STORAGE TANKS – TOTAL COMPONENT VOLUMES

PRESSURE GRADIENT	EFFECTIVE STORAGE (MG)	OPERATIONAL STORAGE (MG)	EQUALIZATION STORAGE (MG)	FIRE RESERVE & EMERGENCY STORAGE (MG)	"DEAD" STORAGE (MG)
Low Service (334') Gradient[1]	5.295	1.123	1.123	4.172	1.046
High Service (500') Gradient[2]	3.948	0.650	1.370	2.773	1.171

[1] Includes Low Service Reduced Gradient and Hope Road Gradient
[2] Includes Read School House Road Gradient, High Service Reduced Gradient and Tiogue Tank Service area

Historical tank charts indicate that the Authority is capable of maintaining a water level in each of the distribution storage tanks within the ranges as indicated for maintaining an adequate consumer system pressure of 35 psi and a fire flow pressure of 20 psi for the serviceable elevations in each pressure zone.

An assessment of the equalization storage volumes from each of the storage facilities in the major pressure zones was performed. The Low Service Gradient tanks' total equalization volume (without the Fiskeville Reservoirs) provides a ratio of 13 percent of the average day demand while the High Service Gradient tanks provide 31 percent. In terms of the water works standard, the High Service Gradient has in excess of the ratio of 25 percent storage capacity of equalization storage while the Low Service Gradient in terms of this standard is considered deficient in that the storage tanks supply a ratio of 13 percent of the recommended 25 percent standard.

Extended period model simulations for projected average and maximum day (with peak hour demand) indicate that all of the distribution system storage tanks operate within a range that has been previously defined for operational and equalization storage capacity. For all scenarios, there were no instances under which the dedicated volume for fire and emergency storage protection was depleted.

It is concluded that the Low Service Gradient storage tanks, while only providing a ratio of 13 percent of the recommended 25 percent volume of average day demand in equalization storage, are not adversely affected in this regard. This is primarily the result of the near continuous operation of the Clinton Avenue Pump Station, which provides sufficient water supply capacity during peak demand conditions such that storage facilities are not over taxed.

Each of the system's storage tanks (excluding the Fiskeville Reservoirs) are determined to have adequate water volume for fire reserve at an elevation such that a 20 psi minimum is maintained for a fire flow rate of 3,500 gpm for a duration of three hours which equates to a total volume of 630,000 gallons.

There is no standard or regulation that indicates that water storage facilities should "turn over" water volume on a periodic basis, however it is commonly recognized within the water works industry that this must occur at regular intervals to promote "good" water quality. This practice, which is improved by internal tank mixing, will assist in maintaining water quality and avoid potential water quality issues such as chlorine decay, adverse color, odor, and taste. As a guide, it is recommended that each storage tank turn over its volume on a weekly basis during low demand periods (i.e. winter months).

Model simulations indicate that each of the storage facilities (with exception of West Street and Wakefield Street tanks) routinely drain and refill at a rate such that the total nominal volume of the tank during a low demand period (Average Day) is turned over in a 1 to 2 week period. The West Street and Wakefield Street Tanks, which are routinely locked up, do not turn over on a routine basis and as previously indicated require an investigation into alternatives to cycle these tanks.

The 20 percent volume of emergency storage to average day demand with the redundant supply is determined sufficient.

Technical Memorandum 5A – Conclusions
The existing water storage facilities provide adequate volumes to meet projected future consumer demands including average day, maximum day, maximum day peak hour and fire flows. This was premised on the ability of each of the storage tanks to collectively meet future anticipated consumer demands while maintaining sufficient capacity for the various defined components of storage (i.e. operational storage, equalization storage, etc.). Hydraulic model analysis of the storage facilities predicts that the individual tanks are able to operate within their operational and equalization storage ranges such that no erosion of fire reserve and emergency storage occurs. The hydraulic model simulations also predict that the water transmission and distribution mains can effectively transfer water flow to and from the storage facilities and the supply sources that supply these facilities. This does not suggest that all locations within the distribution system maintain "adequate" flows and pressures (reference Technical Memorandums 4B and 5B).

The projected future average day system demands are projected to increase from the current 10.61 MGD to 12.96 MGD or 22 percent. The Low Service Pressure Gradient portion of the system is projected to increase from 7.27 MGD to 8.61 MGD or 18 percent. The High Service Pressure Gradient portion of the system is projected to increase from 3.34 MGD to 4.35 MGD or 30 percent. Without the addition of additional storage facilities, this projected increase in consumer demand will reduce the ratio of equalization storage to average day demand on a system-wide basis. The Low Service Pressure Gradient is primarily impacted as the ratio is decreased from 15 to 13 percent and which considers that the Fiskeville Reservoirs are permanently removed from service. The High Service Pressure Gradient, through the benefit of combination with the Read School House Road Gradient increases from 26 to 31 percent of equalization storage to projected average day demand.

Even though the Low Service Pressure Gradient storage facilities do not maintain the 25 percent ratio of equalization storage to average day demand, the hydraulic model simulations predict that the storage facilities are able to sufficiently meet future projected demands. These storage facilities have sufficient volume of operational and equalization storage such that no erosion of fire and emergency reserve capacity occurs. The model simulations also support that the storage facilities within the High Service Pressure Gradient in addition to providing an adequate volume based on general water works standards are capable of meeting all future system demands without erosion of fire and emergency reserve capacity.

Two of the storage tanks in the Low Service Gradient, the West Street and Wakefield Street tanks, continue to exhibit problems related to turn over under these hydraulic simulations. Again, this is due to the need to maintain the Clinton Avenue Pump Station in near continuous operation for overall system supply purposes and the need to maintain pressures at higher service elevations.

These tanks require further assessment such that they can operate in a normal mode. This may include pumping back into the distribution system during off peak demand periods or selective isolation within the distribution system such that the influence of Clinton Avenue Pump Station on

these tanks is diminished. Further consideration for options to increase operational effectiveness of these tanks shall be detailed in the Authority's CIP (2008).

Technical Memorandum 5A – Recommendations
High Service Pressure Gradient
The redefined High Service Pressure Gradient, which includes the combined High Service Pressure Gradient and the Read School House Road Pressure Gradient, has adequate storage capacity including operational, equalization, fire and emergency storage components to meet predicted future consumer demands. The configuration of the existing tanks (i.e. overflow elevation, nominal capacity, height, diameter and volume per foot) is such that each storage facility is effective in operating within the Gradient. The storage tanks drain and fill in combination during normal and peak demand periods and operate such that no one tank drains excessively or remains in a "locked up" condition. The following is noted and recommended through completion of steady state and extended period hydraulic model analysis for projected average and maximum day demands as well as fire flow conditions.

- The High Service Pressure Gradient maintains a ratio of equalization storage to average day demand of 31 percent, which is above the recommended water works guideline of 25 percent.

- It is not recommended that additional storage capacity be provided in the High Service Pressure Gradient.

- It is recommended that each of the three storage facilities in the High Service Pressure Gradient be routinely monitored to ensure that daily operation and fluctuation in the tanks (including periods of peak demands) are consistent with the levels for the various storage components.

Low Service Pressure Gradient
The Low Service Pressure Gradient has been determined to have adequate storage including operational, equalization, fire and emergency storage components to meet future consumer demands. It is noted that the determination for adequacy of the storage tank volumes was premised upon the operation mode of the Clinton Avenue Pump Station, which runs in a near continuous mode of operation. The operational mode of this pump station facility, which is largely operated in response to consumer system demands (i.e. increased number of pumps are placed on line during heavy demands periods and when storage tanks are draining), serves to maintain the water level in the storage tanks during increased consumer demand periods. As such, the storage tanks are not heavily relied upon to supply water demands during periods of peak consumer demand and there is no corresponding rapid depletion in water levels in the storage tanks.

The mode of operation of this pump station creates difficulties with normal operation of several storage tanks in the Low Service Pressure Gradient that are in close proximity to this pump station. This includes the Fiskeville, West Street and Wakefield Street storage facilities. Technical Memorandum 4A advised that the Fiskeville Reservoirs be removed from operational service due to

the fact that they remain in a continuous "locked up" condition during all times when the Clinton Avenue Pump Station is in operation.

West Street and Wakefield Street tanks remain in a continued "locked up" condition due to the station pump head, which is greater than the overflow elevation of these tanks. Alternatives need to be investigated to promote cycling of these particular tank facilities, which could include off peak pumping into the distribution system and isolation valve stations. These tanks also afford a certain level of fire storage protection in the general area in which they are located and are considered critical in that regard.

The existing storage tanks in the Low Service Gradient have a demonstrated ability to effectively meet future peak demands. This in large part is due to the continuous operation of the Clinton Avenue Pump Station, which however creates difficulty with cycling of nearer storage tanks (West Street and Wakefield Street). Adding additional storage capacity must be performed in combination with assessment of the location and affect of the Clinton Avenue pump station. Any new storage facility must contribute to overall system operations, fill and drain at rates conducive to cycling, provide benefit to a specific portion of the distribution system and not adversely affect fill and drain rates of existing storage tanks in the Gradient.

Mishnock Well Field Expansion and Distribution Storage
The Authority has an ongoing capital improvement project, which includes development of groundwater sources at the existing Mishnock well fields for added source of supply. This project also includes the construction of a new water treatment plant (to treat the raw water from the well fields) and the addition of a distribution system storage reservoir. The well fields are located in the southwestern portion of the distribution system opposite the primary sources of supply of the Clinton Avenue Pump Station to the north and Bald Hill Pump Station to the east. The water treatment plant is to be located in proximity to the well field and new transmission mains are to be installed to supply the distribution system storage tank which is to be located near the intersection of Mishnock and Hopkins Hill Road. These facilities are scheduled to be in service by 2010.

The advantages of providing additional distribution storage associated with the Mishnock Well Field Treatment Plant project are as follows:

- Additional distribution system storage will provide for greater usable storage volume to the distribution system and the location in the system is such that routine cycling of the tank can be accomplished. Due to its location in the system, the effect of Clinton Avenue Pump Station is not likely to adversely affect this tank (i.e. "lock up" the tank).

- This new source coupled with storage will reduce the Authority's dependence on wholesale supply connections and provide for a redundant source of supply in the event of emergencies.

- The Authority owns or controls the land rights at these locations and would not require additional land procurement.

- The ground elevation at the site of the storage tank site is in the range of 300 feet and will permit the construction of a ground storage reservoir with overflow elevation equal to that of the Low Service Pressure Gradient at 334 feet.

- The construction of a ground storage reservoir is more economical than an equal size elevated storage tank.

- The proximity of the distribution storage tank is such that the water volume may be utilized for both the Low and High Service Pressure Gradients. Finished water can be supplied by gravity to the Low Service Pressure Gradient and pumped into the High Service Pressure Gradient.

- The addition of distribution system storage at this location in the Low Service Pressure Gradient will stabilize distribution system pressures across the Gradient and in localized areas during periods of peak consumer demand.

- This storage facility will assist in resolving the ongoing problem of marginal system pressures on the suction side of the Johnson Boulevard Booster Pump Station. Pressure problems occur during operation of the station.

- This storage facility would be located within an area of the distribution system where future growth is most likely to occur.

- This storage facility will ease the demand pressure on the Frenchtown Road tank located to the south and east, which reportedly can be "stressed" in the summer months due to the increase in consumer irrigation demands.

The hydraulic model was updated to include the Mishnock project and included: new groundwater sources and treatment plant with total capacity of 2.5 MGD; supply pumps at the treatment plant rated at 1.25 MGD each; new 16 inch transmission main to connect the treatment plant to the distribution system storage tank; 1.5 MG storage reservoir at the intersection of Mishnock and Hopkins Hill Road; 20 inch transmission mains along Hopkins Hill Road to tie in the Low Service Pressure Gradient; 1.0 MG booster pump station at reservoir to the High Service Pressure Gradient.

For purposes of this evaluation, a 1.5 MG storage reservoir was modeled to have an overflow elevation of 334 feet with a base ground elevation of 314 feet. The height is equal to 20 feet with a diameter of 112 feet and capacity of 75,000 gallons per foot.

The following table includes a summary of the various storage components for each of the Low Service Gradient storage tanks with the new Mishnock reservoir.

LOW SERVICE GRADIENT (334') FUTURE (20 YEAR) STORAGE VOLUMES WITH MISHNOCK RESERVOIR

FACILITY	EFFECTIVE STORAGE (MG)	OPERATIONAL STORAGE (MG)	EQUALIZATION STORAGE (MG)	FIRE RESERVE & EMERGENCY STORAGE (MG)	"DEAD" STORAGE (MG)
Wakefield Street Tank	1.115	0.143	0.143	0.972	0.701
Frenchtown Road Tank	1.170	0.150	0.150	1.020	0.165
Setian Lane Tank	2.250	0.750	0.750	1.500	0.0
West Street Tank	0.760	0.080	0.080	0.680	0.180
Mishnock Storage Reservoir	1.125	0.375	0.375	0.750	0.0
TOTALS	**6.420**	**1.498**	**1.498**	**4.922**	**1.046**

The total nominal storage capacity of all storage tanks in the Low Service Pressure Gradient is equal to 9,000,000 gallons. (Note: Fiskeville Tanks have been removed from the storage volume table.)

The following table provides an indication of the ratio of the total tank equalization storage to future average day demand.

LOW SERVICE (334') GRADIENT

EQUALIZATION STORAGE ASSESSMENT – FUTURE 20 YEAR DEMANDS WITH MISHNOCK STORAGE RESERVOIR

DEMAND SCENARIO	FUTURE SYSTEM DEMAND (GAL)	TOTAL EQUALIZATION VOLUME (GAL)	% STORAGE OF AVERAGE DAY DEMAND
Average Day	8,610,000	1,498,000	17%

The total of the *equalization storage* volume in all the Low Service Pressure Gradient tanks provides 17% of the future average day demand, which is below the water works 25% guideline. This is however increased from the 13% provided by the existing storage tanks.

It was also critical to evaluate the new Mishnock reservoir under extended period modeling scenarios for future average and maximum day demand conditions.

Hydraulic modeling of these new facilities under future average and maximum day demand conditions indicate that the Mishnock reservoir fluctuates in a range from 329 to 334 feet. The Mishnock pump cycles on a daily basis in response to the water level in the storage reservoir. Remaining system storage tanks and pump stations function within a normal mode of operation. It is necessary to review operation and control set points for other facilities and most notably for Clinton Avenue and Quaker Lane pump stations in order to increase the frequency of operation of the Mishnock wells in order to reduce reliance on wholesale water supply.

Technical Memorandum 5B – Available Fire Flow Analysis (Future Demand Conditions)
An analysis of the entire water distribution system under future (2025) maximum day conditions was performed utilizing the hydraulic model in order to determine available fire flow rates throughout the water system. This included performing an evaluation to determine the fire flow rate in gallons per minute (gpm) that would be available for each of the various water main segments in the hydraulic model and developing a color-coded map depicting the various ranges of available fire flow rates at each water main within the water system.

The criteria to determine available fire flow rates included specifying a minimum fire flow of 500 gpm and a maximum fire flow of 3,500 gpm. These rates correspond to the upper and lower ranges in the model for the purposes of this analysis and are typical for a service territory such as the Authority's that consists of a mixed use of urban, suburban, commercial and industrial uses. All fire flow rates were determined based upon a minimum residual pressure of 20 psi at the fire flow location and a minimum system pressure of 0 psi. It was necessary to establish the minimum system pressure at 0 psi due to the fact that there exist locations within the distribution system that routinely experience pressures below 20 psi during non fire flow conditions.

This evaluation was similar to that provided in Technical Memorandum 4B except future anticipated consumer demands were utilized in place of current consumer demands. The intent was to identify the potential effects that this increase in consumer demand would have on available fire flow rates. These simulations were performed with the benefit of known system modifications (i.e. Mishnock water treatment plant and tank, High Service Gradient improvements, etc.) as detailed in Technical Memorandum 5A.

In order to locate specific areas of calculated available fire flow rates on a system wide basis, the results were color coded on a system map. As a means to compare available fire flow rates to conditions in the system, which could adversely affect fire flows two additional maps were prepared. These included a color-coded map of all pipelines in the system which are 6 inches in diameter and smaller and a contour map of previously determined customer service elevations in the Low and High Service Gradients.

This allows a comparison of areas within the system that contain pipelines less than 6 inches in diameter with areas in the system with available fire flows of less than 1,000 gpm. If an area has a calculated fire flow of less than 1,000 gpm, the pipeline diameter map can be used to indicate if this same area also has pipelines that are less than 6 inches in diameter. Generally, pipelines 6 inches in diameter and less are inadequate in capacity to support fire flows of 1,000 gpm or higher and could in part be contributing to a "low" calculated fire flow.

Similarly, a contour map of the entire distribution system was developed which depicts those areas in the Low and High Service Gradients that are above the "serviceable" elevations. The serviceable elevation for the Low Service was determined to be 244 feet and the serviceable elevation for the High Service was determined to be 405 feet. If a particular area has calculated fire flows of less than 1,000 gpm, the contour map can be used to indicate if this same area also has high elevations, which may indicate low pressures. Service elevations could in part be contributing to a "low" calculated fire flow.

When comparing available fire flow results for the current and future maximum day demand scenarios, it is evident that the future consumer demands do not significantly impact available fire flow rates throughout the distribution system. Areas with available fire flows of less than 1,000 gpm occur at similar locations under both scenarios. The notable exceptions are specific locations that may be beneficially impacted by the aforementioned infrastructure projects.

In order to effectively increase fire flow to areas with available flows below 1,000 gpm, it will be necessary to evaluate and correct one or both of the two contributing conditions. These include aged and small diameter pipelines and areas in the distribution system above the defined customer service elevations and result in low pressures. These conditions prohibit the ability to effectively convey water in a sufficient quantity and pressure from storage and supply facilities to these locations.

Water mains constructed of cast iron and/or of 6-inch diameter and less cannot effectively convey water flows in the range of 1,000 gpm. Elevations above the defined service elevations have pressures which limit the available fire flow.

EXHIBIT G

February 7, 2008

TASK ORDER NO. 9

AGREEMENT BETWEEN
KENT COUNTY WATER AUTHORITY
AND
ENGINEER FOR SERVICES

This Task Order No. 6 is attached to and made part of the Agreement dated 22 March 2004 between James J. Geremia & Associates, Inc. (ENGINEER) and Kent County Water Authority (OWNER). This Task Order describes the Scope of Service and Compensation for the Task Order known as:

1. SCOPE OF SERVICE

ENGINEER shall provide to OWNER the following specific services to:

a. Modify the **Infrastructure Water System Main Replacements Project** by modifying the plans to reflect the new transmission main on Fairview Avenue Bridge (RIDOT Bridge 414).

3. COMPENSATION INVOICING

The method of payment for services rendered by the ENGINEER as outlined in Section 1of this Task Order shall be as follows (the ENGINEER shall invoice the OWNER based on the percentage of work completed):

Engineering		$ 8,500.00
Preliminary Structural Analysis		4,400.00
Final Structural Engineering Design		8,250.00
Field Survey		4,840.00
	TOTAL	**$ 25,990.00**

Acceptance of the terms of this Task Order is acknowledged by the following authorized signatures of the parties to the Agreement.

OWNER

KENT COUNTY WATER AUTHORITY

By:_____
ROBERT B. BOYER

Title: CHAIRMAN

Date:_____

ENGINEER

JAMES J. GEREMIA & ASSOCIATES, INC.

By:_____
JAMES J. GEREMIA

Title: PRESIDENT

Date: DECEMBER 27, 2007