TOWN OF DURHAM
15 NEWMARKET ROAD
DURHAM, NH 03824-2898
Tel: 603/868-5571
Fax: 603/868-5572

AGENDA

DURHAM TOWN COUNCIL

MONDAY, JUNE 17, 2013
DURHAM TOWN HALL – COUNCIL CHAMBERS
7:00 PM

NOTE: ***THE TOWN OF DURHAM REQUIRES 48 HOURS NOTICE IF SPECIAL COMMUNICATION AIDS ARE NEEDED***

I. **Call to Order**

II. **Approval of Agenda**

III. **Special Announcements**
Recognizing Assistant Fire Chief Jason Cleary for completion of the 4-year National Fire Academy Executive Fire Officer Program

IV. **Approval of Minutes** – May 6, 2013

V. **Councilor and Town Administrator Roundtable**

VI. **Public Comments** ***(Not earlier than 7:45 PM)***

VII. **Unanimous Consent Agenda** *(Requires unanimous approval. Individual items may be removed by any councilor for separate discussion and vote)*

A. Shall the Durham Town Council approve an abatement for sewer in the amount of $34.50 for the Spring 2012 Warrant to Mr. James Bubar, 4 Old Piscataqua Road, and authorize the Town Administrator to sign said abatement?

B. Shall the Town Council, upon recommendation of the Administrator, review and readopt the Town of Durham's Investment Policy as required by New Hampshire Revised Statutes Annotated (RSA) 41:9?

C. Shall the Town Council, upon recommendation of the Administrator, approve a non-industrial wastewater discharge permit application and sewer extension submitted by Tighe & Bond on behalf of Peak Development Corporation for the proposed Mast Road Apartments (Tax Map 13, Lots 6-1 and 10-0)?

D. **RESOLUTION #2013-15** amending Resolution #2012-11 to change the $745,000 funding designation within the 2012 Capital Fund Budget to come from long-term rather than short-term borrowing to purchase the People's United Bank Building located at 8 Newmarket Road for use as the future Town Hall and rescinding Resolution #2012-17 dated October 15, 2012

E. Shall the Town Council schedule a public hearing for Monday, July 1, 2013, in accordance with Section 5.5 of the Durham Town Charter on a resolution authorizing the raising, appropriating, and expenditure of an additional One Hundred and Fifteen Thousand Dollars ($115,000) within the FY 2013 Capital Fund Budget with funds to come from long-term borrowing for emergency radio communication enhancements?

VIII. Committee Appointments - None

IX. Presentation Items

A. Power purchase agreement for the Durham Public Library, Churchill Rink, and Police Department facilities – Stephen Hinchman and Steve Condon, Revision Energy, LLC

B. Presentation regarding the development of a new Water Ordinance addressing emergency drought conditions and update relative to the most recent draft of a Water Use Plan, Drought Management Plan, and Water Conservation Plan for the Lamprey River – David Cedarholm, Town Engineer

X. Unfinished Business - None

XI. New Business

A. Discussion regarding the State legislative process and the Council's role, if any – Robin Mower

B. Other Business

XII. Nonpublic Session (if required)

XIII. Extended Councilor and Town Administrator Roundtable (if required)

XIV. Adjourn *(NLT 10:30 PM)*

TOWN OF DURHAM
15 NEWMARKET ROAD
DURHAM, NH 03824-2898
Tel: 603/868-5571
Fax: 603/868-5572

AGENDA ITEM: # 4

DATE: June 17, 2013

COUNCIL COMMUNICATION

INITIATED BY: Durham Town Council

AGENDA ITEM: **APPROVE THE TOWN COUNCIL MEETING MINUTES FOR MAY 6, 2013**

CC PREPARED BY: Jennie Berry, Administrative Assistant

PRESENTED BY: Todd I. Selig, Town Administrator

AGENDA DESCRIPTION:
Attached for the Council's review and approval are the minutes for the Town Council meeting held on Monday, May 6, 2013.

Please call Jennie Berry with any grammatical/spelling changes prior to the meeting. Discussion at Monday evening's meeting should be limited only to substantive changes.

LEGAL AUTHORITY:
RSA 91-A:2 (II) specifies what must be contained in minutes of public meetings: *"Minutes of all such meetings, including names of members, persons appearing before the bodies or agencies, and a brief description of the subject matter discussed and final decisions, shall be promptly recorded and open to public inspection not more than 5 business days after the public meeting, except as provided in RSA 91-A:6, and shall be treated as permanent records of any body or agency, or any subordinate body thereof, without exception."*

LEGAL OPINION:
N/A

FINANCIAL DETAILS:
N/A

SUGGESTED ACTION OR RECOMMENDATIONS:

MOTION 1:
The Durham Town Council does hereby approve the Town Council meeting minutes for Monday, May 6, 2013 (as presented) (as amended).

DEPARTMENT OF PUBLIC WORKS
TOWN OF DURHAM
100 STONE QUARRY DRIVE
DURHAM, N.H. 03824
603/868-5578
FAX 603/868-8063

AGENDA ITEM: # 7A

DATE: June 17, 2013

COUNCIL COMMUNICATION

INITIATED BY: Public Works Department

AGENDA ITEM: **SHALL THE DURHAM TOWN COUNCIL APPROVE AN ABATEMENT FOR SEWER IN THE AMOUNT OF $34.50 FOR THE SPRING 2012 WARRANT TO MR. JAMES BUBAR, 4 OLD PISCATAQUA ROAD AND AUTHORIZE THE TOWN ADMINISTRATOR TO SIGN SAID ABATEMENT?**

CC PREPARED BY: Michael Lynch, Public Works Director

PRESENTED BY: Todd Selig, Town Administrator
Michael Lynch, Public Works Director

AGENDA DESCRIPTION:
In the spring of 2012 Mr. James Bubar, 4 Old Piscataqua Road, requested to have an irrigation water meter installed at his residence for the purpose of metering the water supplied to his outside irrigation system. His residence is equipped with a residential, town supplied water meter and he is billed for both water and sewer use off this meter. An irrigation meter is paid for by the home owner and installed by a licensed plumber to meter just the water going to the irrigation system and therefore only billed for water consumption.

Mr. Bubar hired a plumber to install a Town-supplied meter (for which the Town is reimbursed). The Town has several of these installations on the water system to measure just the water consumption as this irrigation use never enters the sewer system. These customers receive two bills from the town; one for domestic water and sewer and another for water only. In the case of Mr. Bubar, the plumber incorrectly installed the irrigation meter in line with the residential water meter instead of splitting the domestic water line into two separate lines; one for residential water/sewer use and one for irrigation only use. This issue was discovered with the town's recent water meter upgrade project and has now been corrected. This recent billing period mistakenly billed Mr. Bubar for both water and sewer use on the irrigation meter in the amount of 600 cubic feet of water. This has also been corrected in the billing system.

LEGAL AUTHORITY:
N/A

LEGAL OPINION:
N/A

FINANCIAL DETAILS:
Total Sewer Abatement – 600 cubic feet x $5.75/100 cubic feet = $34.50

SUGGESTED ACTION OR RECOMMENDATIONS:
MOTION :

The Durham Town Council does hereby APPROVE the abatement for sewer in the amount of $34.50 for the Spring 2012 Warrant to Mr. James Bubar of 4 Old Piscataqua Road and authorizes the Town Administrator to sign said abatement.

TOWN OF DURHAM
Business Department

15 Newmarket Road, Durham, NH 03824-2898
Tel: (603) 868-8043 • Fax: (603) 868-5572

Gail E. Jablonski, Business Manager
gjablonski@ci.durham.nh.us

AGENDA ITEM: #7B

DATE: June 17, 2013

COUNCIL COMMUNICATION

INITIATED BY: Gail Jablonski, Business Manager

AGENDA ITEM: **SHALL THE TOWN COUNCIL, UPON RECOMMENDATION OF THE ADMINISTRATOR, REVIEW AND READOPT THE TOWN'S INVESTMENT POLICY AS REQUIRED BY NEW HAMPSHIRE REVISED STATUTES ANNOTATED (RSA) 41:9?**

CC PREPARED BY: Gail Jablonski, Business Manager
Jennie Berry, Administrative Assistant

PRESENTED BY: Gail Jablonski, Business Manager
Todd I. Selig, Town Administrator

AGENDA DESCRIPTION:

In May of 2010 the Town Council approved an Investment Policy for the Town of Durham. RSA 41:9, VII states that "The governing body shall **annually review** and adopt an investment policy for the investment of public funds in conformance with applicable statutes and shall advise the treasurer of such policies."

The adoption of financial policies is a good, sound business practice that fosters confidence in the fiscal operations of the municipality. Financial policies help to provide consistency, stability, and continuity in the financial operations of the Town. Written policies also provide a framework to guide and education both newly elected officials in carrying out their fiduciary responsibilities and newly appointed staff in the conduct of their financial duties. The ability to rely on well-defined financial policies helps to resolve conflicts and avoid allegations of bias or favoritism.

At this time no changes in the current policy are being recommended.

LEGAL AUTHORITY:

RSA 41, Choice and Duties of Town Officers

LEGAL OPINION:

N/A

FINANCIAL DETAILS:

N/A

SUGGESTED ACTION OR RECOMMENDATIONS:

MOTION:

The Durham Town Council does hereby, upon review and recommendation of the Administrator, readopt the Investment Policy for the Town of Durham as presented and as required by New Hampshire Revised Statutes Annotated (RSA) 41:9.

TOWN OF DURHAM, NH
INVESTMENT POLICY

I. SCOPE

This investment policy establishes a framework for the safe and prudent investment of public funds. It applies to all financial assets in the custody of the town treasurer of the Town of Durham, NH. These funds are accounted for in the Town's annual financial report and include the following:

- General Fund
- Special Revenue Funds
- Capital Project Funds
- Forfeiture/Seizure Funds
- Any new fund created by the Town Council unless specifically exempted by the articles of its creation.

II. OBJECTIVES

The primary objective of the Town of Durham's Investment Policy is to set forth appropriate investment activities that provide for, first and foremost, the safety of principal, as well as sufficient liquidity to support operations while generating a reasonable investment yield.

The specific investment policy objectives are as follows:

- To ensure the preservation of capital and the protection of investment principal;
- To maintain sufficient liquidity to meet operating requirements;
- To satisfy all legal requirements;
- To attain market-average rate of return on investments taking into account risk and legal constraints and cash flow considerations.

III. DELEGATION OF AUTHORITY

In accordance with Chapter 41:29 of the Revised Statutes Annotated (RSA), of the State of New Hampshire, the responsibility for conducting investment transactions resides with the Town Treasurer, *except in the instance of capital reserve funds or trust funds, when the responsibility for conducting investment transactions reside with the Trustees of the Trust Funds in accordance with RSA 35:9.*

No person may engage in an investment transaction except as provided under the terms of this policy and the internal procedures and controls hereby established.

IV. PRUDENCE

The investment policy will be conducted in accordance with the "prudent person" standard which requires that:

> Investments shall be made with judgment and care, under circumstances then prevailing, which persons of prudence, discretion and intelligence exercise in the management of their

own affairs, not for speculation, but for investment, considering the probable safety of their capital as well as the probable income to be derived.

The Town recognizes that investment risks can result from issuer defaults, market price changes or various technical complications leading to temporary non-liquidity. The Treasurer is expected to display prudence in the selection of investments in a way to minimize default risk.

Officers and employees involved in the investment process shall refrain from personal business activity that could conflict (or appear to conflict) with proper execution of the investment program, or which could impair their ability to make impartial investment decisions.

V. INTERNAL CONTROLS

The internal controls for the Town of Durham shall be designed to prevent losses of public funds arising from fraud, employee error, misrepresentation by third parties, unanticipated changes in financial markets, imprudent actions by employees and officers of the Town.

In accordance with RSA 41:6 Bonds, Town Treasurers shall be bonded by position under a blanket bond from a surety company authorized to do business in the state.

All depository accounts of the Town must be held in the name of the Town. All income payable to the Town and all revenue received by the Town shall be forwarded to the Town Treasurer.

VI. INVESTMENT INSTRUMENTS

The treasurer shall deposit all such moneys in participation units in the public deposit investment pool established pursuant to RSA 383:22 or in federally insured banks chartered under the laws of New Hampshire or the federal government with a branch within the state, except that funds may be deposited in federally insured banks outside the state if such banks pledge and deliver to a third party custodial bank or the federal reserve bank collateral security for such deposits of the following types:

(a) United States government obligations;
(b) United States government agency obligations; or
(c) Obligations of the state of New Hampshire in value at least equal to the amount of the deposit in each case.

Whenever the town treasurer has in custody an excess of funds which are not immediately needed for the purpose of expenditure, the town treasurer shall invest the same in the public deposit investment pool established pursuant to RSA 383:22, or in deposits, including money market accounts, or certificates of deposit, or repurchase agreements, and all other types of interest bearing accounts, of federally insured banks chartered under the laws of New Hampshire or the federal government with a branch within the state, or in obligations fully guaranteed as to principal and interest by the United States government. The obligations may be held directly or in the form of securities of or other interests in any open-end or closed-end management-type investment company or investment trust registered under 15 U.S.C. section 80a-1 et seq., if the portfolio of the investment company or investment trust is limited to such obligations and repurchase agreements fully collateralized by such obligations.

VII. POLICY REVIEW

This policy shall be reviewed at least annually by the Council, or its designee, with changes made as warranted, followed by re-adoption by the governing body.

The Council reserves the right to implement changes to this policy without prior notice if it is deemed in the Town's best interest.

Adopted by the Durham Town Council on May 3, 2010

Reviewed and Re-Adopted by the Durham Town Council on May 16, 2011.
Reviewed and Re-Adopted by the Durham Town Council on June 4, 2012.

______________________________ ____________________

Todd I. Selig Date
Town Administrator

DEPARTMENT OF PUBLIC WORKS
TOWN OF DURHAM
100 STONE QUARRY DRIVE
DURHAM, N.H. 03824
603/868-5578
FAX 603/868-8063

AGENDA ITEM: # 7C

DATE: June 17, 2013

COUNCIL COMMUNICATION

INITIATED BY: Public Works Department

AGENDA ITEM: **SHALL THE TOWN COUNCIL, UPON RECOMMENDATION OF THE ADMINISTRATOR, APPROVE A NON-INDUSTRIAL WASTEWATER DISCHARGE PERMIT APPLICATION AND SEWER EXTENSION SUBMITTED BY TIGHE & BOND ON BEHALF OF PEAK DEVELOPMENT CORPORATION FOR THE PROPOSED MAST ROAD APARTMENTS (TAX MAP 13, LOTS 6-1 AND 10-0)?**

CC PREPARED BY: David Cedarholm, Town Engineer
Todd Selig, Administrator

PRESENTED BY: David Cedarholm, Town Engineer

AGENDA DESCRIPTION:

On behalf of Peak Campus Development, LLC and Blue Atlantic Acquisition Company, LLC, Tighe & Bond, submitted a non-industrial wastewater discharge permit for the proposed Mast Road Apartments on Mast Road (Tax Map 13, Lots 6-1 and 10-0). The proposed project consists of an apartment style residential housing development, with various sizes of apartment buildings containing a combined total of 460 beds. The project will include a new sewer extension of approximately 2,200 linear feet of 8-inch diameter PVC pipe and 12 manholes. There will one connection to the existing twelve (12) inch sewer along Mast Road. This project is estimated to generate approximately 23,903 gallons per day of wastewater based on an average usage of 50 gallons per day per resident.

Tighe & Bond provided the attached Sewer Connection Permit Application and initial assessment computation documenting the expected wastewater flows estimated for this project. Pertinent sheets (reduced in scale) from the proposed Site Development Plans are also attached for informational purposes. The project has met all its approvals with the Planning Board with the exception of a few routine precedent conditions of approval, and the developer is on schedule to start breaking ground in mid-July.

As required in Section III of the Durham Sewer Ordinance Chapter 106 for all sewer extensions, a public hearing will be scheduled to receive public comment on the proposed project. The comments gathered at the public hearing will be considered during the review by the Durham Water/Wastewater/Stormwater Committee prior to recommending action on this permit application.

Wastewater System Capacity:

The sewer system immediately downstream of the project has adequate capacity, specifically due to the recent capacity upgrades to the West End sewer collection system in the vicinity of the UNH field house. Further improvements to the downstream collection system are underway with a major upgrade to the Old Concord Road Wastewater Pump Station which will be completed before the Mast Road Apartments are occupied in 2014.

The capacity of the Durham Wastewater Treatment Plant (WWTP) was evaluated and the results indicate that the additional discharge is manageable.

Water supply for the proposed development is proposed to tap the existing 10-inch diameter water main on Mast Road. In January 2013 the Department of Public Works conducted an evaluation of the impact on the water system from the recent residential development, which totaled 1872 new town and UNH residents since 2005, suggests that water production/demand has only increased 2% from 2005 to 2012 as a result (see attached Figure 1 and 2 from the evaluation). This very minor increase is most likely due to a variety of factors including more efficient water system operations, the installation of water efficient fixtures in all the new developments and numerous recent UNH building renovation projects, and a general improved awareness of water conservation measures throughout the community.

The New Hampshire Department of Environmental Services Wastewater Engineering Bureau reviewed the engineering plans and specification for the sewer extension and associated appurtenances and recently provided their written approval.

Water System Capacity:

Water supply for the development is proposed to tap the existing 10-inch water main on Mast Road. The Department of Public Works and the Water/Wastewater/Solid Waste Committee recommends approval of the application, and based on the results of a recent hydrant flow test that was performed on Mast Rd., it was recommended that the developer contract with a third party engineer to complete a water system impact analysis to evaluate available pressure for their proposed fire suppression system.

A public hearing for the proposed sewer extension was advertised in the Foster Daily Democrat newspaper on Friday, May 24th and was held on Tuesday June 4th. No one from the public was in attendance.

The information relative to this wastewater connection application and request for a sewer extension, as described above, was discussed at the June 20, 2013 Durham Water/Wastewater/Solid Waste Committee and the Committee voted unanimously to recommend approving this application conditional upon the public hearing a completed water system impact analysis.

LEGAL AUTHORITY:

N/A

LEGAL OPINION:

Sewer line extensions require Town Council actions per Section III of Durham's Sewer Ordinance.

FINANCIAL DETAILS:

Based on the estimated annual water use and sewer discharge, and the rate of $0.0227 per gallon for combine water and wastewater, the initial assessment totaling the amount of $198,048.31 will become due prior to final approval to connect to the water and sewer systems.

SUGGESTED ACTION OR RECOMMENDATIONS:

MOTION:

The Durham Town Council does hereby, upon recommendation of the Administrator, approve the application for a non-industrial wastewater discharge permit application and sewer extension request submitted by Tighe & Bond on behalf of Peak Development Corporation for the proposed Mast Road Apartments (Tax Map 13, Lots 6-1 and 10-0), conditional upon a completed water system impact study as recommended by the Durham Water/Wastewater/Solid Waste Committee.

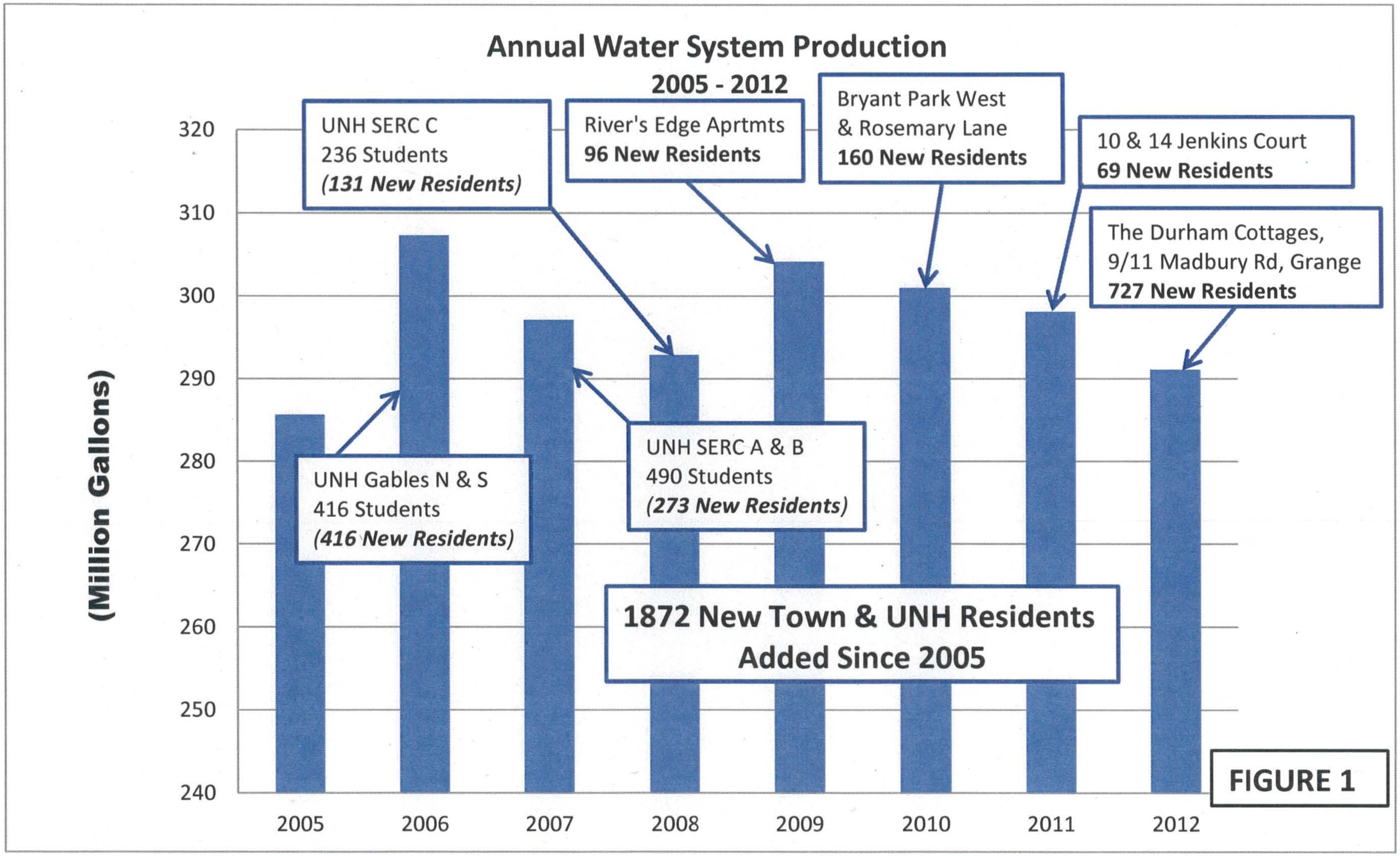
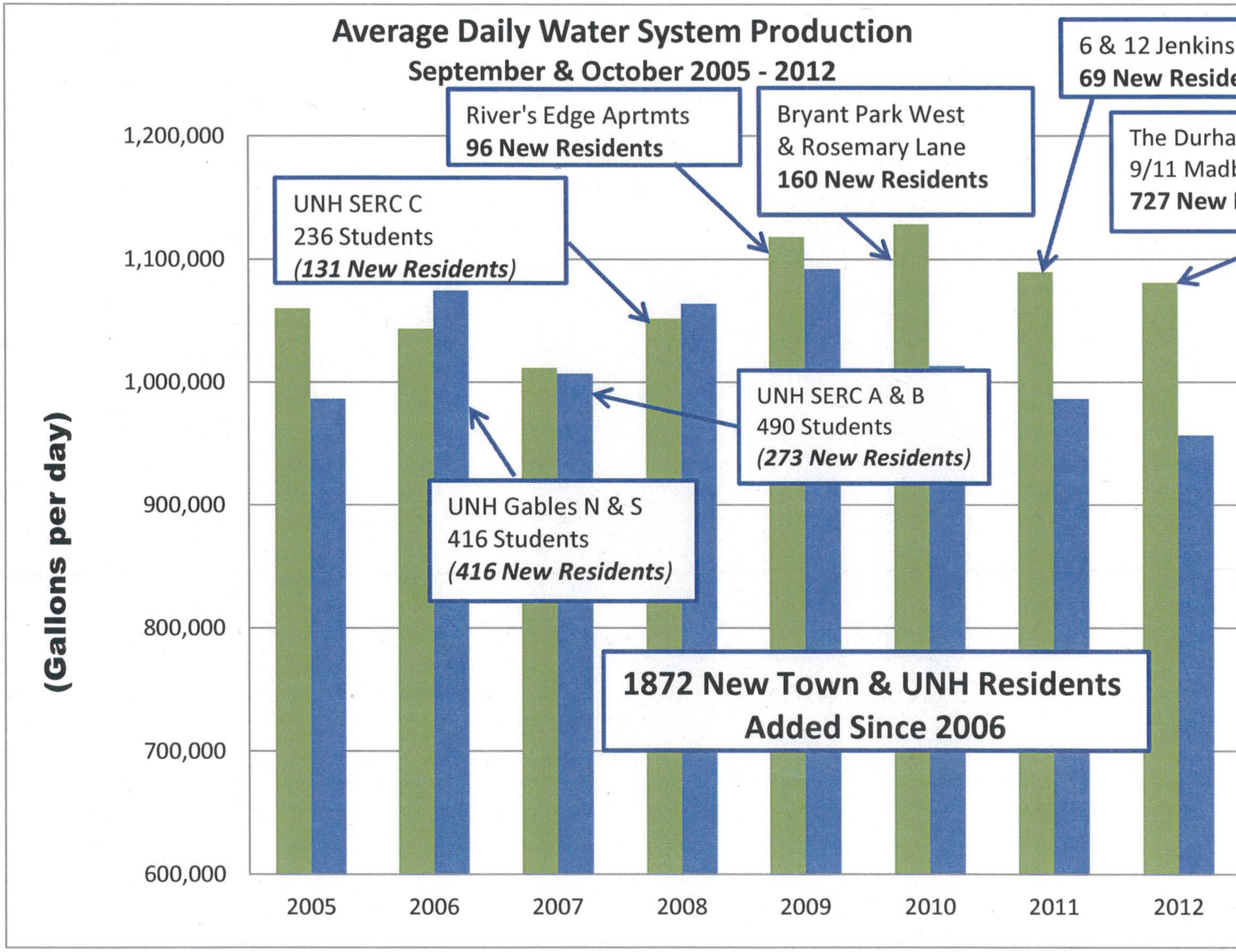

Annual Water System Production
2005 - 2012
(Million Gallons)
320
310
300
290
280
270
260
250
240
2005
2006
2007
2008
2009
2010
2011
2012
UNH SERC C
236 Students
(131 New Residents)
River's Edge Aprtmts
96 New Residents
Bryant Park West
& Rosemary Lane
160 New Residents
10 & 14 Jenkins Court
69 New Residents
The Durham Cottages,
9/11 Madbury Rd, Grange
727 New Residents
UNH Gables N & S
416 Students
(416 New Residents)
UNH SERC A & B
490 Students
(273 New Residents)
1872 New Town & UNH Residents
Added Since 2005

FIGURE 1



Average Daily Water System Production
September & October 2005 - 2012
(Gallons per day)
1,200,000
1,100,000
1,000,000
900,000
800,000
700,000
600,000
2005
2006
2007
2008
2009
2010
2011
2012
September
October
UNH SERC C
236 Students
(131 New Residents)
River's Edge Aprtmts
96 New Residents
Bryant Park West
& Rosemary Lane
160 New Residents
6 & 12 Jenkins Court
69 New Residents
The Durham Cottages,
9/11 Madbury Rd, Grange
727 New Residents
UNH SERC A & B
490 Students
(273 New Residents)
UNH Gables N & S
416 Students
(416 New Residents)
1872 New Town & UNH Residents
Added Since 2006

FIGURE 2

Tighe&Bond

www.tighebond.com

P-0637-1
March 7, 2013

Mr. Dave Cedarholm, Town Engineer
Town of Durham
Department of Public Works
100 Stone Quarry Drive
Durham, New Hampshire 03824

Re: **Mast Road Apartments – Sewer Connection Permit**
Durham, NH

Dear Mr. Cedarholm,

On behalf of Peak Campus Development, LLC, Tighe & Bond is submitting to you an application for a Permit to Connect to Public Utility for the proposed Mast Road Apartments. This application is in addition to the NHDES Sewer Connection Permit Application and supporting documentation submitted to you on February 7, 2013.

As discussed on March 6th, 2013 we have revised the calculations for the proposed 460 bedroom apartment style housing project to use 50 gallons per bed instead of 75 gallons per bed. Therefore the sewer use for the project has been calculated as follows:

Residential Units: (460 beds) * (50 gpd/bed) = 23,000 gpd

Clubhouse Fitness Center (assume 1/3 of residents use clubhouse per day):
(155 users/day) * (5 gal/user^) = 775 gpd

Employees: (8 employees) * (15 gal/employee^) = 120 gpd

Hot Tub (assume annual cleaning and drain/refill):
(2,750 gallons) / (365 days/year) = 8 gpd

Total Sewer Use: **23,903 gpd**

^ Sewer flow rates based on: Wastewater Engineering, Treatment and Reuse, Fourth Edition, Metcalf & Eddy, 2003.

Based on the above estimated use, and the new sewer and water connection fees provided on March 6th, the revised sewer and water connection fee is estimated as follows:

Water Connection Fee:

(23,903 gpd)*(365 days/year)*($0.0077 per gallons/year) = $67,179.38

Sewer Connection Fee:

(23,903 gpd)*(365 days/year)*($0.015 per gallons/year) = $130,868.93

Total Connection Fees: **$198,048.31**

The fee will be paid to the Town by the project developer prior to connection to the municipal water and sewer system. If you have any questions or need any additional information, please do not hesitate to call me at 603-433-8818 or email me at jmpersechino@tighebond.com.

Very truly yours,

TIGHE & BOND, INC.

Joseph Persechino, P.E.
Project Manager

Enclosures

Copy: Jeff Githens, Peak Campus Development, LLC

J:\P\P0637 Peak Campus Development - Durham, NH - Mast Road Student Housing\ADMIN\2506371-033(Sewer Connection Permit Cvr Ltr Town REV).Doc

PERMIT TO CONNECT TO PUBLIC UTILITY

Department of Public Works
100 Stone Quarry Drive
Durham, New Hampshire 03824
PHONE: 603-868-5578

FOR OFFICE USE ONLY:
Permit No. 2013-02
Acceptance Date March 11, 2013
Fees Paid $________ Date________
Date of Permit to Connect ________
Date of Final Approval ________

Pursuant to the provisions of the Durham Water and Sewer Ordinances, anyone wishing to modify, replace, or connect to any part of the Town's utility systems use for conveyance of water or wastewater within the Town of Durham cannot do so without satisfying the conditions outline herein and obtaining a Water and Sewer Connection Permit issued by the Durham Department of Public Works. Applications are accepted and dated as such only when fully complete with all required attachments and information. An incomplete package will be returned without review. Utility connections are permitted only after all applicable plans are reviewed and approved, all fees are paid in full, and issuance of a Conditional Permit to Proceed from the Department of Public Works (DPW). **See attached fee schedule for water and sewer connection fees**. Final approval may be granted only upon submittal of all applicable documents, approved record drawings, and satisfaction of warranty period. This permit application is automatically deemed null and void if all conditions are not met within 1 year of the permit to connect. The Town reserves the right to terminate utility service is any condition described herein or in the Durham Town Code are violated.

Please check where applicability:

Sewer System x Water System x New Service x Modification ____ Increase ____

Single Family Dwelling ____ Multi-Dwelling Unit x Commercial ____ Industrial ____

1 – PROJECT/OWNER INFORMATION

Project/Parcel Owners Name John A. McGinty Rev. Trust / Chet Tecce Jr. Rev Living Trust Tax Map and Lot # 13, 6-1, 10-0

Project Address or Location 251 Mast Road, Durham, NH 03824

Owner's Mailing Address 251 Mast Road, Durham, NH 03824 / 240 Mast Road, Durham, NH 03824

Telephone Number ________ E-Mail Address ________

Project Description A proposed 460 bedroom apartment style housing complex with clubhouse.

2 – APPLICANT (PERMITTEE) INFORMATION

Name of Applicant/Owner's Authorized Agent (if different from Owner) ________

Name of Agent's Firm Blue Atlantic Aquisition Group, LLC Address 2970 Clairmont Rd., Suite 310, Atlanta, GA 30329

Name of Contractor (if different from Agent) TBD

Agent's Mailing Address Same as above

Telephone Number 404.920.5361 E-Mail Address jgithens@peakcampus.com

3 – DOCUMENT CHECK LIST

x **Design Drawings** – Submit detailed Construction Plans prepared by a New Hampshire Licensed Professional Engineer. Construction Plans shall include an scaled surveyed site plan showing, site local, benchmarks, structures, piping, manholes, roadways and driveways, surface drainage features (*where applicable*), sidewalks, curbing, and locations of all utility connections. Construction Plans shall include detailed schematics with accurate dimensions of main and service connection piping, elevations of stubs or laterals, locations and elevations of all changes in direction and slope, manholes rim elevations, invert elevations and structure numbers. In addition, the size, material, location, and elevation of all underground utilities encountered during construction shall be indicated on the Construction Plans. Requests to waive some of the above may be considered for single family dwellings. Construction plans submitted for subdivisions, commercial, multi-dwelling units, and sewer and water extensions, shall be prior approved by the Durham Planning Board.

_x_ **Estimate of Use** – Submit a calculation prepared by a New Hampshire Licensed Professional Engineer (excepting individual single family dwellings) describing the estimated peak and average daily, and average annual use (demand or discharge). Water and sewer use calculation shall be based on an average per capital demand of 50 gallons/person/day.

____ **Record Drawings** – Submit a full set of Record Drawings (Construction Plans updated with correct as-built information) (excepting individual single family dwellings) showing the final location of all utilities including physical and ties with dimensions to locations of utility connections and structures (*where applicable*). All Record Drawings shall be prepared, signed and sealed by a New Hampshire Licensed Professional Engineer or Surveyor.

ISSUANCE OF PERMIT TO CONNECT: The Department of Public Works will conduct a site inspection and issue a **Permit to Connect** when all fees are paid in full. **The applicant is required to notify DPW at least 48 hours prior to constructing the connection to schedule inspections by the applicable Division.**

The signature of the below owner/agent certifies that the property owner(s) have read this entire document, and understands and agrees to adhere to all requirements and conditions defined herein:

____

Signature of Property Owner or Authorized Agent

--- **FOR OFFICE USE ONLY** ---

CONFORMANCE INSPECTION:

The Site/Connection was inspected on ____________ and ____ meets ____ does not meet conditions as set forth above. INSPECTED BY: ____________________

Conditions not met which require conformance for final approval: ____________________

SECOND INSPECTION (If necessary) BY: ____________________ Date____________

Conditions not met which require conformance for final approval: ____________________

THIRD INSPECTION (If necessary) BY: ____________________ Date____________

Conditions not met which require conformance for final approval: ____________________

FINAL INSPECTION (prior to issuance of Final Completion Certificate) BY: ____________________ Date____________

UTILITY NOTES:

1. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE AND THE LOCATIONS ARE NOT GUARANTEED BY THE OWNER OR ENGINEER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE ALL UTILITIES, ANTICIPATE CONFLICTS, REPAIR EXISTING UTILITIES, AND RELOCATE EXISTING UTILITIES REQUIRED TO COMPLETE THE WORK AT NO ADDITIONAL COST TO THE OWNER.

2. SEE EXISTING CONDITIONS PLAN FOR BENCHMARK INFORMATION.

3. SEE GRADING, DRAINAGE & EROSION CONTROL PLAN FOR PROPOSED GRADING AND EROSION CONTROL MEASURES.

4. ALL WATER MAIN INSTALLATIONS SHALL BE AWWA C900, PVC PIPE, CLASS 150.

5. ALL WATERMAIN INSTALLATIONS SHALL BE PRESSURE TESTED AND CHLORINATED AFTER CONSTRUCTION PRIOR TO ACTIVATING THE SYSTEM. CONTRACTOR SHALL COORDINATE CHLORINATION AND TESTING WITH THE DURHAM WATER DEPARTMENT.

6. ALL SEWER PIPE SHALL BE PVC SDR 35 UNLESS OTHERWISE STATED.

7. ALL WORK WITHIN TOWN ROWS SHALL BE COORDINATED WITH TOWN OF DURHAM.

8. CONTRACTOR SHALL MAINTAIN UTILITY SERVICES TO ABUTTING PROPERTIES THROUGHOUT CONSTRUCTION.

9. CONNECTION TO EXISTING WATERMAIN SHALL BE CONSTRUCTED TO TOWN OF DURHAM STANDARDS.

10. EXISTING UTILITIES TO BE REMOVED SHALL BE CAPPED AT THE MAIN AND MEET THE DEPARTMENT OF PUBLIC WORKS STANDARDS FOR CAPPING OF WATER AND SEWER SERVICES.

11. ALL ELECTRICAL MATERIAL WORKMANSHIP SHALL CONFORM TO THE NATIONAL ELECTRIC CODE, LATEST EDITION, AND ALL APPLICABLE STATE AND LOCAL CODES.

12. THE EXACT LOCATION OF NEW UTILITY SERVICES AND CONNECTIONS SHALL BE COORDINATED WITH THE BUILDING DRAWINGS AND THE UTILITY COMPANIES.

13. ADJUST ALL MANHOLES, CATCH BASINS, CURB BOXES, ETC. WITHIN LIMITS OF WORK TO FINISH GRADE.

14. ALL UNDERGROUND CONDUITS SHALL HAVE NYLON PULL ROPES TO FACILITATE PULLING CABLES.

15. THE CONTRACTOR SHALL OBTAIN, PAY FOR, AND COMPLY WITH ALL REQUIRED PERMITS, ARRANGE FOR ALL INSPECTIONS, AND SUBMIT COPIES OF ACCEPTANCE CERTIFICATES TO THE OWNER PRIOR TO THE COMPLETION OF THIS PROJECT.

16. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL MANHOLES, BOXES, FITTINGS, CONNECTORS, COVER PLATES, AND OTHER MISCELLANEOUS ITEMS NOT NECESSARILY DETAILED ON THESE DRAWINGS TO RENDER INSTALLATION OF UTILITIES COMPLETE AND OPERATIONAL.

17. CONTRACTOR SHALL PROVIDE EXCAVATION, BEDDING, BACKFILL AND COMPACTION FOR NATURAL GAS SERVICES.

18. A 10-FOOT MINIMUM EDGE TO EDGE HORIZONTAL SEPARATION SHALL BE PROVIDED BETWEEN ALL WATER AND SANITARY SEWER LINES. AN 18-INCH MINIMUM OUTSIDE TO OUTSIDE VERTICAL SEPARATION SHALL BE PROVIDED AT ALL WATER/SANITARY SEWER CROSSINGS.

19. THE CONTRACTOR SHALL CONTACT "DIG-SAFE" 72 HOURS PRIOR TO COMMENCING CONSTRUCTION. THE CONTRACTOR SHALL HAVE THE "DIG-SAFE" NUMBER ON SITE AT ALL TIMES.

20. CONTRACTOR TO SUBMIT AS-BUILT PLANS ON REPRODUCIBLE MYLARS AND IN DIGITAL FORMAT (.DXF FILES) TO THE OWNER AND ENGINEER UPON COMPLETION OF THE PROJECT. AS-BUILTS SHALL BE PREPARED AND CERTIFIED BY A LICENSED LAND SURVEYOR OR PROFESSIONAL ENGINEER.

21. SAWCUT AND REMOVE PAVEMENT AND CONSTRUCT PAVEMENT TRENCH PATCH FOR ALL PROPOSED UTILITIES LOCATED IN EXISTING PAVEMENT AREAS TO REMAIN

22. HYDRANTS, GATE VALVES, FITTINGS, ETC. SHALL MEET THE REQUIREMENTS OF THE TOWN OF DURHAM.

23. COORDINATE TESTING OF SEWER CONSTRUCTION WITH THE TOWN OF DURHAM.

24. ALL SEWER PIPE WITH LESS THAN 4' OF COVER IN UNPAVED AREAS AND 6' OF COVER IN PAVED AREAS SHALL BE INSULATED.

25. CONTRACTOR SHALL COORDINATE ALL ELECTRIC WORK INCLUDING BUT NOT LIMITED TO: CONDUIT CONSTRUCTION, MANHOLE CONSTRUCTION, UTILITY POLE CONSTRUCTION, OVERHEAD WIRE RELOCATION, AND TRANSFORMER CONSTRUCTION WITH POWER COMPANY.

26. CONTRACTOR SHALL PHASE UTILITY CONSTRUCTION, PARTICULARLY WATER MAIN AND GAS MAIN CONSTRUCTION AS TO MAINTAIN CONTINUOUS SERVICE TO ABUTTING PROPERTIES. CONTRACTOR SHALL COORDINATE TEMPORARY SERVICES TO ABUTTERS WITH THE UTILITY COMPANY AND AFFECTED ABUTTER.

27. SITE LIGHTING SPECIFICATIONS, CONDUIT LAYOUT AND CIRCUITRY FOR PROPOSED SITE LIGHTING AND SIGN ILLUMINATION SHALL BE PROVIDED BY THE PROJECT ELECTRICAL ENGINEER.

LEGEND

PROPERTY LINE
ABUTTER LINE
BUILDING SETBACK
EDGE OF WETLAND
EXISTING TREELINE
PROPOSED TREELINE
EXISTING STONEWALL
EXISTING DRAINAGE
PROPOSED DRAINAGE
EXISTING ELECTRIC/TELEPHONE/CABLE
EXISTING OVERHEAD WIRE
PROPOSED UNDERGROUND ELECTRIC/TELEPHONE/CABLE
APPROX. WATER LINE
PROPOSED WATER
PROPOSED THRUST BLOCK
PROPOSED HYDRANT
PROPOSED GATE VALVE
PROPOSED CURB STOP
PROPOSED REDUCER
PROPOSED GAS
EXISTING SEWER
PROPOSED SEWER
MATCH LINE
PROPOSED LIGHT POLE BASE
PROPOSED SEWER MANHOLE
EXISTING SEWER MANHOLE
PROPOSED DRAIN MANHOLE
PROPOSED CATCH BASIN
PROPOSED YARD DRAIN

PROPOSED SEWER STRUCTURE TABLE

PSMH1 RIM=104.10 INV.IN=97.50 INV.OUT=97.40	PSMH8 RIM=101.15 INV.IN=94.25 INV.OUT=94.15
PSMH2 (DROP) RIM=102.85 INV.IN=96.30 INV.OUT=93.80	PSMH9 RIM=103.50 INV.IN=93.15 INV.OUT=93.05
PSMH3 RIM=100.85 INV.IN=93.10 INV.OUT=93.00	PSMH10 RIM=103.95 INV.IN=91.65 INV.OUT=91.55
PSMH4 (DROP) RIM=102.00 INV.IN=92.45 INV.OUT=90.75	PSMH11 RIM=104.00 INV.IN=90.80 INV.OUT=90.50
PSMH5 (DROP) RIM=101.70 INV.IN=89.80 (PSMH4) INV.IN=91.90 (PSMH13) INV.OUT=89.70	PSMH12 RIM=102.75 INV.IN=89.45 INV.OUT=89.35
PSMH6 RIM=103.95 INV.IN=88.60 (PSMH5) INV.IN=88.60 (PSMH12) INV.OUT=88.50	PSMH13 RIM=99.80 INV.IN=92.45 INV.OUT=92.35
PSMH7 RIM=102.00 INV.IN=87.95 INV.OUT=87.85	

SPECIAL UTILITY NOTES:

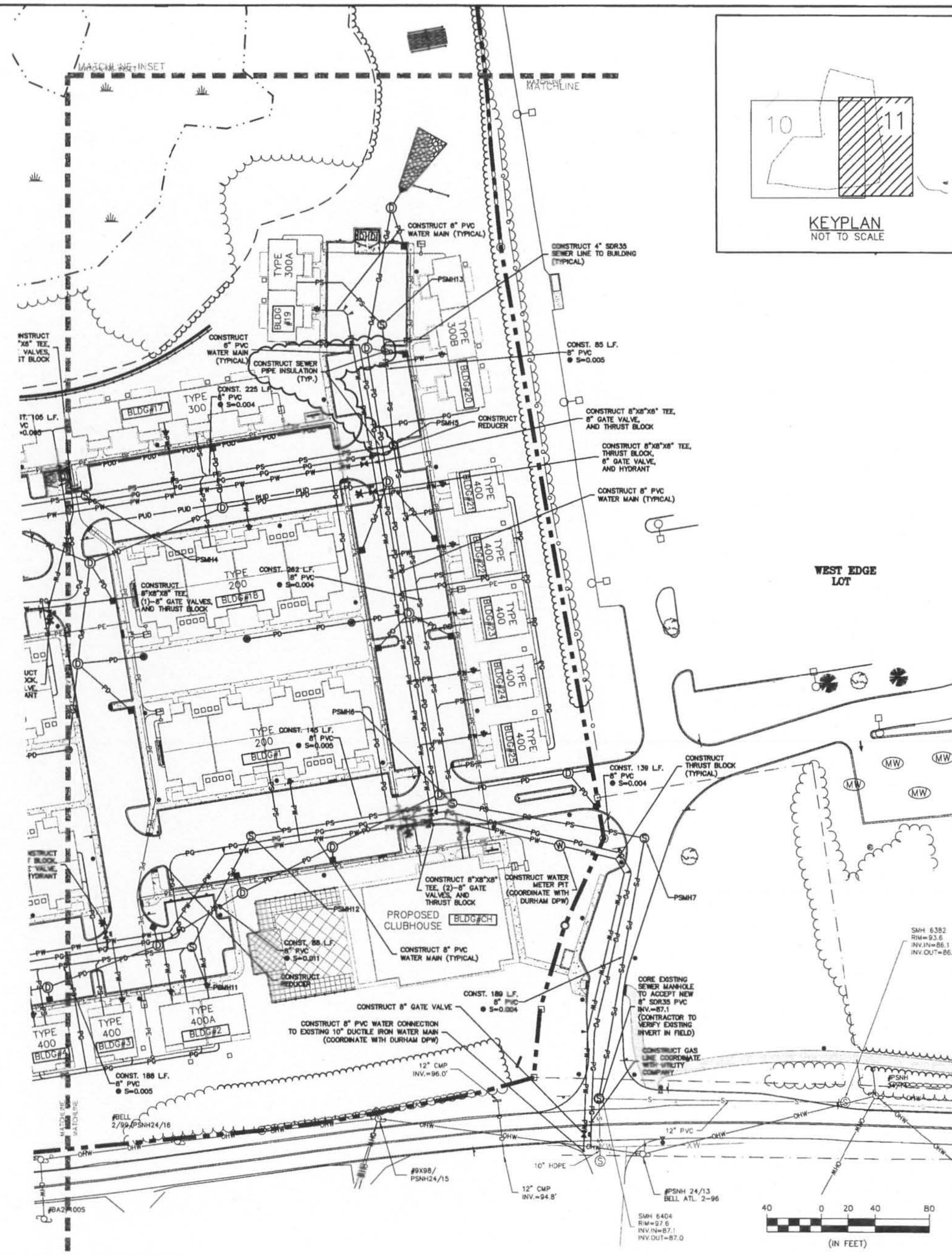
1. INDIVIDUAL WATER SERVICES SHALL BE 4" PVC WITH SHUT-OFF VALVE FOR ALL BUILDINGS.

2. INDIVIDUAL SEWER SERVICES SHALL BE 4" SDR35 SEWER FOR BUILDING TYPES 300, 300A, 400 AND 400A AND 6" SDR35 FOR BUILDING TYPES 200 AND 200A WITH A MINIMUM 2 PERCENT SLOPE AND CLEANOUT WITHIN 30" OF THE BUILDING.

3. INDIVIDUAL ELECTRIC AND GAS SERVICES SHALL HAVE SEPARATE METERS AT BUILDINGS.

4. ALL INSPECTION/OBSERVATION SERVICES FOR ALL WATER, WASTEWATER, AND STORMWATER MANAGEMENT INFRASTRUCTURE INSTALLATIONS ASSOCIATED WITH THE DEVELOPMENT SHALL BE PERFORMED BY AUTHORIZED REPRESENTATIVES OF THE TOWN OF DURHAM AS DEEMED NECESSARY BY THE DURHAM DEPARTMENT OF PUBLIC WORKS AND THE DEVELOPER SHALL REIMBURSE THE TOWN FOR ALL ASSOCIATED INSPECTION/OBSERVATION COSTS.

5. ALL UTILITY PIPING AND WIRING SHALL BE LOCATED UNDERGROUND.



Tighe&Bond
Consulting Engineers
177 Corporate Drive
Portsmouth, NH 03801
www.tighebond.com
100 YEARS STRONG
1911-2011

GREGG M. NIKOLAIDES No. 6954
4-19-13

Peak Campus Development, LLC

Mast Road Apartments

Durham, NH

Mark	Date	Description
G	04/19/13	REV. PER NHDES COMMENTS
F	3/8/13	REVISED FOR CONDITIONAL APPROVAL
E	02/07/13	REV. FOR SEWER CONNECTION
D	12/10/12	REVISED FOR AoT SUBMISSION
C	11/1/12	REVISED FOR PB SUBMISSION
B	9/26/12	REVISED FOR PB SUBMISSION
A	8/22/12	PB SUBMISSION

PROJECT NO:	P0637
FILE:	P0637_UTIL.DWG
DRAWN BY:	KAM/SLK1
CHECKED:	JMP2
APPROVED BY:	GMM

UTILITIES PLAN

SCALE: AS SHOWN

SHEET 11 OF 28

LEGEND

—▬ ▪ ▪ ▬—	PROPERTY LINE
	ABUTTER LINE
	BUILDING SETBACK
	EDGE OF WETLAND
	EXISTING TREELINE
	PROPOSED TREELINE
	EXISTING STONEWALL
—D—	EXISTING DRAINAGE
—PD—	PROPOSED DRAINAGE
—E—	EXISTING ELECTRIC/TELEPHONE/CABLE
—OHW—	EXISTING OVERHEAD WIRE
—PE—	PROPOSED UNDERGROUND ELECTRIC/TELEPHONE/CABLE
—XW—	APPROX. WATER LINE
—PW—	PROPOSED WATER
	PROPOSED THRUST BLOCK
	PROPOSED HYDRANT
	PROPOSED GATE VALVE
	PROPOSED CURB STOP
	PROPOSED REDUCER
—PG—	PROPOSED GAS
—S—	EXISTING SEWER
—PS—	PROPOSED SEWER
	MATCH LINE
	PROPOSED LIGHT POLE BASE
	PROPOSED SEWER MANHOLE
	EXISTING SEWER MANHOLE
	PROPOSED DRAIN MANHOLE
	PROPOSED CATCH BASIN
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SEE UTILITY NOTES ON SHEET 11

SPECIAL UTILITY NOTES:

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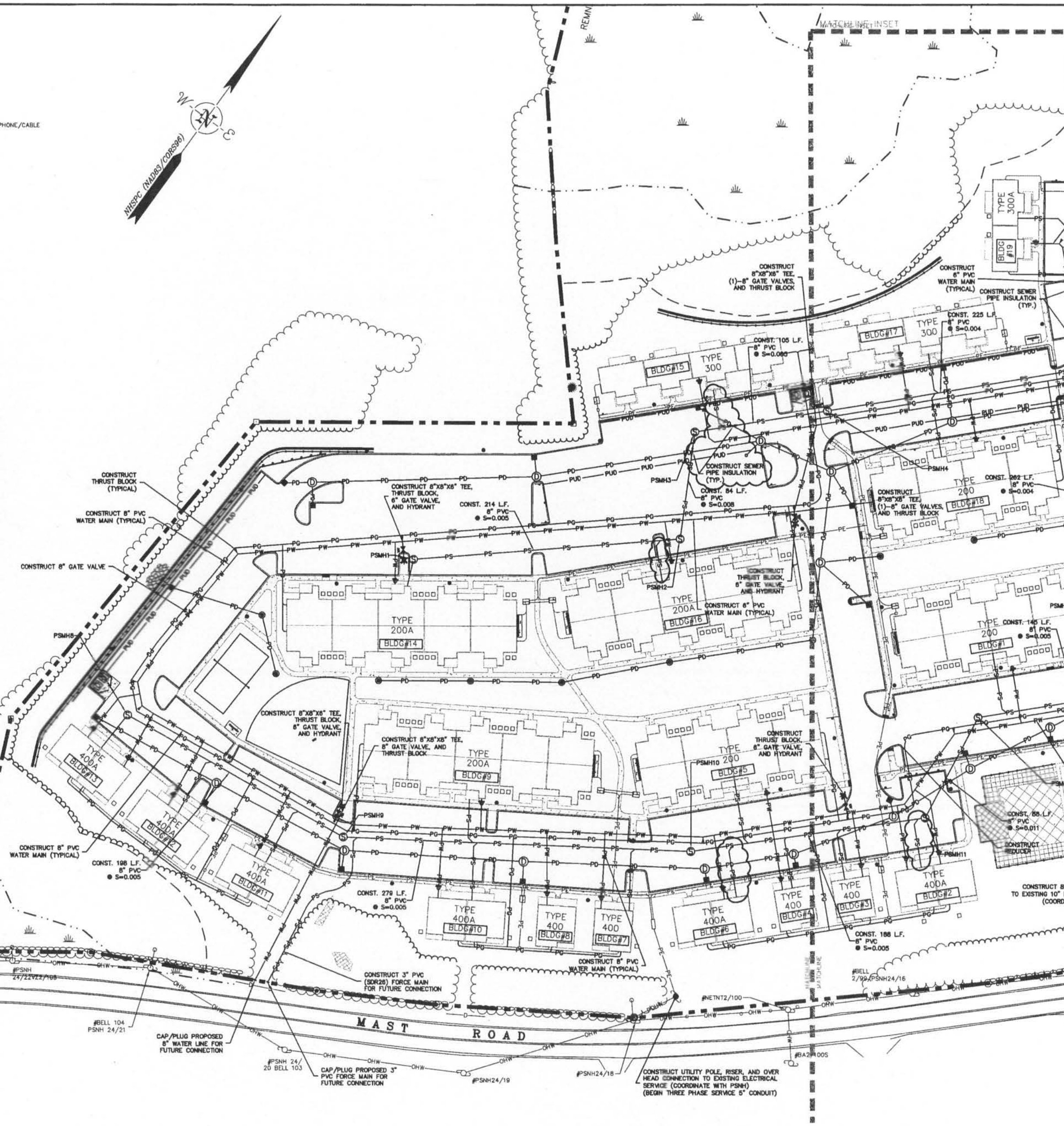

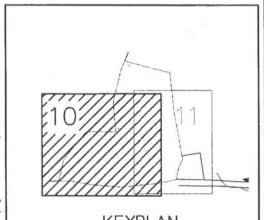

KEYPLAN
NOT TO SCALE

Tighe&Bond
Consulting Engineers
177 Corporate Drive
Portsmouth, NH 03801
www.tighebond.com

100 YEARS STRONG 1911-2011

Peak Campus Development, LLC

Mast Road Apartments

Durham, NH

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PROJECT NO:	P0637
FILE:	P0637_UTIL.DWG
DRAWN BY:	KAM/SLK1
CHECKED:	JMP2
APPROVED BY:	GMM

UTILITIES PLAN

SCALE: AS SHOWN

SHEET 10 OF 28

TOWN OF DURHAM
15 NEWMARKET ROAD
DURHAM, NH 03824-2898
Tel: 603/868-5571
Fax: 603/868-5572

AGENDA ITEM: # 7D

DATE: June 17, 2013

COUNCIL COMMUNICATION

INITIATED BY: Todd I. Selig, Administrator

AGENDA ITEM: **RESOLUTION #2013-15 AMENDING RESOLUTION #2012-11 TO CHANGE THE $745,000 FUNDING DESIGNATION WITHIN THE 2012 CAPITAL FUND BUDGET TO COME FROM LONG-TERM RATHER THAN SHORT-TERM BORROWING TO PURCHASE THE PEOPLE'S UNITED BANK BUILDING LOCATED AT 8 NEWMARKET ROAD FOR USE AS THE FUTURE TOWN HALL AND RESCINDING RESOLUTION #2012-17 DATED OCTOBER 15, 2012**

CC PREPARED BY: Jennie Berry, Administrative Assistant

PRESENTED BY: Todd I. Selig, Administrator

AGENDA DESCRIPTION:

On May 21, 2012 the Town Council held a public hearing on both the possible acquisition of the People's United Bank building located at 8 Newmarket Road and on Resolution #2012-11 to raise, appropriate, and expend an additional $745,000 within the 2012 Capital Fund Budget (with funds to come from the Undesignated Fund Balance) to purchase the 8 Newmarket Road site for use as the future Town Hall. The Council also adopted the resolution by a two-thirds majority vote required by Section 5.5 of the Durham Town Charter.

After adopting Resolution #2012-11, Town staff spoke with Moody's Investors Service who advised the Town that it would be best to obtain funding for the $745,000 through short-term borrowing in order for the Town to retain its Undesignated (Unassigned) Fund Balance reserve amount should the economy worsen and cause a substantial decrease in property tax payments that could adversely affect the Town's bond rating. Durham's current Moody rating is Aa2 which means that the Town has a very strong capacity to meet its financial commitments. It differs from the highest rated obligors only in small degree.

On October 15, 2012, the Council adopted Resolution #2012-17 which amended Resolution #2012-11 to change the $745,000 fund designation within the 2012 Capital

Fund Budget to come from short-term bonding rather than the Undesigndated (Unassigned) Fund Balance and to authorize the short-term borrowing of $745,000 for up to one year for the purpose of purchasing the People's United Bank building located at 8 Newmarket Road for use as the future Town Hall.

After researching current interest rates, we believe that it would be more cost-effective at this time to change borrowing on this project from a short-term to a long-term bond and to issue the debt within the next few months as interest rates are presently very low creating a beneficial situation for Durham. The project will be aggregated with several projects and some debt refinancing resulting in savings for the community. We tentatively plan to schedule a Public Hearing on a debt issuance for July 1st. Attached for the Council's consideration is a draft resolution that would make this change.

LEGAL AUTHORITY:
N/A

LEGAL OPINION:
N/A

FINANCIAL DETAILS:
N/A

SUGGESTED ACTION OR RECOMMENDATIONS:

MOTION 1:
The Durham Town Council does hereby ADOPT Resolution #2013-15 amending Resolution #2012-11 to change the $745,000 funding designation within the 2012 Capital Fund Budget to come from long-term rather than short-term borrowing to purchase the People's United Bank building located at 8 Newmarket Road for use as the future Town Hall and rescinding Resolution #2012-17 dated October 15, 2012.

RESOLUTION #2013-15 OF DURHAM, NEW HAMPSHIRE

AMENDING RESOLUTION $2012-11 TO CHANGE THE $745,000 FUNDING DESIGNATION WITHIN THE 2012 CAPITAL FUND BUDGET TO COME FROM LONG-TERM RATHER THAN SHORT-TERM BORROWING TO PURCHASE THE PEOPLE'S UNITED BANK BUILDING LOCATED AT 8 NEWMARKET ROAD FOR USE AS THE FUTURE TOWN HALL AND RESCINDING RESOLUTION #2012-11 DATED OCTOBER 15, 2012

WHEREAS, on May 21, 2012 the Town Council held a public hearing on both the possible acquisition of the People's United Bank building located at 8 Newmarket Road and on Resolution #2012-11 to raise, appropriate, and expend an additional $745,000 within the 2012 Capital Fund Budget (with funds to come from the Undesignated Fund Balance) to purchase the 8 Newmarket Road site for use as the future Town Hall; and

WHEREAS, On May 21, 2012 the Town Council approved, by a two-thirds majority vote, Resolution #2012-11 to raise, appropriate, and expend an additional $745,000 within the 2012 Capital Fund Budget (with funds to come from the Undesignated Fund Balance) to purchase the People's United Bank building located at 8 Newmarket Road for use as the future Town Hall; and

WHEREAS, after adopting Resolution 2012-11, Town staff was advised by Moody's Investors Service that it would be best to obtain funding for the $745,000 through short-term borrowing in order for the Town to retain its Undesignated (Unassigned) Fund Balance reserve amount should the economy worsen and cause a substantial decrease in property tax payments that could adversely affect the Town's bond rating; and

WHEREAS, upon Moody's advice and in accordance with Sections 5.5 and 5.12 of the Durham Town Charter and New Hampshire Revise Statutes Annotated (RSA) 33:9, the Town Council adopted Resolution #2012-17 on October 15, 2012 to change the funding designation within the 2012 Capital Fund Budget to come from short-term borrowing and authorize the short-term borrowing of $745,000 for up to one year for the purpose of purchasing the People's United Bank building located at 8 Newmarket Road for use as the future Town Hall; and

WHEREAS, after researching current interest rates, the Town believes that it would be more cost-effective at this time to change borrowing for this project from a short-term to a long-term bond;

NOW, THEREFORE BE IT RESOLVED that the Durham Town Council, the governing body of the Town of Durham, New Hampshire, does hereby ADOPT Resolution #2013-15 amending Resolution #2012-11 to change the $745,000 funding designation within the 2012 Capital Fund Budget to come from long-term rather than short-term borrowing to purchase the People's United Bank building located at 8 Newmarket Road for use as the future Town Hall and rescinding Resolution #2012-17 dated October 15, 2012.

PASSED AND ADOPTED this ____ day of **, 2013** on a vote of the Durham Town Council with ______ voting in favor, ____ voting against, and ______ abstaining.

____
Jay B. Gooze, Chair
Durham Town Council

ATTEST:

____
Lorrie Pitt, Town Clerk

TOWN OF DURHAM
Business Department

15 Newmarket Road, Durham, NH 03824-2898
Tel: (603) 868-8043 • Fax: (603) 868-5572

Gail E. Jablonski, Business Manager
gjablonski@ci.durham.nh.us

AGENDA ITEM: #7E

DATE: June 17, 2013

COUNCIL COMMUNICATION

INITIATED BY: Gail Jablonski, Business Manager

AGENDA ITEM: **SCHEDULING A PUBLIC HEARING FOR JULY 1, 2013 ON A RESOLUTION AUTHORIZING THE RAISING, APPROPRIATING, AND EXPENDITURE OF AN ADDITIONAL ONE HUNDRED AND FIFTEEN THOUSAND DOLLARS ($115,000) WITHIN THE FY 2013 CAPITAL FUND BUDGET (WITH FUNDS TO COME FROM LONG-TERM BONDING) FOR EMERGENCY RADIO COMMUNICATION ENHANCEMENTS?**

CC PREPARED BY: Gail Jablonski, Business Manager

PRESENTED BY: Gail Jablonski, Business Manager

AGENDA DESCRIPTION:

At the May 6, 2013 Town Council meeting Luke Vincent and Police Chief David Kurz held a discussion on the existing deficiencies with radio communication between the Strafford County Communications Center with Durham Fire and Police units and a proposed solution. The current radio configuration transmits signals back and forth between Durham entities and Strafford County, located in Dover, to and from a microwave antenna located at Beech Hill. From the microwave antenna, transmission is accomplished via four separate antennas located within Durham via Fairpoint telephone lines. It is at this point that problems persist with periodic complete failure of radio communications. This is due to the telephone lines having a 90-95% reliability rate, considered a high rate of success for telephone lines, when it is obvious that emergency communications demands 100% functionality. To rectify this deficiency, an engineering proposal recommends an elimination of Durham's dependency upon telephone lines with a conversion to microwave antennas enabling not only dependable service but system redundancy.

During budget deliberations, this issue was discussed but staff did not have firm proposals nor cost parameters to present to the Council. At this point we have a proposal from 2-Way Communications to perform the Upgrade in the amount of $115,000.00 and are requesting Council approval to amend the 2013 Capital Fund Budget

LEGAL AUTHORITY:

Article 5 Section 5.5 of the Durham Town Charter states that no appropriation shall be made for any purpose not included in the annual budget as adopted unless approved by a two-thirds majority of the Council after a public hearing. The Council shall, by resolution, designate the source of any money so appropriated. This provision shall not apply, however, to emergency appropriations adopted pursuant to 3.10 of this Charter.

LEGAL OPINION:

N/A

FINANCIAL DETAILS:

See attached Bond Payment Schedule.

NOTE: This is for review purposes only. The actual schedule will be determined once the Bond Sale has been completed.

SUGGESTED ACTION OR RECOMMENDATIONS:

MOTION:

The Durham Town Council does hereby schedule a public hearing for Monday, July 1, 2013 on a resolution to appropriate an additional $115,000 within the FY 2013 Capital Fund Budget for emergency radio communication enhancements, at which time Chief Kurz and Luke Vincent will plan to attend to answer questions from the Town Council and public.

RESOLUTION #2013-XX OF DURHAM, NEW HAMPSHIRE

AUTHORIZING THE RAISING, APPROPRIATING, AND EXPENDITURE OF AN ADDITIONAL ONE HUNDRED AND FIFTEEN THOUSAND DOLLARS ($115,000) WITHIN THE FY 2013 CAPITAL FUND BUDGET TO IMPROVE RADIO COMMUNICATIONS WITH FUNDS TO COME FROM LONG TERM BONDING

WHEREAS, the need for improvements to the current radio system between the Town of Durham Police and Fire Departments and the Strafford County Communication Center were discussed during the 2013 budget deliberations; and

WHEREAS, at that time a proposal was not available outlining the necessary work and cost; and

WHEREAS, a proposal has been received in the amount of $115,000 which would involve conversion to a microwave system that would provide dependable service; and

WHEREAS, in accordance with Section 5.5 of the Town Charter, the Durham Town Council may approve additional appropriations not included in the annual budget by resolution designating the source of the additional appropriation with a two-thirds vote of the Council after a public hearing; and,

WHEREAS, the $115,000, not included in the approved 2013 budget, would come from the 2013 Capital Fund Budget Long-Term Bonding; and

WHEREAS, on May 6, 2013 the Council received a presentation and held discussion with Luke Vincent and Police Chief David Kurz concerning the current deficiencies in the radio communications between the Durham Police and Fire Departments and the Strafford County Communication Center and subsequently, a public hearing was scheduled for July 1, 2013 in accordance with Section 5.5 of the Durham Town Charter on a resolution to raise, appropriate, and expend an additional $115,000 within the 2013 Capital Fund Budget (with funds to come from Long Term Bonding) to improve the radio communications; and

WHEREAS, a public hearing notice was published in the *Foster's Daily Democrat* on **Thursday, June 20, 2013** and was posted on the public bulletin board located outside of the Town Hall, at the Department of Public Works, and the Durham Public Library; and

WHEREAS, on **July 1, 2013**, a public hearing was held on Resolution #2013-XX to raise, appropriate, and expend an additional $115,000 within the 2013 Capital Fund Budget (with funds to come from long-term borrowing) for emergency radio communication enhancements;

NOW, THEREFORE BE IT RESOLVED that the Durham Town Council, the governing body of the Town of Durham, New Hampshire, does hereby approve hereby approve Resolution #2013-XX to raise, appropriate, and expend an additional $115,000 within the 2013 Capital Fund Budget (with funds to come from Long Term Bonding) to improve radio communications between the Durham Police and Fire Departments and the Strafford County Communication Center.

PASSED AND ADOPTED this _______day of ______by a two-thirds majority vote of the Durham Town Council with __________ voting in favor, _______ voting against, and ____________ abstaining.

____
Jay B. Gooze, Chair
Durham Town Council

ATTEST:

____
Lorrie Pitt, Town Clerk

TOWN OF DURHAM
15 NEWMARKET ROAD
DURHAM, NH 03824-2898
Tel: 603/868-5571
Fax: 603/868-5572

AGENDA ITEM: # 9A

DATE: June 17, 2013

COUNCIL COMMUNICATION

INITIATED BY: Durham Energy Committee
Todd I. Selig, Administrator

AGENDA ITEM: PRESENTATION ON POWER PURCHASE AGREEMENT FOR THE DURHAM PUBLIC LIBRARY, CHURCHILL RINK, AND POLICE DEPARTMENT FACILITIES – STEPHEN HINCHMAN AND STEVE CONDON, REVISION ENERGY, LLC

CC PREPARED BY: Jennie Berry, Administrative Assistant

PRESENTED BY: Todd Selig, Administrator

AGENDA DESCRIPTION:

In April 2012, the Town sent out Request for Qualifications for Energy Efficiency Systems to include assessment and consulting, system design and development, financing and procurement, installation, and maintenance of potential energy efficiency systems, as well energy procurement, for the Town of Durham. In short, the RFQ stated the desire of the Town to:

- Reduce total energy use and fossil fuel emissions within municipal infrastructure;
- Improve energy efficiency in buildings, infrastructure, and other areas as determined by the community;
- Procure energy commodities as cost effectively as possible.

After careful review of the proposals received, the company Revision Energy, LLC was selected for the project. Over the past year, Revision Energy, LLC has been working with the Administrator and members of the Durham Energy Committee to develop a plan/agreement that would accomplish the goals mentioned above for several of Durham's facilities, including the Durham Public Library, Churchill Rink, and the Police Department.

At Monday night's meeting, Stephen Hinchman and Steve Condon of Revision Energy, LLC, will provide the Council with an overview of a plan they have developed and how elements contained within the plan will be implemented at each of three municipal facilities. The Council is not required to take action, and unless there are specific concerns expressed by Councilors regarding the proposed agreement, the Administrator plans to move forward with its implementation.

LEGAL AUTHORITY:
N/A

LEGAL OPINION:
N/A

FINANCIAL DETAILS:
See attached information.

SUGGESTED ACTION OR RECOMMENDATIONS:
No formal action is required by Council. Receive presentation from representatives of Revision Energy, LLC, and hold question and answer session if desired. If no concerns are expressed by Council members regarding the agreement, the Administrator will move forward with Revision Energy, LLC on its implementation.

ReVision Energy

Professional design, installation and service of solar energy systems

Durham, NH Solar PPA 6-11-2013
Churchill's Rink (99.45 kW) – Police Station (5.2 kW) – Public Library (15.6 kW)



120.25 kW Combined Photovoltaic Solar Project, Estimated Production of 127,631 kWh in year 1

- **$410,540 system – with no upfront cost to Town.** ReVision Energy will finance, own and operate.
- **20 Year Power Purchase Agreement:** Host will buy power at price equal to its utility rate
  - **Years 1-6:** generation from the combined Churchill's Rink and Public Library will be charged to the town at a rate fixed to the PSNH (and third party provider supply) rate established today to be $9.7 cents kWH.
  - **Years 1-6:** generation from the 5.2 kW Police Station rooftop solar array will be contributed to the town at no charge (estimated year 1 output 6,500 kwh/year, saving an estimated $630/year at current rates).
- **Option to purchase in year 7 for $130,500** (equals purchase price of $1.09/watt, 32% of original cost).
  - **Annual Energy Savings:** once host owns system, it will save over $13,000/year depending on the value of RECs and O&M agreement chosen with ReVision Energy.
  - **Buyout Payback:** Combined savings will pay for system in approximately 11 years from buyout.
  - **Long Term Savings:** 30-years anticipated savings exceed $158,000. System life expectancy is 40+ years.
  - **Conservative financial modeling:** Higher electric rates will accelerate and increase savings.
- **Host may forego buyout** and continue to purchase solar power after year 7 at market rates.
- **Remote Monitoring:** Real time solar generation data can be shared on town website and with schools.
- **No Maintenance –** During the term of the PPA, the system will be owned and operated by ReVision Energy. The Town will have no maintenance obligations or expenses. After buyout O&M is modeled as an expense in the Pro Forma.
- **Inverter Replacement-**Modeled as a cumulative fund beginning in year 7. Please see write up on inverter expectations 10-15 years from today.
- **Carbon Footprint:** solar generation from the will lower the town's CO2e emissions by over 164,000 lbs. per year.
- **PPA Structure** – Allows project to capture tax benefits; provides host with onsite solar power at no extra cost; improves sustainability; lowers long term energy costs.

91 West Main Street
Liberty, ME 04949
(207) 589-4171

142 Presumpscot Street
Portland, ME 04103
(207) 221-6342

7 Commercial Drive
Exeter, NH 03833
(603) 501-1822

www.revisionenergy.com

ProForma - Town of Durham: Churchill Rink (99.45 kW); Durham Public Library (15.6 kW); Durham Police Station (5.2 kW)

System Design	
Installed Equipment Cost	$ 386,930
ITC Eligible Development Costs	$ 23,611
ITC Ineligible Development Costs	$ -
Initial Debt Service Reserve	$ -
Total System Price	$3.41 Watt
Total System Cost	$ 410,540

System Inputs	
System Size (kw DC)	120
kwh/kw/year	1,061
Annual Output Year 1 (kwh)	127,631
Annual Degradation Factor	0.80%
PPA Term (yrs)	20/30

Tax Assumptions	
Federal Tax Rate	28.0%
State Tax Rate	8.5%
Effective Tax Rate	34%
Taxable Grant Income	$ 66,640
Eligible Basis for Depreciation	$ 348,959

Grants and Incentives	
Investment Tax Credit (ITC)	30%
Federal Depreciation	50% Bonus & 5 Yr MACRS
State Depreciation	5 yr MACRS
State Tax Credits	n/a
State Solar Rebate	$ 66,640
USDA REAP	$ -

Financing				
Int/Pts on Construction Loan		$	-	(capitalized)
Bridge Loan		*$*	-	
Int/Term/Pts on Bridge Loan				
Long Term Loan		*$*	*356,992*	
Int/Term/Pts on LT Debt	4.0%		6	0
Cost of LT Debt		$	45,143	
% Financed with Debt Equity			87%	(bridge plus long-term)
% Financed with Tax Investor Equity			13%	

Energy and REC Values			
Net Metered Savings Yrs ($/kwh)	$	0.097	(year one)
Net Meter Escalator		1.5%	
REC Multiplier		1.00	(off)
REC Sales Year 1 ($/mwh)	$	10,211	$080/MWh

		ITC Recapture Period											
20 Year PPA Cash Flow		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**
Energy Production (kwh)		127,631	126,610	125,597	124,593	123,596	122,607	121,626	120,653	119,688	118,731	117,781	116,838
Cost per kwh		0.097	0.098	0.100	0.101	0.103	0.104	0.106	0.109	0.111	0.113	0.115	0.118
Energy Sales		$ 12,363	$ 12,448	$ 12,534	$ 12,620	$ 12,707	$ 12,794	$ 12,946	$ 13,099	$ 13,254	$ 13,411	$ 13,570	$ 13,730
RECs (MWh)		128	127	126	125	124	123	122	121	120	119	118	117
$/REC		$ 80	$ 80	$ 80	$ 50	$ 50	$ 50	$ 35	$ 35	$ 25	$ 25	$ -	$ -
REC Sales		$ 10,211	$ 10,129	$ 10,048	$ 6,230	$ 6,180	$ 6,130	$ 4,257	$ 4,223	$ 2,992	$ 2,968	$ -	$ -
Pre-Paid Energy & RECs		$ -	$ -	$ -	$ -	$ -	$ -						
Income		**$ 22,574**	**$ 22,577**	**$ 22,582**	**$ 18,850**	**$ 18,887**	**$ 18,925**	**$ 17,203**	**$ 17,322**	**$ 16,246**	**$ 16,379**	**$ 13,570**	**$ 13,730**
O&M ($/kw)	$10.00	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203
Landowner Payments		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Property tax (00.00 mills w/ 0.3%escalator)		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Insurance ($/$1000 0.5% escalator)	$3.30	$ 1,355	$ 1,362	$ 1,368	$ 1,375	$ 1,382	$ 1,389	$ 1,396	$ 1,403	$ 1,410	$ 1,417	$ 1,424	$ 1,431
Owners Management Fee		$ 4,105	$ 4,112	$ 4,118	$ 4,124	$ 4,130	$ 4,136	$ 4,142	$ 4,149	$ 4,155	$ 4,161	$ 4,167	$ 4,174
Utilities (elect. meter and phone)		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Road maintenance		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Snow removal		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Accountant		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Expenses		$ 6,663	$ 6,676	$ 6,689	$ 6,702	$ 6,715	$ 6,728	$ 6,741	$ 6,754	$ 6,767	$ 6,781	$ 6,794	$ 6,807
Operating Income (EBITDA)		**$ 15,911**	**$ 15,901**	**$ 15,893**	**$ 12,148**	**$ 12,172**	**$ 12,197**	**$ 10,462**	**$ 10,568**	**$ 9,479**	**$ 9,599**	**$ 6,776**	**$ 6,923**
Loan Proceeds		$ 356,992											
Debt Service - Principal		$ (53,721)	$ (55,909)	$ (58,187)	$ (60,558)	$ (63,025)	$ (65,574)	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service - Interest		$ (13,302)	$ (11,113)	$ (8,835)	$ (6,465)	$ (3,998)	$ (1,430)	$ -	$ -	$ -	$ -	$ -	$ -
Bridge Loan - Principal		$ -	$ -										
Bridge Loan - Pts & Interest		$ -	$ -										
Federal ITC		$ 123,162	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fed Tax Benefits (Cost) from Depreciation		$ 24,242	$ 14,293	$ 7,404	$ 4,037	$ 3,339	$ (201)	$ (3,530)	$ (3,566)	$ (3,199)	$ (3,239)	$ (2,287)	$ (2,336)
State Tax Benefits (Cost) from Depreciation		$ (3,045)	$ 6,141	$ 3,444	$ 1,983	$ 1,840	$ 536	$ -	$ -	$ -	$ -	$ -	$ -
Rebates/Grants/Other		$ 66,640	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
After-Tax Cash Flow	**$ (410,540)**	**$ 516,879**	**$ (30,688)**	**$ (40,282)**	**$ (48,855)**	**$ (49,671)**	**$ (54,472)**	**$ 6,931**	**$ 7,002**	**$ 6,280**	**$ 6,360**	**$ 4,489**	**$ 4,587**
Cumulative		$ 516,879	$ 486,191	$ 445,909	$ 397,055	$ 347,384	$ 292,912	$ 299,843	$ 306,845	$ 313,125	$ 319,485	$ 323,974	$ 328,561
Profit (Shortfall)		*$ 106,338*	*$ 75,650*	*$ 35,369*	*$ (13,486)*	*$ (63,157)*	*$ (117,628)*	*$ (110,697)*	*$ (103,696)*	*$ (97,415)*	*$ (91,056)*	*$ (86,567)*	*$ (81,980)*

Benefits to Host After Year 7 Buyout	
Energy Savings @ Police Sta. ($600/yr)	*$ 3,600*
Flip Cost	*$ 130,500*
Tax to LLC on Flip	*$ (49,347)*
Flip $/watt	*$ 1.09*
% of Original Cost	*32%*
Average Annual Energy Savings	*$ 11,811*
Years to Breakeven on Buyout	*11.0*
Estimated 30-Year Project Savings	*$ 158,447*

Host Annual Cash Flow		*Year 7*	*Year 8*	*Year 9*	*Year 10*	*Year 11*	*Year 12*
Post Flip Income	*$ (130,500)*	*$ 17,203*	*$ 17,322*	*$ 16,246*	*$ 16,379*	*$ 13,570*	*$ 13,730*
-Insurance		*$ (1,396)*	*$ (1,403)*	*$ (1,410)*	*$ (1,417)*	*$ (1,424)*	*$ (1,431)*
-O&M (half to inverter replacement fund)		*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*
-Inverter Replacement Fund		*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*
Net Post Flip Cash Flow		***$ 13,702***	***$ 13,815***	***$ 12,732***	***$ 12,858***	***$ 10,041***	***$ 10,195***
Cumulative Cash Flow		*$ 17,302*	*$ 31,117*	*$ 43,849*	*$ 56,707*	*$ 66,748*	*$ 76,943*
Savings	*$ 3,600*						
Cumulative Inverter Fund		*$ 1,503*	*$ 3,006*	*$ 4,509*	*$ 6,013*	*$ 7,516*	*$ 9,019*

ProForma - Town of Durham: Churchil

System Design		
Installed Equipment Cost	$	386,930
ITC Eligible Development Costs	$	23,611
ITC Ineligible Development Costs	$	-
Initial Debt Service Reserve	$	-
Total System Price		$3.41 Watt
Total System Cost	$	410,540

System Inputs	
System Size (kw DC)	120
kwh/kw/year	1,061
Annual Output Year 1 (kwh)	127,631
Annual Degradation Factor	0.80%
PPA Term (yrs)	20/30

20 Year PPA Cash Flow		**Year 13**	**Year 14**	**Year 15**	**Year 16**	**Year 17**	**Year 18**	**Year 19**	**Year 20**	**Year 21**	**Year 22**	**Year 23**	**Year 24**
Energy Production (kwh)		115,904	114,977	114,057	113,144	112,239	111,341	110,450	109,567	108,690	107,821	106,958	106,103
Cost per kwh		0.120	0.122	0.125	0.127	0.130	0.132	0.135	0.138	0.140	0.143	0.146	0.149
Energy Sales		$ 13,893	$ 14,057	$ 14,224	$ 14,392	$ 14,563	$ 14,735	$ 14,910	$ 15,086	$ 15,265	$ 15,446	$ 15,628	$ 15,813
RECs (MWh)		116	115	114	113	112	111	110	110	109	108	107	106
$/REC		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
REC Sales		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pre-Paid Energy & RECs													
Income		**$ 13,893**	**$ 14,057**	**$ 14,224**	**$ 14,392**	**$ 14,563**	**$ 14,735**	**$ 14,910**	**$ 15,086**	**$ 15,265**	**$ 15,446**	**$ 15,628**	**$ 15,813**
O&M ($/kw)	$10.00	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203
Landowner Payments		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Property tax (00.00 mills w/ 0.3%escalator)		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Insurance ($/$1000 0.5% escalator)	$3.30	$ 1,438	$ 1,446	$ 1,453	$ 1,460	$ 1,467	$ 1,475	$ 1,482	$ 1,489	$ 1,497	$ 1,504	$ 1,512	$ 1,519
Owners Management Fee		$ 4,180	$ 4,186	$ 4,192	$ 4,199	$ 4,205	$ 4,211	$ 4,218	$ 4,224	$ 4,230	$ 4,237	$ 4,243	$ 4,249
Utilities (elect. meter and phone)		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Road maintenance		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Snow removal		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Accountant		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Expenses		$ 6,821	$ 6,834	$ 6,848	$ 6,861	$ 6,875	$ 6,889	$ 6,902	$ 6,916	$ 6,930	$ 6,944	$ 6,957	$ 6,971
Operating Income (EBITDA)		**$ 7,072**	**$ 7,223**	**$ 7,376**	**$ 7,531**	**$ 7,688**	**$ 7,847**	**$ 8,007**	**$ 8,170**	**$ 8,335**	**$ 8,502**	**$ 8,671**	**$ 8,842**
Loan Proceeds													
Debt Service - Principal		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt Service - Interest		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bridge Loan - Principal													
Bridge Loan - Pts & Interest													
Federal ITC		*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Fed Tax Benefits (Cost) from Depreciation		$ (2,387)	$ (2,438)	$ (2,489)	$ (2,541)	$ (2,594)	$ (2,648)	$ (2,702)	$ (2,757)	$ (2,813)	$ (2,869)	$ (2,926)	$ (2,984)
State Tax Benefits (Cost) from Depreciation		*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
Rebates/Grants/Other		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
After-Tax Cash Flow	**$ (410,540)**	**$ 4,686**	**$ 4,786**	**$ 4,887**	**$ 4,990**	**$ 5,094**	**$ 5,199**	**$ 5,305**	**$ 5,413**	**$ 5,522**	**$ 5,633**	**$ 5,745**	**$ 5,858**
Cumulative		$ 333,246	$ 338,032	$ 342,919	$ 347,909	$ 353,002	$ 358,201	$ 363,506	$ 368,920	$ 374,442	$ 380,075	$ 385,820	$ 391,678
Profit (Shortfall)		*$ (77,294)*	*$ (72,508)*	*$ (67,621)*	*$ (62,632)*	*$ (57,538)*	*$ (52,339)*	*$ (47,034)*	*$ (41,621)*	*$ (36,098)*	*$ (30,466)*	*$ (24,721)*	*$ (18,862)*

Benefits to Host After Year 7 Buyout		**Year 13**	**Year 14**	**Year 15**	**Year 16**	**Year 17**	**Year 18**	**Year 19**	**Year 20**	**Year 21**	**Year 22**	**Year 23**	**Year 24**
Energy Savings @ Police Sta. ($600/yr)	*$ 3,600*	*$ 13,893*	*$ 14,057*	*$ 14,224*	*$ 14,392*	*$ 14,563*	*$ 14,735*	*$ 14,910*	*$ 15,086*	*$ 15,265*	*$ 15,446*	*$ 15,628*	*$ 15,813*
Flip Cost	*$ 130,500*	*$ (1,438)*	*$ (1,446)*	*$ (1,453)*	*$ (1,460)*	*$ (1,467)*	*$ (1,475)*	*$ (1,482)*	*$ (1,489)*	*$ (1,497)*	*$ (1,504)*	*$ (1,512)*	*$ (1,519)*
Tax to LLC on Flip	*$ (49,347)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*
Flip $/watt	*$ 1.09*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*
% of Original Cost	*32%*	***$ 10,350***	***$ 10,508***	***$ 10,667***	***$ 10,828***	***$ 10,991***	***$ 11,156***	***$ 11,323***	***$ 11,492***	***$ 11,664***	***$ 11,837***	***$ 12,012***	***$ 12,190***
Average Annual Energy Savings	*$ 11,811*	*$ 87,293*	*$ 97,801*	*$ 108,467*	*$ 119,295*	*$ 130,286*	*$ 141,443*	*$ 152,766*	*$ 164,258*	*$ 175,922*	*$ 187,758*	*$ 199,771*	*$ 211,960*
Years to Breakeven on Buyout	*11.0*						*$ 10,943*	*$ 22,266*	*$ 33,758*	*$ 45,422*	*$ 57,258*	*$ 69,271*	*$ 81,460*
Estimated 30-Year Project Savings	*$ 158,447*	*$ 10,522*	*$ 12,025*	*$ 13,528*	*$ 15,031*	*$ 16,534*	*$ 18,038*	*$ 19,541*	*$ 21,044*	*$ 1,503*	*$ 3,006*	*$ 4,509*	*$ 6,013*

ProForma - Town of Durham: Churchil

System Design	
Installed Equipment Cost	$ 386,930
ITC Eligible Development Costs	$ 23,611
ITC Ineligible Development Costs	$ -
Initial Debt Service Reserve	$ -
Total System Price	$3.41 Watt
Total System Cost	$ 410,540

System Inputs	
System Size (kw DC)	120
kwh/kw/year	1,061
Annual Output Year 1 (kwh)	127,631
Annual Degradation Factor	0.80%
PPA Term (yrs)	20/30

		10 Year Extension of PPA					
20 Year PPA Cash Flow		**Year 25**	**Year 26**	**Year 27**	**Year 28**	**Year 29**	**Year 30**
Energy Production (kwh)		105,254	104,412	103,576	102,748	101,926	101,110
Cost per kwh		0.152	0.155	0.158	0.161	0.165	0.168
Energy Sales		$ 16,001	$ 16,190	$ 16,382	$ 16,576	$ 16,772	$ 16,971
RECs (MWh)		105	104	104	103	102	101
$/REC		$ -	$ -	$ -	$ -	$ -	$ -
REC Sales		$ -	$ -	$ -	$ -	$ -	$ -
Pre-Paid Energy & RECs							
Income		**$ 16,001**	**$ 16,190**	**$ 16,382**	**$ 16,576**	**$ 16,772**	**$ 16,971**
O&M ($/kw)	$10.00	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203	$ 1,203
Landowner Payments		$ -	$ -	$ -	$ -	$ -	$ -
Property tax (00.00 mills w/ 0.3%escalator)		$ -	$ -	$ -	$ -	$ -	$ -
Insurance ($/$1000 0.5% escalator)	$3.30	$ 1,527	$ 1,535	$ 1,542	$ 1,550	$ 1,558	$ 1,566
Owners Management Fee		$ 4,256	$ 4,262	$ 4,269	$ 4,275	$ 4,281	$ 4,288
Utilities (elect. meter and phone)		$ -	$ -	$ -	$ -	$ -	$ -
Road maintenance		$ -	$ -	$ -	$ -	$ -	$ -
Snow removal		$ -	$ -	$ -	$ -	$ -	$ -
Tax Accountant		$ -	$ -	$ -	$ -	$ -	$ -
Expenses		$ 6,985	$ 6,999	$ 7,013	$ 7,028	$ 7,042	$ 7,056
Operating Income (EBITDA)		**$ 9,015**	**$ 9,191**	**$ 9,368**	**$ 9,548**	**$ 9,730**	**$ 9,915**
Loan Proceeds							
Debt Service - Principal		$ -	$ -	$ -	$ -	$ -	$ -
Debt Service - Interest		$ -	$ -	$ -	$ -	$ -	$ -
Bridge Loan - Principal							
Bridge Loan - Pts & Interest							
Federal ITC		$ -	$ -	$ -	$ -	$ -	$ -
Fed Tax Benefits (Cost) from Depreciation		$ (3,042)	$ (3,101)	$ (3,161)	$ (3,222)	$ (3,284)	$ (3,346)
State Tax Benefits (Cost) from Depreciation		$ -	$ -	$ -	$ -	$ -	$ -
Rebates/Grants/Other		$ -	$ -	$ -	$ -	$ -	$ -
After-Tax Cash Flow	**$ (410,540)**	**$ 5,973**	**$ 6,089**	**$ 6,207**	**$ 6,326**	**$ 6,447**	**$ 6,569**
Cumulative		$ 397,651	$ 403,740	$ 409,947	$ 416,274	$ 422,720	$ 429,289
Profit (Shortfall)		*$ (12,889)*	*$ (6,800)*	*$ (593)*	*$ 5,733*	*$ 12,180*	*$ 18,749*

Benefits to Host After Year 7 Buyout		***Year 25***	***Year 26***	***Year 27***	***Year 28***	***Year 29***	***Year 30***
Energy Savings @ Police Sta. ($600/yr)	*$ 3,600*	*$ 16,001*	*$ 16,190*	*$ 16,382*	*$ 16,576*	*$ 16,772*	*$ 16,971*
Flip Cost	*$ 130,500*	*$ (1,527)*	*$ (1,535)*	*$ (1,542)*	*$ (1,550)*	*$ (1,558)*	*$ (1,566)*
Tax to LLC on Flip	*$ (49,347)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*	*$ (601)*
Flip $/watt	*$ 1.09*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*	*$ (1,503)*
% of Original Cost	*32%*	***$ 12,369***	***$ 12,551***	***$ 12,735***	***$ 12,921***	***$ 13,110***	***$ 13,301***
Average Annual Energy Savings	$ 11,811	*$ 224,329*	*$ 236,880*	*$ 249,615*	*$ 262,537*	*$ 275,647*	*$ 288,947*
Years to Breakeven on Buyout	11.0	*$ 93,829*	*$ 106,380*	*$ 119,115*	*$ 132,037*	*$ 145,147*	*$ 158,447*
Estimated 30-Year Project Savings	*$ 158,447*	*$ 7,516*	*$ 9,019*	*$ 10,522*	*$ 12,025*	*$ 13,528*	*$ 15,031*


Lang Door and Hardwa

Professional design, installation and service of solar energy systems

ReVision Energy – Solar Energy Partnership through PPA

The rising cost of energy has made solar a better choice than ever for schools, nonprofit organizations and towns. A very different funding and budgetary process means that these organizations often need a creative *partner* in order to reduce dependence on fossil fuels and make projects happen. ReVision Energy can help your organization evaluate your solar opportunities, identify funding sources, and successfully install a solar energy system that will save your organization money for 20+ years.

ReVision Energy so believes in the mission of bringing solar to nonprofit organizations that company founders Phil Coupe, Bill Behrens, and Fortunat Mueller created another company, ReVision Investments, along with environmental attorney Steve Hinchman.

Through Power Purchase Agreements, ReVision Investments helps nonprofits reduce the costs of solar energy systems by creating a mechanism for donors or private investors to purchase solar energy systems on behalf of nonprofits and thus qualify for state and federal incentives. After a period of time, the donor can elect to sell the solar energy system to the nonprofit at a steeply reduced rate, or donate the system completely. The nonprofit initially pays no upfront capital, but pays for the cost of the solar-generated electricity at competitive rates. The organization then has several years to seek out grants and/or fundraise the additional capital needed to purchase the solar project outright.

Once a project is physically completed and your community is generating energy from the sun, the true value of the ReVision Energy partnership begins. Our experience has shown that outreach, education and our availability to the communities in which we work are the most effective ways to further the development of solar energy in Northern New England. ReVision Energy remains committed to growing its partnership with the customer in order to educate its community with Ribbon Cuttings for the projects, Solar 101 discussions, and marketing campaigns to increase awareness around the value of solar within our communities. The execution of a ReVision Energy PPA is the beginning of a lasting relationship to further our knowledge of renewable energy within the community.

ReVision Energy – Solar PV Module Choice and Commitment

During our 10 years in the solar business, the industry of manufacturing photovoltaic (solar electric) panels has undergone massive transformation. Due to efficiency gains in technology, colossal government and private sector investments around the globe, growing worldwide demand and a vicious price war among manufacturers, the cost of panels has plummeted to a fraction of what they cost a decade ago. This cost reduction is great news for end customers of solar energy systems who have the opportunity to invest in solar energy systems at historically low prices, making solar competitive or cheaper than grid electricity in most cases. On the other hand, the tumultuous market environment has also resulted in a 'thinning of the manufacturing herd,' with a number of solar manufacturers unable to stay in business and we think there are additional companies unlikely to survive. At the same time, we are 100% confident that there are plenty of robust, high quality panel manufacturers that continue to deliver reliable equipment at historically low prices.

From our front row seat on this rollercoaster, we have learned that the most critical factor in the long-term sustainability of our company is ensuring that we deliver the highest quality components to our customers, installed to the highest standards of workmanship and durability to last for decades in a harsh northern climate.

To guarantee the quality of the equipment we install, ReVision Energy relies on the experience, judgment and ongoing rigorous industry research by our engineering team, led by company co-founder and managing partner William Behrens, MIT PhD in environmental economics and BS in electrical engineering.

Based on Bill's 25 years' industry experience, ReVision Energy has resisted the lure of the most inexpensive modules and intentionally and selectively offers only top tier solar products from trusted and proven manufacturers. Currently, ReVision is designing and installing systems using three of the top photovoltaic panel brands on the market today: Canadian Solar (www.canadiansolar.com), Suniva (www.suniva.com) and SunPower (www.sunpowercorp.com).

Canadian Solar is one of the top solar manufacturers worldwide. They are also one of the very few manufacturers that offers an "insurance-backed" 25-year warranty on its photovoltaic panels. Recognizing that industry turmoil and bankruptcies would make consumers nervous about the value of a long-term warranty if the manufacturer were no longer in business to honor the warranty, Canadian Solar introduced its insurance-backed warranty five years ago. We believe it is a sign of their strength and innovation that they took out a third party insurance policy on their warranty program to protect consumers, regardless of Canadian Solar's viability as a company. We also like the fact that Canadian Solar panels consistently deliver performance ratings among the top 5%

of all panels on the market today. During the past five years we have installed more than 10,000 Canadian Solar panels for our clients in Maine and New Hampshire, with two panel failures, *total.* In response to concerns about a growing solar panel tariff war between China, Germany and the U.S., Canadian Solar moved its solar cell manufacturing operations to Taiwan two years ago, while final module assembly is done in either China, Canada or Mexico. The company is headquartered in Ontario, Canada and is publicaly traded on the NASDAQ.

In 2011 ReVision Energy decided to take direct action to support domestic manufacturing jobs and the U.S. solar panel manufacturing industry, and we began researching the top photovoltaic brands made on American soil. It did not take us long to determine that Suniva is perhaps the strongest player in the U.S. manufacturing industry. After nearly two years of installing more than 3,000 Suniva Optimus photovoltaic panels, we have yet to experience a single panel failure. We love the fact that Suniva's headquarters and manufacturing facilities are located right here on the east coast in Norcross, GA.

ReVision Energy has been a premier dealer of SunPower photovoltaic panels for the past five years. SunPower, originally a spinoff from Cyprus semiconductor and now majority owned by the European energy giant, Total, is based in California and has its manufacturing facilities in the Philippines and Southern California and Mexico. Thanks to their innovative back contact cell design, SunPower manufactures the most efficient photovoltaic panels on the market today, which means that each panel delivers up to 20% more power per area than competing panels like Canadian Solar and Suniva. The only drawback to SunPower panels is that the 20% efficiency advantage comes at a 30% cost premium, making SunPower the most expensive photovoltaic panel on the market. We continue to offer SunPower because they have earned their reputation as one of the highest quality manufacturers worldwide during nearly two decades of consistently delivering industry-leading products.

ReVision Energy Speculation on Inverter Replacement:

Solar plants are capable of interacting with the rest of the grid in a variety of ways. The industry expectation is that in the future, solar inverters will be accessible by centralized control software to act in unison to provide power conditioning, phase correction, peak load support, supply shift from storage to load, and other services, in addition to passive generation, as the grid becomes smarter. The current generation of solar inverters does not include either the hardware or the software to make this possible (exception: large >500kW central inverters have some power conditioning capability but usually not deployed as utilities do not have the control software in place), but all of it is in the design stage. Thus the industry expects that such inverters will become the norm within 15 years. Analysts expect that inverter replacement costs, 15 years from now, may likely be covered by payments to solar plants to provide the additional services, as these services provide relief from further investment in generation and distribution hardware.

91 West Main Street
Liberty, ME 04949
(207) 589-4171

142 Presumpscot Street
Portland, ME 04103
(207) 221-6342

7 Commercial Drive
Exeter, NH 03833
(603) 501-1822

www.revisionenergy.com

Received by Town of Durham 6/13/13

DRAFT

POWER PURCHASE AGREEMENT

Dated as of

_________ __, 2013

between

The Town of Durham

and

Durham Solar, LLC,
a wholly owned subsidiary of
ReVision Energy, LLC

CONTENTS

POWER PURCHASE AGREEMENT

This Power Purchase Agreement ("**Agreement**") is entered into as of ____________ __, 2013, by and between Durham Solar, LLC, a New Hampshire limited liability company ("Provider"), and the Town of Durham, New Hampshire ("Host").

WHEREAS, Host is the owner of property located at 9 Old Piscataqua Road (Ice Rink), 86 Dover Road (Police Station), and 49 Madbury Road (Library) in Durahm, NH 03824, and desires to make a portion of these properties available to Provider for the construction, operation and maintenance of a solar powered electric generating project, and to purchase from Provider the electric energy produced by the project.

WHEREAS, Provider, desires to develop, design, construct, own and operate the project located on Host's property, and sell to Host the electric energy produced by the project.

NOW, THEREFORE, in consideration of the premises, the covenants set forth herein, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows.

PART A: LEASE OF SOLAR GENERATING AREA

1. Lease. Host does hereby lease to Provider in accordance with the terms and conditions hereinafter set forth, approximately 8,400 square feet of the real property located at 9 Old Piscataqua Road (Ice Rink) in Durham, NH 03824, approximately 600 square feet of the real property located at 86 Dover Road (Police Station) in Durham, NH 03824, and approximately 1,300 square feet of the real property located at 49 Madbury Road (Library) in Durham, NH 03824, as described in further detail attached hereto as Exhibits C and D (individually and collectively, the "Premises"), for the sole purposes of installing, maintaining and operating a solar powered electric generating project ("Generating Facilities"). Consistent with Section B3, Host hereby also grants to Provider, for the Term as defined in Section B2, a non-exclusive right-of-way for vehicular and pedestrian ingress and egress to the Premises or the Generating Facilities to the extent required by Provider and as mutually agreed upon by the Parties.

2. Benefits. Provider hereby covenants to pay Host, on or before the Commercial Operation Date, and on or before each anniversary of the Commercial Operation Date during the Term as defined in Section B2(c), as and for rent of the Premises $1.00 (one U.S. dollar).

PART B: POWER PURCHASE AGREEMENT

1. DEFINITIONS. Certain capitalized terms used in this Agreement have the meanings set forth in the attached GLOSSARY OF TERMS.

2. TERM.

(a) Term. This Agreement shall consist of an Initial Period and an Operations Period. As used herein, "Term" shall mean all of the Initial Period and the Operations Period, unless the Provider or Host terminates the Agreement prior to the end of the Initial Period pursuant to the terms of this Agreement.

(b) Initial Period. The Initial Period will begin on the date set forth above and will terminate on the earlier of (i) the Commercial Operation Date or (ii) the date the Agreement is terminated pursuant to the provisions of Section 4(b) or 4(d).

(c) Operations Period. If applicable, the Operations Period will commence on the Commercial Operation Date and will terminate at 11:59 p.m. on the last day of the month in which the twentieth (20^{th}) anniversary of the Commercial Operation Date occurs or upon the date this agreement is terminated, whichever is sooner.

(d) Extensions. Twenty-four months prior to the end of the Operations Period, the Parties will meet to discuss the extension of this Agreement on terms and conditions reflecting the then current market for solar generated electricity and with such other amendments and additional terms and conditions as the Parties may agree. Neither Party shall be obligated to agree to an extension of this Agreement.

3. ACCESS RIGHTS.

(a) Access Specifications. Host hereby grants Provider and its designees (including Installer, persons responsible for implementing the Applicable Solar Program, and Financing Party) access to the Premises, for the Term, at reasonable times and upon reasonable notice, for the purposes of designing, installing, inspecting, operating, maintaining, repairing and removing the Project, and any other purpose set forth in this Agreement, and otherwise in accordance with the provisions of this Agreement. Access Rights with respect to the Site include without limitation:

(i) Vehicular & Pedestrian Access. Reasonable vehicular and pedestrian access across the Site to the Premises as designated on Exhibit D for purposes of designing, installing, operating, maintaining, repairing and removing the Project. In exercising such access Provider shall reasonably attempt to minimize any disruption to activities occurring on the Site.

(ii) Transmission Lines & Communication Cables. The right to locate transmission lines and communications cables across the Site as designated on Exhibit D. The location of any such transmission lines and communications cables outside the areas designated on Exhibit D shall be subject to Host's approval and shall be at locations that minimize any disruption to Host's activities occurring on the Site.

(iii) Storage. Adequate storage space on the Site convenient to the Premises for materials and tools used during construction, installation, and maintenance of the Project. Provider shall be responsible for providing shelter and security for stored items during construction and installation.

(iv) Utilities. Water, drainage, electrical, and ethernet connections on the Premises for use by Provider in installing, operating and maintaining the Project.

(b) Easement Rights. Upon request by Provider, the Parties shall execute and record with the appropriate Land Registry easements and other instruments documenting the Access Rights granted by Host to Provider in this Agreement, and which shall be in form and substance indicated on Exhibit G or other form agreed by the Parties. The cost of preparation and recording shall be borne by the Provider.

(c) Remote Monitoring. Host will provide an internet portal or equivalent access by means of which Provider will communicate data from the revenue grade performance monitoring system. Provider will be responsible for connecting monitoring equipment for the Project to the internet so that it is possible for Provider and Host to remotely monitor the Project.

4. PLANNING, INSTALLATION AND OPERATION OF PROJECT.

(a) Site Assessment and Planning. During the Initial Period, Provider shall have the right, at its own expense, to assess the suitability of the Premises for the Project and shall act diligently in conducting such assessment. The assessment shall include the right to inspect the physical condition of the structures on which the Project will be located; to apply for any building permits or other governmental authorizations necessary for the construction of the Project; to arrange interconnections with the Local Electric Utility; to make any applications to the appropriate Public Utilities Commission or other agencies for receipt of payments for the Project under the Applicable Solar Program; to apply to any other governmental agencies or other persons for grants or other determinations necessary for the construction of or receipt of revenues from the Project; or to make any other investigation or determination necessary for the financing, construction, operation or maintenance of the Project.

(b) Termination of Development Activities. At any time during the Initial Period, Provider shall have the right to cease development of the Project on the Premises, for any reason, in its sole discretion. If Provider gives Host notice of such determination, this Agreement shall terminate effective as of the delivery of such notice without any further liability of the Parties to each other, provided that (i) Provider shall remove any equipment or materials which Provider has placed on the Site; (ii) Provider shall restore any portions of the Site disturbed by Provider to its pre-existing condition; (iii) the Parties shall not be released from any payment or other obligations arising under this Agreement prior to the delivery of the notice; and (iv) the confidentiality provisions of Section 14, the indemnity obligations under Section 15 hereof, and the dispute resolution provisions of Section 23 hereof shall continue to apply notwithstanding the termination of this Agreement.

(c) Commencement of Construction, Modification of Design. At any time during the Initial Period, upon at least ten (10) Business Days notice to Host, Provider shall have the right to commence installing the Project on the Premises.

(i) As of the date hereof, Provider anticipates that the Project shall consist of the components and shall have the designs set forth in Exhibit E attached hereto.

(ii) Notwithstanding subsection (i) above, Provider has the right to modify the design of the Project, including the selection of the components in the Project, as Provider, in its sole discretion, may determine, provided, however, that such changes shall not result in the Project exceeding the nameplate capacity, building footprint, location and height set forth in Exhibits D and E, without Host's approval.

(d) Construction Commencement Deadline. If within 365 days following the date of this Agreement (not including any days in which a Force Majeure Event existed), Provider has not commenced the installation of the Project on the Premises, Host may terminate this Agreement by delivering notice to Provider of its intention to terminate this Agreement, and the Agreement shall terminate twenty-one (21) days after Provider's receipt of such notice; provided, that if Provider commences installation of the Project within such twenty-one (21) day period, this Agreement shall not terminate. Upon any termination in accordance with this Section 4(d) neither Party shall have any further liability to the other with respect to the Facility, provided that (i) Provider shall remove any equipment or materials that Provider has placed on the Site; (ii) Provider shall restore any portions of the Site disturbed by Provider to their condition prior to the commencement of construction; (iii) the Parties shall not be released from any payment or other obligations arising under this Agreement prior to the delivery of the notice; and (iv) the confidentiality provisions of Section 14, the indemnity obligations under Section 15 hereof, and the dispute resolution provisions of Section 23 hereof shall continue to apply notwithstanding the termination of this Agreement.

(e) Contractors. Provider shall use licensed contractors to perform the work of installing, operating, and maintaining the Project. Provider intends to use Installer to perform such work, but may use other contractors, for all or a portion of such work, subject to the reasonable approval of Host. Provider shall advise Host of the Installer prior to commencement of the work on the Site. Provider shall be responsible for the conduct of Installer and its subcontractors, and Host shall have no contractual relationship with Installer or its subcontractors in connection with the work on the Project. Provider shall ensure that Installer maintains insurance applicable to the Installer's activities that satisfy the requirements in Exhibit F.

(f) Status Reports. Provider shall give Host regular updates, on a reasonable schedule requested by Host, on the progress of installation of the Project and shall notify Host of when Provider will commence testing of the Project. Host shall have the right to have its representatives present during the testing process, but subject to reasonable written rules and procedures as may be established by Provider and Installer. After Provider has determined, in its reasonable judgment, that the Project meets the requirements of the Local Electric Utility, has been installed in accordance with all Applicable Laws, and is capable of producing electricity on a continuous basis, Provider shall notify Host that installation of the Project is complete and shall specify the Commercial Operation Date for the Project, which may be immediately upon delivery of such notice to Host. All electricity produced by the Project prior to the Commercial Operation Date shall be delivered to Host and Host shall pay for such electricity at the rate applicable to the first Operations Year but in no event greater than the rate otherwise payable by Host to the Electric Service Provider.

(g) Standard of Operation. Provider shall design, obtain permits, install, operate, and maintain the Project so as to keep it in good condition and repair, in compliance with all Applicable Laws and in accordance with the generally accepted practices of the electric industry, in general, and the solar generation industry, in particular. Such work shall be at Provider's sole expense. Except for emergency situations or unplanned outages, Provider shall cause the work to be performed between the hours of 7:00 am and 7:00 pm, Monday through Saturday, in a manner that minimizes interference with Host and Host's employees, visitors, tenants and licensees and their customers to the extent commercially practical. Provider shall, and shall cause its contractors to, keep the Site reasonably clear of debris, waste material and rubbish, and to comply with reasonable safety procedures established by Host for conduct of business on the Site.

(h) Hazardous Materials. Provider and Installer are not responsible for any Hazardous Materials encountered at the Site except to the extent introduced by Provider. Upon encountering any Hazardous Materials, Provider and Installer will stop work in the affected area and duly notify Host and, if required by Applicable Law, any Governmental Authority with jurisdiction over the Site. Upon receiving notice of the presence of suspected Hazardous Materials at the Site, Host shall take all measures required by Applicable Law to address the Hazardous Materials discovered at the Site. Host may opt to remediate the Site so that the Project may be installed on the Site, or determine that it is not economically justifiable or is otherwise impractical to remediate the Site, in which case Host and Provider may agree upon a different location for the Project whereupon such replacement location shall be the Site for purposes of this Agreement. Provider and Installer shall be obligated to resume work at the affected area(s) of the Site only after Host notifies Provider and Installer that Host has complied with all Applicable Laws, and a qualified independent expert provides written certification that (i) remediation has been accomplished as required by Applicable Law and (ii) all necessary approvals have been obtained from any Governmental Authority having jurisdiction over the Project or the Site. Host shall reimburse Provider for all additional costs incurred by Provider or Installer in the installation of the Project resulting from the presence of and/or the remediation of Hazardous Materials, including demobilization and remobilization expenses. Notwithstanding the preceding provisions, Host is not responsible for any Hazardous Materials introduced to the Site by Provider or Installer, nor is Host required to remediate an affected area if such remediation is deemed to be economically unjustifiable or otherwise impractical.

(i) Site Security. Host will provide security for the Project to the extent of its normal security procedures, practices, and policies that apply to all Host Premises, including the Project. Host will advise Provider immediately upon observing any damage to the Project. Upon request by Provider, such as Provider receiving data indicating irregularities or interruptions in the operation of the Project, Host shall, as quickly as reasonably practicable, send a person to observe the condition of the Project and report back to Provider on such observations.

(j) System Shut Down. Provider may shut down the Project at any time in order to perform required emergency repairs to the Project. At other times, Provider shall give Host notice of the shutdown as may be reasonable in the circumstances. Provider shall not have any obligation to reimburse Host for costs of purchasing electricity that would have been produced by the Project but for such shutdown. Provider shall not schedule shutdowns during peak periods of electric generation and periods when peak energy and demand prices are charged by the Electric Service Provider, except as may be required in accordance with prudent electric industry safety practices in the event of equipment malfunction.

(k) Applicable Solar Program Requirements. Exhibit H identifies certain requirements of the Applicable Solar Program. The Parties shall comply with the obligations identified in Exhibit H or subsequently adopted by the Applicable Solar Program. In the event of any inconsistency between the obligations of the Parties under this Agreement or any of the requirements of the Applicable Solar Program, the more stringent obligation shall govern, and if such cannot be determined, the requirements of the Applicable Solar Program shall govern.

5. SALE OF ELECTRIC ENERGY.

(a) Sale of Electricity. Throughout the Operations Period, subject to the terms and conditions of this Agreement, Provider shall sell to Host and Host shall buy from Provider all electric energy produced by the Project, whether or not Host is able to use all such electric energy. The Point of Delivery of the electric energy for each generating facility shall be as indicated in Exhibit E. Title to and risk of loss with respect to the energy shall transfer from Provider to Host at the Point of Delivery.

(b) Delivery of Electricity. The electric energy from the Project shall be delivered from Provider to Host at the specifications set forth in Exhibit E and otherwise in compliance with all requirements of the Local Electric Utility.

(c) Limits on Obligation to Deliver. Provider does not warrant or guarantee the amount of electric energy to be produced by the limits on Project for any hourly, daily, monthly, annual or other period. Provider is not a utility or public service company and does not assume any obligations of a utility or public service company to supply Host's electric requirements. Provider is not subject to rate review by governmental authorities.

(d) Meter Testing. Provider shall install one or more meter(s) at the Project, as Provider deems appropriate, to measure the output of the Project at the Point of Delivery. Provider shall install an Interval Data Recorder (IDR) with industry standard telemetry at the Project. Provider shall conduct tests of the meters at such times as it deems appropriate in accordance with industry standards, but not less than once per year. Host shall pay for any independent testing of the meter(s) in excess of such minimum testing schedule that Host deems necessary, except if, after such testing, the meter is shown to be in error in Provider's favor by more than 1%, Provider shall pay for the cost of such test and shall make corresponding adjustments to the records of the amount of electrical energy provided by the Project delivered based on the period that is half-way in between the date of this testing and the last testing date of the meter. If there is an error of less than or equal to 2% no billing adjustments will be made. In the event there is an error of greater than 2%, Provider shall adjust the next invoice to be provided to Host under Section 6(b) hereof, to either charge the Host additional amounts for energy produced over the stated meter amount during the applicable period at the applicable rate or provide Host a credit against future billing for energy produced under the stated meter amount during the applicable period, provided, however, that any deficiencies or credits not theretofore applied or satisfied at the expiration or earlier termination of the Operations Period shall be settled in cash.

6. PAYMENT AND BILLING.

(a) Rates. Host shall pay Provider for electricity produced by the Project at the rates set forth in Exhibit A attached hereto.

(b) Billing. Host shall pay for the electricity produced by the Project quarterly in arrears. Promptly after the end of each quarter, Provider shall provide Host with an invoice setting forth the quantity of electricity produced by the Project in such quarter, the applicable rates for such, and the total amount due, which shall be the product of the quantities and the applicable rates.

(c) Invoice Delivery. Invoices shall be in writing and shall be either (i) delivered by hand; (ii) mailed by first-class, registered or certified mail, return receipt requested, postage prepaid; (iii) delivered by a recognized overnight or personal delivery service; (iv) transmitted by facsimile (such transmission to be effective on the day of receipt if received prior to 5:00 pm local time on a Business Day or in any other case as of the next Business Day following the day of transmittal); or (v) transmitted by email if receipt of such transmission by email is specifically acknowledged by the recipient (automatic responses not being sufficient for acknowledgement), addressed as follows:

Todd Selig
Town Administrator
Town of Durham
15 Newmarket Road
Durham NH 03824
Email: tselig@ci.durham.nh.us

(d) Payment. Host shall pay each invoice within thirty (30) days of receipt of the invoice. Any amounts not paid when due, including any amounts properly disputed and later determined to be owing, shall accrue interest on the unpaid amount at the rate equal to the lesser of (i) 1% per month, compounded monthly or (ii) the highest rate allowed by applicable law.

(e) Disputed Invoices. If Host objects to all or a portion of an invoice, Host shall, on or before the date payment of the invoice is due, (i) pay the undisputed portion of the invoice, and (ii) provide an itemized statement of its objections setting forth in reasonable detail the basis for its objections. If Host does not object prior to the date payment of any invoice is due, Host shall be obligated to pay the full amount of such invoices but Host may subsequently object to such invoice and, if such objection proves to be correct, receive a refund of the disputed amount; provided, however, that Host may not object to any invoice more than thirty-six (36) months after the date on which such invoice is rendered. The right to dispute or object to an invoice, shall, subject to the time limitation provided in this Section 6(e), survive the expiration or termination of this Agreement.

7. SUPPLEMENTAL POWER, NET METERING AND RECS.

(a) Back-up and Supplemental Electricity. Except as otherwise provided herein, throughout the Term, Host shall be responsible for obtaining all of its requirements for electric energy in excess of the amounts produced by the Project and pay for such service pursuant to contracts with or applicable tariffs of the Local Electric Utility or other Electric Service Provider. Provider shall have no obligation to obtain or pay for such supplemental or back-up electricity.

(b) Net Metering & Utility Credits. At any time that electric production from the Project is greater than Host's requirements at such time, Host shall nevertheless pay Provider for all of the electricity produced by the Project at the rates and in the manner provided in this Agreement. Host may make arrangements with the Local Electric Utility so that power in excess of Host's requirements may be delivered to the Local Electric Utility through the Point of Delivery and Host shall receive any credits or payments from the Local Electric Utility may be available under net metering or similar programs. If Applicable Law or the practice of the Local Electric Utility restricts the ability of the Host to deliver electricity produced by the Project to the Local Electric Utility, then the Parties shall agree on alternate arrangements to enable Host, insofar as possible, to receive benefits from the Local Electric Utility comparable to those available under net metering programs, provided that the economic benefits to Provider remain as provided in this Section 7(b).

(c) Interconnection. Provider shall be responsible for arranging the interconnection of the Project with Host's Local Electric Utility in a manner which includes bi-directional or "net metering". Host shall timely apply to its utility for any necessary approvals, agreements or contracts.

(d) Applicable Solar Program Incentives. Except as provided in Section 7(b), during the term of the agreement, Provider shall be exclusively entitled to any Applicable Solar Program incentives.

(e) Ownership of Tax Attributes. Provider (and/or Financing Party) shall be the owner of any Tax Attributes that may arise as a result of the operation of the Project and shall be entitled to transfer such Tax Attributes to any person. Host shall provide reasonable assistance to Provider in preparing all documents necessary for Provider to receive such Tax Attributes, and if Host is deemed to be the owner of any such Tax Attributes, Host shall assign the same (or the proceeds thereof) to Provider. If Host receives any payments in respect of such Tax Attributes, it shall promptly pay them over to Provider.

(f) Environmental Attributes. Provider (and/or Financing Party) shall be the owner of any Environmental Attributes which may arise as a result of the operation of the Project and shall be entitled to transfer such Environmental Attributes to any person. Host shall provide reasonable assistance to Provider in preparing all documents necessary for Provider to receive such Environmental Attributes, and if Host is deemed to be the owner of any such Environmental Attributes, Host shall assign the same (or the proceeds thereof) to Provider. If Host receives any payments in respect of such Environmental Attributes, it shall promptly pay them over to Provider.

(g) Capacity & Ancillary Services. Provider shall be entitled to receive any payments for electric capacity or ancillary services that may become available as a result of the construction or operation of the Project. Host shall provide reasonable assistance to Provider in preparing all documents necessary for Provider to receive such payments, and if Host is deemed to be the owner or provider of such capacity or services, Host shall assign the same to Provider. If Host receives any payments in respect of capacity or such services it shall promptly pay them over to Provider.

(h) No Resale of Electricity. Except as contemplated by the provisions of Section 7(b), the electricity purchased by Host from Provider under this Agreement shall not be resold, assigned or otherwise transferred to any other person without prior approval of the Provider, which approval shall not be unreasonably withheld, and Host shall not take any action which would cause Host or Provider to become a utility or public service company.

(i) Provider Is Not A Utility. Neither Party shall assert that Provider is an electric utility or public service company or similar entity that has a duty to provide service, is subject to rate regulation, or is otherwise subject to regulation by any governmental authority as a result of Provider's obligations or performance under this Agreement.

8. PERMITS, OWNERSHIP OF PROJECT, LIENS, MORTGAGES

(a) Permits. Provider shall pay for and obtain all approvals from governmental entities necessary for the construction and operation of the Project, including land use permits, building permits, demolition and waste disposal permits and approval.

(b) System Ownership. Except as provided in Section 9, Provider or Financing Party shall be the legal and beneficial owner of the Project at all times. The Project is personal property and shall not attach to or be deemed a part of, or fixture to, the Site. The Project shall at all times retain the legal status of personal property as defined under Article 9 of the Uniform Commercial Code. Host covenants that it will place all persons having an interest in or lien upon the real property comprising the Premises, on notice of the ownership of the Project and the legal status or classification of the Project as personal property. Host and/or Provider shall make any necessary filings to disclaim the Project as a fixture of its respective Premises and Site in the appropriate Land Registry to place all interested parties on notice of the ownership of the Project by Provider.

(c) Liens. To the extent permitted by Applicable Law, each Party shall not directly or indirectly cause, create, incur, assume or suffer to exist any mortgage, pledge, lien, (including mechanics', labor or materialman's lien), charge, security interest, encumbrance or claim of any nature, including claims by governmental authorities for taxes (collectively referred to as "Liens" and each, individually, a "Lien") on or with respect to the interests of the other in the Site, the Premises, and the Project, and in the Access Rights granted hereunder. Provider shall, to the extent allowed under Applicable Law, have Installer and its subcontractors execute lien waivers with respect to any mechanic's or materialman's lien against Host's interest in the Site. If permitted under Applicable Law, Host will post notices of non-responsibility to notify Installer and others that Host is not responsible for work performed on the Project. Each Party shall promptly notify the other of the imposition of a Lien on the property interests of the other Party, and shall promptly discharge such lien, provided however, that a Party may seek to contest the amount or validity of any Lien affecting the property of the other Party, provided it timely complies with all procedures for contesting such Lien, posts any bond or other security necessary under such procedures, and if such procedures do not require the posting of security, the Party establishes for the benefit of the other Party a deposit, letter of credit, or other security acceptable to the other Party to indemnify the other Party against any Loss which could reasonably be expected to arise if such Lien is not removed or discharged.

(d) Non Disturbance Agreements. Host shall pay for and obtain all consents required for it to enter into and perform its obligations under this Agreement from its lenders, landlord, tenants, and any other persons with interests in the Site. If there is any mortgage or fixture filing against the Premises which could reasonably be construed as prospectively attaching to the Project, Host shall promptly upon request of Provider, provide an acknowledgement and consent from such lienholder, in form and substance reasonably acceptable to Financing Party, stating that the ownership of the Project remains in Provider and further acknowledging that the Project is personal property of Provider and agreeing not to disturb the rights of Provider in the Project and under this Agreement. If Host is the fee owner of the Premises, Host consents to the filing of a disclaimer of the Project as a fixture of the Premises in the Land Registry. If Host is not the fee owner, Host will obtain such consent from such owner of the Premises. Such acknowledgment and consents, or acceptable notices thereof, shall be recorded, at Host's expense, in the appropriate Land Registry. Host may in the future mortgage, pledge, and grant security interests in all or a portion of the Site and the improvements thereon, provided the mortgagee or other grantee of the encumbrance acknowledges this Agreement, the Project, the Access Rights granted hereunder, and the priority of Provider's (and/or Financing Party's) rights in the Project and the Access Rights.

9. PURCHASE OPTIONS; REMOVAL AT END OF TERM.

(a) Early Purchase Options. Beginning on the seventh (7^{th}) anniversary of the Commercial Operation Date, provided no Host Event of Default has occurred and is continuing, the Host shall annually have the option to purchase the Project from Provider at the Fair Market Value of the Project at such anniversary date, plus, if applicable, repayment or recapture of Applicable Solar Program or other governmental payments occasioned by the exercise of such option. If Host desires to exercise this option, it shall no later than ninety (90) days prior to the applicable anniversary date notify Provider of its election to exercise the option, and on or before ninety (90) days after such anniversary date shall pay the purchase price to Provider by electronic transfer in immediately available funds to an account designated by Provider. At any time following receipt of the notice from Host, but no later than thirty (30) days after the date Host gives notice of its election to exercise the option, Provider may provide Host an appraisal of the Fair Market Value. If Host agrees with the appraisal of the Fair Market Value it shall pay such sum to Provider. If Host disagrees with the appraisal's estimate of the Fair Market Value of the Project, Host may request that the Parties meet to discuss the appraisal. If the Parties cannot agree within ten (10) days of the Host's receipt of the appraisal of the Fair Market Value, the Parties will be deemed to enter into a Dispute for purposes of Section 23(a) and shall follow the procedures in Section 23(c) for resolution of the Dispute. The process of determining the Fair Market Value of the Project in this Agreement shall be undertaken by a nationally recognized independent appraiser with experience and expertise in the solar photovoltaic industry acting reasonably and in good faith to determine the Fair Market Value of the Project.

(b) End of Term Purchase Option. Host shall have the right to purchase the Project from Provider at the expiration of the Operations Period at the then Fair Market Value of the Project. No earlier than twelve months prior to the expiration of such Operations Period and no later than nine (9) months prior to the expiration of the

Operations Period, Host shall notify Provider of its intent to exercise the option. Within ninety-one (91) days of its receipt of such notice, Provider shall give Host its appraisal of the Fair Market Value of the Project at the end of the Term. Host may, but is not obligated to, accept such appraisal. If Host does not accept such appraisal within ten (10) days of receiving the appraisal from Provider, the Parties shall meet to discuss the appraisal. If they are unable to reach agreement within twenty (20) days of the Host's receipt of the appraisal from Provider, the Parties will be deemed to enter into a dispute for purposes of Section 23(a) and shall follow the procedures in Section 23 for resolution of the dispute. Notwithstanding the foregoing, in the event that Provider enters into a sale/leaseback transaction in connection with funding the installation of the Project, the process of determining the Fair Market Value of the Project in this Agreement shall be undertaken by a nationally recognized independent appraiser with experience and expertise in the solar photovoltaic industry acting reasonably and in good faith to determine the Fair Market Value of the Project and shall be undertaken consistently with the terms of such transaction so that the process for determining Fair Market Value under this Agreement shall be the same as provided in the agreements for such sale/leaseback transaction.

(c) Transfer of Ownership. Upon Host's notice that it elects to exercise the option set forth in either Section 9(a) or 9(b) above, Provider shall prepare and deliver to Host a set of records on the operation and maintenance history of the Project, including a summary of known defects. Upon payment of the purchase price, Provider shall deliver, or cause to be delivered, to Host a bill of sale conveying the Project to Host. Such bill of sale shall not contain any warranties other than a warranty against any defects in title arising through Provider. Provider shall use all reasonable efforts to transfer any remaining manufacturer's warranties on the Project, or portions thereof, to Host.

(d) Operation & Maintenance After Sale. Prior to the effective date of Host's purchase of the Project under Section 9(a) or 9(b), Host and Provider shall discuss entering into an operation and maintenance agreement under which Provider shall perform all or a portion of the operation and maintenance requirements of the Project following Host's purchase of the Project. However, neither Party shall be under an obligation to enter into such an agreement.

(e) Decommissioning. If Host does not exercise the option set forth in Section 9(b) above, then Provider, at its expense, shall promptly decommission and remove the Project following the expiration of the Operations Period. Provider shall not be obligated, however, to remove any support structures for the Project which are affixed to Host's structures or any below grade structures, including foundations and conduits, or any roads. Host grants Provider and its representatives reasonable vehicular and pedestrian access across the Site to the Premises for purposes of decommissioning the Project. In exercising such access and performing the decommissioning, Provider shall reasonably attempt to minimize any disruption to activities occurring on the Site. Host will provide Provider adequate storage space on the Site convenient to the Premises for materials and tools used during decommissioning. Provider shall be responsible for providing shelter and security for stored items during de-commissioning and removal. Host further agrees that its normal security measures, practices, and policies which apply to its own Premises shall also apply to the Project. During decommissioning, Provider will comply with all Applicable Laws.

(f) No Survival of Purchase Option. The options for Host to purchase the Project under Sections 9(a) and 9(b) shall not survive the termination of this Agreement.

10. SHUTDOWNS, RELOCATION; CLOSURE OR SALE OF SITE.

(a) Host Requested Shutdown. Host from time to time may request Provider to temporarily stop operation of the Project for a period no longer than thirty (30) days, such request to be reasonably related to Host's activities in maintaining and improving the Site. During any such shutdown period (but not including periods of Force Majeure), Host will pay Provider an amount equal to the sum of (i) payments that Host would have made to Provider hereunder for electric energy that would have been produced by the Project during the period of the shutdown; (ii) revenues that Provider would have received with respect to the Project under the Applicable Solar Program and any other assistance program with respect to electric energy that would have been produced during the period of the shutdown; and (iii) revenues from Environmental Attributes and Tax Attributes that Provider would have received with respect to electric energy that would have been produced by the Project during the period of the shutdown. Determination of the amount of energy that would have been produced during the period of the shutdown shall be based, during the first Operations Year, on estimated levels of production and, after the first Operations Year, based on actual operation of the Project during the same period in the previous Operations Year, unless Provider and Host mutually agree to an alternative methodology.

(b) Provider Safety Shutdown. In addition to the right of Provider to shut down the Project for maintenance as provided in Section 4(j), Provider may shutdown the Project if Provider, in the exercise of reasonable judgment, believes Site conditions or activities of persons on a Site, which are not under the control of Provider, whether or not under the control of Host, may interfere with the safe operation of the Project. Provider shall give Host notice of a shutdown immediately upon becoming aware of the potential for such conditions or activities. Provider and Host shall cooperate and coordinate their respective efforts to restore Site conditions so as to not interfere with the safe operation of the Project and to reduce, to the greatest extent practicable, the duration of the shutdown. In the event of such a shutdown, Host shall be deemed to have acted under Section 10(a) to shut down the Project, and shall pay Provider the amounts described in Section 10(a) with respect to the period of the shutdown, except that Host shall not be required to pay such amounts relative to any time period prior to Provider's notice of the shutdown or during any Force Majeure Event. If a shutdown pursuant to this Section 10(b) continues for one hundred and eighty (180) days or longer, Provider may terminate this Agreement and require Host to pay the Early Termination Amount.

(c) Project Relocation. Host may request to move the Project to another location on the Site or to another site owned by Host, but any such relocation shall be subject to the approval of Provider and Financing Party in each of their sole discretion. In connection with such relocation, Host shall execute an amendment to this Agreement reflecting the new location of the Project but otherwise continuing all the terms and conditions of this Agreement for the remaining term of this Agreement. Host shall also provide any consents or releases required by Provider in connection with the new location. Host shall pay all costs associated with the removal and relocation of the Project, including installation and testing costs and interconnection costs. In addition, during the Relocation Event, Host will pay Provider an amount equal to the sum of (i) payments that Host would have made to Provider hereunder for electric energy that would have been produced by the Project following the Relocation Event; (ii) revenues that Provider would have received with respect to the Project under the Applicable Solar Program and any other assistance program with respect to electric energy that would have been produced following the Relocation Event; and (iii) revenues from Environmental Attributes and Tax Attributes that Provider would have received with respect to electric energy that would have been produced by the Project following the Relocation Event. Determination of the amount of energy that would have been produced following the Relocation Event shall be based, during the first Operations Year, on the estimated levels of production and, after the first Operations Year, based on actual operation of the Project in the same period in the previous Operations Year, unless Provider and Host mutually agree to an alternative methodology.

(d) Premises Shutdown; Interconnection Deactivated. In the event Premises are closed as a result of an event that is not (i) a Force Majeure Event or (ii) caused by or related to any unexcused action or inaction of Provider, Host shall nevertheless continue to pay Provider for all electricity produced by the Project on the Premises and delivered to the Point of Delivery. If an interconnection with the Local Electric Utility becomes deactivated for reasons that are not (i) a Force Majeure Event or (ii) caused by or related to any unexcused action or inaction of Provider such that the Project is no longer able to produce electricity or transfer electricity to its respective Premises or to the Local Electric Utility, Host will pay Provider an amount equal to the sum of (A) payments that Host would have made to Provider hereunder for electric energy that would have been produced by the Project following such closure; (B) revenues that Provider would have received with respect to the Project under the Applicable Solar Program and any other assistance program with respect to electric energy that would have been produced following such closure; and (C) revenues from Environmental Attributes that Provider would have received with respect to electric energy that would have been produced by the Project following such closure. Determination of the amount of energy that would have been produced following such closure shall be based, during the first Operations Year, on the estimated levels of production and, after the first Operations Year, based on actual operation of the Project in the same period in the previous Operations Year, unless Provider and Host mutually agree to an alternative methodology. If a shutdown pursuant to this Section 10(d) continues for one hundred and eighty (180) days or longer, Provider may terminate this Agreement and require Host to pay the Early Termination Amount.

(e) Sale of Site. In the event Host transfers (by sale, lease or otherwise) all or a portion of its interest in the Site, Host shall remain primarily liable to Provider for the performance of the obligations of Host hereunder notwithstanding such transfer. However, if no Host Event of Default has occurred and is continuing and the transferee is acceptable to Provider and Financing Party in their sole discretion and executes agreements assuming this Agreement in form and substance satisfactory to Provider and Financing Party in their sole discretion, Host may be released from further obligations under this Agreement.

11. TAXES.

(a) Income and Utility Taxes. Provider shall be responsible for any and all income taxes associated with payments from Host to Provider for electric energy from the Project or utility taxes assessed against the project. Provider (and/or Financing Party), as owner of the Project, shall be entitled to all Tax Attributes with respect to the Project.

(b) Sales Taxes. Host shall be responsible for all taxes, fees, and charges, including sales, use, and gross receipts taxes, imposed or authorized by any Governmental Authority on the sale of electric energy by Provider to Host. Host shall timely report, make filings for, and pay any and all such taxes assessed directly against it and shall reimburse Provider for any and all such taxes assessed against and paid by Provider.

(c) Property Taxes. Host shall be responsible for all ad valorem personal property or real property taxes levied against the Site, improvements thereto and personal property located thereon, except that Provider shall be responsible for ad valorem personal property or real property taxes levied against the Project. If Host is assessed any taxes related to the existence of the Project on the Premises, Host shall immediately notify Provider. Host and Provider shall cooperate in contesting any such assessment or seeking a waiver of taxes against the project; provided, however, that Host shall pay such taxes to avoid any penalties or interest on such Taxes, subject to reimbursement by Provider. If after resolution of the matter, such tax is imposed upon Host related to the improvement of real property by the existence of the Project on the Site, Provider shall reimburse Host for such tax.

` (d) Tax Contests. Each Party has the right to contest taxes in accordance with Applicable Law and the terms of encumbrances against the Site. Each Party shall use all reasonable efforts to cooperate with the other in any such contests of tax assessments or payments. In no event shall either Party postpone during the pendency of an appeal of a tax assessment the payment of taxes otherwise due except to the extent such postponement in payment has been bonded or otherwise secured in accordance with Applicable Law.

(e) Payment of Delinquent Taxes. In the event either Party fails to pay any taxes that may become a lien upon the other Party's property, such Party may pay such amounts and in such event shall be entitled to recover such paid amount from the other Party, together with interest thereon at the rate of one percent (1%) per month, compounded monthly.

(f) Reimbursement Deadline. Any reimbursement of taxes owing pursuant to this Section 11 shall be paid within twenty (20) Business Days of receiving an invoice therefor from the Party who paid the taxes.

12. INSURANCE.

(a) Coverage. Host and Provider shall each maintain the insurance coverage set forth in Exhibit F in full force and effect throughout the Term.

(b) Applicable Solar Program Requirements. Host and Provider will also maintain the additional insurance requirements (if any) specified in Exhibit H to satisfy the requirements of the Applicable Solar Program.

(c) Insurance Certificates. Each Party shall furnish current certificates indicating that the insurance required under this Section 12 is being maintained. Each Party shall give the other Party thirty (30) days written notice before the insurance is cancelled or materially altered.

(e) Insurance Providers. All insurance maintained hereunder shall be maintained with companies rated no less than A- as to Policy Holder's Rating in the current edition of Best's Insurance Guide (or with an association of companies each of the members of which are so rated).

13. COOPERATION; SOLAR ACCESS; FUTURE IMPROVEMENTS.

(a) Cooperation. The Parties acknowledge that the performance of each Party's obligations under this Agreement will frequently require the assistance and cooperation of the other Party. Each Party therefore agrees, in addition to those provisions in this Agreement specifically providing for assistance from one Party to the other, that it will at all times during the Term cooperate with the other Party and provide all reasonable assistance to the other Party to help the other Party perform its obligations hereunder.

(b) Host to Not Restrict Solar Access. Host, or any lessee, grantee or licensee of Host, shall not erect any structures on, or make other modifications to, or plantings on, the Site which will interfere with the construction, operation or maintenance of, or solar access of, the Project.

(c) Adjoining Properties. If Applicable Law and existing easements do not ensure that structures or plantings on adjoining property will not interfere with the solar access for the Project, then Host and Provider shall work together to obtain from owners of adjoining properties any easements reasonably necessary to protect the solar access of the Project. Such easements shall run for the benefit of both Host and Provider. Provider shall pay for the expense of obtaining such easements, including payments to property owners and legal costs, but the rates payable by Host for electric energy from the Project shall be increased by an amount sufficient for Provider to fully amortize such costs, over a period equal to the lesser of (i) ten years and (ii) the remaining term of this Agreement without regard to Host's option to purchase the Project.

14. PRESS RELEASES AND CONFIDENTIALITY.

(a) Press Releases. The Parties acknowledge that they each desire to publicize information about this Agreement and the Project. The Parties therefore agree that each may make independent press releases about entering into this Agreement, the size and location of the Project, and the identity of the other Party, without the prior written consent of the other Party, so long as only Provider has the exclusive right to (i) claim that electric energy provided to Host was generated by the Project, (ii) Provider is responsible for the reductions in emissions of pollution and greenhouse gases resulting from the generation of such electric energy and (iii) Provider is entitled to all credits, certificates, registrations, etc., evidencing or representing any of the foregoing except as otherwise expressly provided in this Agreement.

(b) Limits on Disclosure of Confidential Information. Subject to the exceptions set forth below in Section 14(c) and the requirements of New Hampshire R.S.A 91-A, each Party agrees that, (i) without the consent of the other Party, it shall not disclose any Confidential Information received from the other Party to any other person and (ii) it shall use any Confidential Information received from the other Party only for the purpose of fulfilling its obligations under this Agreement. Notwithstanding the foregoing, the Parties may, and shall, disclose any information required to be disclosed under R.S.A 91-A and by rules, regulations and contracts implementing the Applicable Solar Program or Tax Attributes required to be disclosed by any Governmental Authority under Applicable Law or pursuant to a validly issued subpoena or required filing.

(c) Permissible Disclosures. Provider may provide this Agreement, and any correspondence, notices and other information related to this Agreement to any person who has provided or who is interested in providing construction or permanent financing, or any refinancing thereof, to Provider in connection with the Project. In addition, if Host is required by Applicable Law, including New Hampshire R.S.A. 91-A, a validly issued subpoena, required filing, or the rules of any stock exchange, to disclose any Confidential Information it may make the disclosure as required by law.

15. INDEMNIFICATION.

(a) Provider Indemnification. To the fullest extent permitted by law, Provider shall protect, indemnify, save, defend and hold harmless the Host, including its officials, agents, volunteers and employees ("Host's Indemnified Parties"), from and against any and all liabilities, obligations, claims, damages, penalties, causes of action, costs, interest and expenses, including but not limited to reasonable attorney and paralegal fees, which Host's Indemnified Parties may become obligated or suffer by reason of any accident, bodily injury, personal injury, death of person, or loss of or damage to property, but only if caused solely by the negligence of Provider. The Provider's obligations to defend, indemnify and hold harmless the Indemnified Parties hereunder shall survive the term of this Contract. Such duty to indemnify with respect to any injuries to persons or damage to property arising from the generation of electricity from the Project shall not extend to incidents occurring on Host's side of the Point of Delivery except to the extent caused by incidents on Provider's side of the Point of Delivery. Such duty to indemnify shall not apply to any action or claim, whether in tort (including negligence and strict liability), contract or otherwise for any loss, injury, or costs resulting from interruptions in service. Provider shall not be obligated to indemnify Host or any Host Indemnified Party for any Loss to the extent such Loss is due to the negligence or willful misconduct of Host or any Host Indemnified Party.

(b) Host Indemnification. To the fullest extent permitted by law, the Host shall protect, indemnify, save, defend and hold harmless the Provider, including its officials, agents, volunteers and employees ("Provider's Indemnified Parties"), from and against any and all liabilities, obligations, claims, damages, penalties, causes of action, costs, interest and expenses, including but not limited to reasonable attorney and paralegal fees, which Provider's Indemnified Parties may become obligated or suffer by reason of any accident, bodily injury, personal injury, death of person, or loss of or damage to property, but only if caused solely by the negligence of the Host and only if the claim, liability, damages, costs, penalties and expenses would otherwise have been matters covered by the provisions of the Host's liability coverage. The Host's obligations to defend, indemnify and hold harmless the Indemnified Parties hereunder shall survive the term of this Contract. Host shall not be obligated to indemnify Provider or any Provider Indemnified Party for any Loss to the extent such Loss is due to the negligence or willful misconduct of Provider or any Provider Indemnified Party.

(c) Notice of Claims. Whenever any claim arises for indemnification under this Agreement, the Indemnified Person shall notify the Indemnifying Party in writing as soon as possible (but in any event prior to the time by which the interest of the Indemnifying Party will be materially prejudiced as a result of its failure to have received such notice) after the Indemnified Person has knowledge of the facts constituting the basis for such claim (the "Notice of Claim"). Such Notice of Claim shall specify all facts known to the Indemnified Person giving rise to the indemnification right and the amount or an assessment of the amount of the liability arising therefrom.

(d) Defense of Claims. The Indemnifying Party has the right, but not the obligation to assume the defense or the matter for which indemnification is sought hereunder. If the Indemnifying Party does not assume the defense, it shall timely pay all costs of counsel and case expenses incurred by Indemnified Person in connection with the defense, when and as incurred. If the Indemnifying Party assumes the defense, the Indemnified Person has the right to hire its own counsel to defend it, but the Indemnified Person shall be responsible for the reasonable costs of such counsel. The Indemnifying Party shall not consent to the entry of any judgment or enter into any settlement with respect to the matter for which indemnification is sought without the prior written consent of the Indemnified Person (which consent shall not be unreasonably withheld) unless the judgment or settlement involves the payment of money damages only and does not require the acknowledgement of the validity of any claim.

(e) Payments. At the time that the Indemnifying Party makes any indemnity payments under this Agreement, the indemnification payment shall be adjusted such that the payment will result in the Indemnified Person receiving an indemnity payment equal to the Loss after taking into account (i) all federal, state, and local income taxes that are actually payable to the Indemnified Person with respect to the receipt of such payment and (ii) all national, state, and local tax deductions allowable to the Indemnified Person for any items of loss and deduction for which the Indemnified Party is being indemnified.

(f) Survival of Indemnification. The obligations of indemnification hereunder shall survive termination of this Agreement.

16. REPRESENTATIONS AND WARRANTIES.

(a) Mutual Representations. Each Party hereby represents and warrants to the other, as of date hereof, that:

(i) Organization. It is duly organized, validly existing and in good standing under the laws of its state of incorporation and of the state in which the Premises are located, respectively, and has the power and authority to enter into this Agreement and to perform its obligations hereunder.

(ii) No Conflict. The execution and delivery of this Agreement and the performance of and compliance with the provisions of this Agreement will not conflict with or constitute a breach of or a default under (1) its organizational documents; (2) any agreement or other obligation by which it is bound; (3) any law or regulation.

(iii) Enforceability. (1) All actions required to be taken by or on the part of such Party necessary to make this Agreement effective have been duly and validly taken; (2) this Agreement has been duly and validly authorized, executed and delivered on behalf of such Party; and (3) this Agreement constitutes a legal, valid and binding obligation of such Party, enforceable in accordance with its terms, subject to laws of bankruptcy, insolvency, reorganization, moratorium or other similar laws.

(iv) No Material Litigation. There are no court orders, actions, suits or proceedings at law or in equity by or before any governmental authority, arbitral tribunal or other body, or threatened against or affecting it or brought or asserted by it in any court or before any arbitrator of any kind or before or by any governmental authority that could reasonably be expected to have a material adverse effect on it or its ability to perform its obligations under this Agreement, or the validity or enforceability of this Agreement.

(b) Host Representations. In addition to the representations and warranties in Section 16(a), Host hereby represents and warrants to Provider, as of date hereof, that:

(i) Electric Usage. Host has provided to Provider complete and correct records of its electric usage at the Site for the preceding year.

(ii) Condition of Premises. Host has provided to Provider Host's complete and correct records of the physical condition of the Premises. If it is discovered that the actual site conditions on part of, or on the entire Premises upon which all or part of the Project is to be installed, are materially different from the information presented by Host, then if practicable the rates payable by Host hereunder shall be adjusted to compensate Provider for the cost of design and construction changes and delays incurred to adapt the Project to the unknown conditions. If such adjustment is not practicable, Provider shall have other rights under this Agreement.

(iii) Financial Information. The financial statements Host has provided to Provider present fairly in all material respects the financial condition and results of operations of Host.

17. FORCE MAJEURE.

(a) Excuse for Force Majeure Event. Except as provided in Section 17(b) or otherwise specifically provided in this Agreement, neither Party shall be considered in breach of this Agreement or liable for any delay or failure to comply with this Agreement, if and to the extent that such delay or failure is attributable to the occurrence of a Force Majeure Event; provided that the Party claiming relief as a result of the Force Majeure Event shall promptly (i) notify the other Party in writing of the existence and details of the Force Majeure Event; (ii) exercise all reasonable efforts to minimize delay caused by such Force Majeure Event; (iii) notify the other Party in writing of the cessation of such Force Majeure Event; and (iv) resume performance of its obligations hereunder as soon as practicable thereafter.

(b) No Excuse for Payment for Prior Services. Obligations to make payments for services already provided shall not be excused by a Force Majeure Event.

(c) Restoration. In the event of a casualty event, to the extent that such casualty event is attributable to the occurrence of a Force Majeure Event, which destroys all or a substantial portion of the Premises, Host shall elect, within ninety (90) days of such event, whether it will restore the Premises, which restoration will be at the sole expense of Host. If Host does not elect to restore the Premises, then Provider shall not restore the Project and this Agreement will terminate. If Host does elect to restore the Premises, Host shall provide notice of such election to Provider and Provider shall then elect, within ninety (90) days of receipt of such notice, whether or not to restore the Project, subject to the Parties agreeing on a schedule for the restoration of the Premises and an equitable extension to the Term of this Agreement. If the Parties are not able to so agree or if Provider does not elect to restore the Project, Provider shall promptly remove any portions of the Project remaining on the Premises, and this Agreement shall terminate. If Provider does elect to restore the Project, it shall do so at its sole expense. In the event of termination of this Agreement pursuant to this Section 17(c), (i) the Parties shall not be released from any payment or other obligations arising under this Agreement prior to the casualty event; and (ii) the confidentiality provisions of Section 14, the indemnity obligations under Section 15 hereof, and the dispute resolution provisions of Section 23 hereof shall continue to apply notwithstanding the termination of this Agreement.

(d) Termination for Force Majeure Event. Notwithstanding anything to the contrary in this Section 17, if nonperformance on account of a Force Majeure Event continues beyond a continuous period of three hundred and sixty-five (365) days, then either Party shall have the right to terminate this Agreement upon thirty (30) days notice to the other. Upon such termination, Provider shall be required to decommission and remove the Project from the applicable Site in accordance with the provisions of Section 9(e) (unless there has been a casualty event, in which case the provisions of clause (c) above shall apply to the removal of the Project). In the event of such a termination of this Agreement with respect to the Project, the Parties shall not be released from any payment or other obligation arising under this Agreement which accrued prior to the shutdown of the Project or the Premises, and the indemnity, confidentiality and dispute resolution provisions of this Agreement shall survive the termination of this Agreement.

18. CHANGE IN LAW.

In the event there is a Change in Law that is applicable to the operation of the Project, the sale of electric energy produced by the Project, or any other obligation of the Provider hereunder, and compliance with the Change in Law results in an increase in Provider's costs to operate and/or maintain the Project, Provider will promptly submit to Host a written notice setting forth (i) the applicable Change in Law; (ii) the manner in which such Change in Law increases Provider's costs; and (iii) Provider's proposed adjustment to the then applicable and future rates for electric energy in this Agreement to reflect such increases in costs. Host agrees to an adjustment in the then applicable and future rates such that the new rates compensate Provider for the total cost increase arising from the Change in Law and said adjustment will remain in effect for as long as the costs arising from the Change in Law continue to be incurred by the Provider; provided, however any such increase shall be no greater than ten percent (10%) of the rates set forth in Exhibit A.

19. PROVIDER DEFAULT AND HOST REMEDIES.

(a) Provider Events of Default. Provider shall be in default of this Agreement if any of the following ("Provider Events of Default") shall occur:

(i) Misrepresentation. Any representation or warranty by Provider under Section 16 hereof, is incorrect or incomplete in any material way, or omits to include any information necessary to make such representation or warranty not materially misleading, and such defect is not cured within fifteen (15) days after receipt of notice from Host identifying the defect.

(ii) Abandonment During Installation. After commencement of installation of the Project, Provider abandons installation of the Project for thirty (30) days and fails to resume installation within thirty (30) days after receipt of notice from Host stating that, in Host's reasonable determination, Provider has abandoned installation of the Project.

(iii) Failure to Operate. After the Commercial Operation Date, Provider fails to operate the Project for a period of 90 days which failure is not due to equipment failure, or damage to the Project, act of governmental authority, or exercise of Provider's rights under this Agreement, or otherwise excused by the provisions of Section 17(b) (relating to Force Majeure Events); and Provider fails to resume operation within thirty (30) days after receipt of notice from Host stating that, in Host's reasonable determination, Provider has ceased operation of the Project , provided, however, that the cure period shall be extended by the number of calendar days during which Provider is prevented from taking curative action if Provider had begun curative action and was proceeding diligently, using commercially reasonable efforts, to complete such curative action.

(iv) Obligation Failure. Provider fails to perform any obligation hereunder, such failure is material, such failure is not excused by the provisions of Section 17(b) (relating to Force Majeure Events), and such failure is not cured within: (A) thirty (30) days if the failure involves a failure to make payment when due or maintain required insurance; or (B) sixty (60) days if the failure involves an obligation other than payment or the maintenance of insurance, after receipt of notice from Host identifying the failure.

(v) Insolvency. Provider (A) applies for or consents to the appointment, or the taking of possession by, a receiver, custodian, trustee or liquidator of itself or a substantial portion of its property; (B) admits in writing its inability, or is generally unable, to pay its debts as such debts become due; (C) makes a general assignment for the benefit of its creditors; (D) commences a voluntary case under any bankruptcy law; (E) files a petition seeking to take advantage of any other law relating to bankruptcy, insolvency, reorganization, winding up, or composition or readjustment of debts; (F) acquiesces in, or fails to contest in a timely manner, any petition filed against Provider in an involuntary case under bankruptcy law or seeking to dissolve Provider under other Applicable Law; or (G) takes any action authorizing its dissolution.

(b) Financing Party Opportunity to Cure; Host Remedies. Upon an Event of Default by Provider, provided that Host complies with its obligations under Section 21 and Financing Party does not cure such Event of Default by Provider, Host may terminate this Agreement, seek to recover damages for costs of replacement electricity and pursue other remedies available at law or equity.

20. HOST DEFAULT AND PROVIDER REMEDIES.

(a) Host Events of Default. Host shall be in default of this Agreement if any of the following ("Host Events of Default") shall occur:

(i) Misrepresentation. Any representation or warranty by Host under Section 16 hereof, is incorrect or incomplete in any material way, or omits to include any information necessary to make such representation or warranty not materially misleading, and such defect is not cured within fifteen (15) days after receipt of notice from Provider identifying the defect.

(ii) Obstruction. Host obstructs commencement of installation of the Project or fails to take any actions necessary for the interconnection of the Project, or fails to take electric energy produced by the Project, and fails to correct such action within ten (10) days of when such payment was due.

(iii) Payment Failure. Host fails to make any payment due under the terms of this Agreement, and fails to make such payment within thirty (30) days after receipt of notice thereof from Provider.

(iv) Obligation Failure. Host fails to perform any obligation hereunder, such failure is material, such failure is not excused by the provisions of Section 17(b) (relating to Force Majeure Events), and such failure is not cured within: (A) ten (10) days if the failure involves a failure to maintain required insurance; or (B) sixty (60) days if the failure involves an obligation other than payment or the maintenance of insurance, after receipt of notice from Provider identifying the failure.

(v) Insolvency. Host (A) applies for or consents to the appointment, or the taking of possession by, a receiver, custodian, trustee or liquidator of itself or a substantial portion of its property; (B) admits in writing its inability, or be generally unable, to pay its debts as such debts become due; (C) makes a general assignment for the benefit of its creditors; (D) commences a voluntary case under any bankruptcy law; (E) files a petition seeking to take advantage of any other law relating to bankruptcy, insolvency, reorganization, winding up, or composition or readjustment of debts; (F) acquiesces in, or fails to contest in a timely manner, any petition filed against Host in an involuntary case under bankruptcy law or seeking to dissolve Host under other Applicable Law; or (G) takes any action authorizing its dissolution.

(b) Default Damages. Upon an Event of Default by Host, Provider may require Host to pay to Provider the Early Termination Amount, sell electricity produced by the Project to persons other than Host, and recover from Host any loss in revenues resulting from such sales; and/or pursue other remedies available at law or in equity. After Provider's receipt of such Early Termination Amount pursuant to this Section 20(b), Provider shall collect no additional damages resulting from lost revenues from sales of electricity from the Project.

21. COLLATERAL ASSIGNMENT, FINANCING PROVISIONS.

(a) Financing Arrangements. Provider may mortgage, pledge, grant security interests, assign, or otherwise encumber its interests in this Agreement to any persons providing financing for the Project. Host acknowledges that Provider will obtain construction financing for the Project from third party and that Provider may either obtain term financing secured by the Project or sell or assign the Project to a Financing Party or may arrange other financing accommodations from one or more financial institutions and may from time to time refinance, or exercise purchase options under, such transactions. Host acknowledges that in connection with such transactions Provider may secure Provider's obligations by, among other collateral, an assignment of this Agreement and a first security interest in the Project. In order to facilitate such necessary sale, conveyance, or financing, and with respect to any lender or lessor, as applicable, Host agrees as follows:

(i) Consent to Collateral Assignment. Host hereby consents to both of the sale of the Project to a Financing Party and the collateral assignment to the Financing of the Provider's right, title and interest in and to this Agreement.

(ii) Rights of Financing Party. Notwithstanding any contrary term of this Agreement:

(A) Step-In Rights. The Financing Party, as owner of the Project, or as collateral assignee of this Agreement, shall be entitled to exercise, in the place and stead of Provider, any and all rights and remedies of Provider under this Agreement in accordance with the terms of this Agreement. The Financing Party shall also be entitled to exercise all rights and remedies of owners or secured parties, respectively, generally with respect to this Agreement and the Project;

(B) Opportunity to Cure Default. The Financing Party shall have the right, but not the obligation, to pay all sums due under this Agreement and to perform any other act, duty or obligation required of Provider thereunder or cause to be cured any default of Provider thereunder in the time and manner provided by the terms of this Agreement. Nothing herein requires the Financing Party to cure any default of Provider under this Agreement or (unless the Financing Party has succeeded to Provider's interests under this Agreement) to perform any act, duty or obligation of Provider under this Agreement, but Host hereby gives it the option to do so;

(C) Exercise of Remedies. Upon the exercise of remedies, including any sale of the Project by the Financing Party, whether by judicial proceeding or under any power of sale contained therein, or any conveyance from Provider to the Financing Party (or any assignee of the Financing Party as defined below) in lieu thereof, the Financing Party shall give notice to Host of the transferee or assignee of this Agreement. Any such exercise of remedies shall not constitute a default under this Agreement;

(D) Cure of Bankruptcy Rejection. Upon any rejection or other termination of this Agreement pursuant to any process undertaken with respect to Provider under the United States Bankruptcy Code, at the request of Financing Party made within ninety (90) days of such termination or rejection, Host shall enter into a new agreement with Financing Party or its assignee having substantially the same terms and conditions as this Agreement. Host and the Financing Party shall mutually agree on a third party solar contractor that will be responsible to manage and inspect the system, and make any repairs necessary.

(iii) Right to Cure.

(A) Cure Period. Host will not exercise any right to terminate or suspend this Agreement unless it shall have given the Financing Party prior written notice of its intent to terminate or suspend this Agreement, as required by this Agreement, specifying the condition giving rise to such right, and the Financing Party shall not have caused to be cured the condition giving rise to the right of termination or suspension within thirty (30) days after such notice or (if longer) the periods provided for in this Agreement; provided that if such Provider default reasonably cannot be cured by the Financing Party within such period and the Financing Party commences and continuously pursues cure of such default within such period, such period for cure will be extended for a reasonable period of time under the circumstances, such period not to exceed an additional ninety (90) days. The Parties' respective obligations will otherwise remain in effect during any cure period.

(B) Continuation of Agreement. If the Financing Party or its assignee (including any purchaser or transferee), pursuant to an exercise of remedies by the Financing Party, shall acquire title to or control of Provider's assets and shall, within the time periods described in Section 21(a)(iii)(A) above, cure all defaults under this Agreement existing as of the date of such change in title or control in the manner required by this Agreement and which are capable of cure by a third person or entity, then such Person shall no longer be in default under this Agreement, and this Agreement shall continue in full force and effect.

(b) Financing Party a Third Party Beneficiary. Host agrees and acknowledges that Financing Party is a third party beneficiary of the provisions of this Section 21.

(c) Entry to Consent to Assignment. Host agrees to (i) execute any consents to assignment or acknowledgements and (ii) provide such opinions of counsel as may be reasonably requested by Provider and/or Financing Party in connection with such financing or sale of the Project.

22. LIMITATIONS ON DAMAGES.

EXCEPT AS EXPLICITLY PROVIDED IN THIS AGREEMENT (including, without limitation, in Sections 10 and 20(b)), NEITHER PARTY NOR ANY OF ITS INDEMNIFIED PERSONS SHALL BE LIABLE TO THE OTHER PARTY OR ITS INDEMNIFIED PERSONS FOR ANY SPECIAL, PUNITIVE, EXEMPLARY, INDIRECT, OR CONSEQUENTIAL DAMAGES, ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT.

23. DISPUTE RESOLUTION.

(a) Negotiation Period. The Parties shall negotiate in good faith and attempt to resolve any dispute, controversy or claim arising out of or relating to this Agreement (a "**Dispute**") within 30 days after the date that a Party gives written notice of such Dispute to the other Party.

(b) Mediation. If, after such negotiation in accordance with Section 23(a), the Dispute remains unresolved, either Party may require that a non-binding mediation take place. In such mediation, representatives of the Parties with authority to resolve the dispute shall meet for at least three (iii) hours with a mediator whom they choose together. If the Parties are unable to agree on a mediator, then either Party is hereby empowered to request the American Arbitration Association to appoint a mediator. The mediator's fee and expenses shall be paid one-half by each Party.

(c) Arbitration of Disputes.

(i) Rules of Arbitration. Any Dispute that is not settled to the mutual satisfaction of the Parties pursuant to Sections 23(a) or 23(b) shall (except as provided in Section 23(d)) be settled by binding arbitration between the Parties conducted in New Hampshire, or such other location mutually agreeable to the Parties, and in accordance with the Commercial Arbitration Rules of the American Arbitration Association (the "**AAA**") in effect on the date that a Party gives notice of its demand for arbitration.

(ii) Dispute Submission. The Party initiating the Arbitration (the "**Submitting Party**") shall submit such Dispute to arbitration by providing a written demand for arbitration to the other Party (the "**Responding Party**"), which demand must include statements of the facts and circumstances surrounding the dispute, the legal obligation breached by the other Party, the amount in controversy and the requested relief, accompanied by all relevant documents supporting the Demand.

(iii) Arbitrator Selection. The arbitrator(s) selected shall have contract resolution experience and experience in the electric power business and shall not have any current or past substantial business or financial relationships with the Parties or their Affiliates. Arbitrators must agree to be bound by the confidentiality provisions of this Agreement. If the amount in controversy is less than $250,000, the Dispute will be determined by a single neutral arbitrator, who will be chosen by the Parties within forty-five (45) days of submission of the demand on the Responding Party. If the Parties cannot agree on a single neutral arbitrator within such period, the arbitrator shall be chosen by the AAA. If the amount in controversy is $250,000 or greater, the Dispute will be determined by a Panel of three (3) arbitrators. Each Party shall select one arbitrator, but if a Party fails to select an arbitrator within forty-five (45) days of the submission of the demand on the Responding Party, the arbitrator will be chosen by the AAA. The two arbitrators so selected will select the third arbitrator, who shall act as the chairman of the panel. If the two arbitrators cannot select the third arbitrator within thirty (30) days (or such additional time as the Parties may agree) of the selection of both of the first two arbitrators, the third arbitrator shall be chosen by the AAA. As used herein, "**Panel**" means either a single arbitrator or a group of three arbitrators selected as provided herein.

(iv) Discovery. Within fifteen days (15) of the selection of the third arbitrator, the Parties shall submit statements to the Panel summarizing the issues in the case and including recommendations for discovery. Within twenty (20) days of receipt of the statements from the Parties, the Panel will meet with the Parties and issue orders on the scheduling of the case and any discovery to be permitted.

(v) Decision. Upon ten (10) days of completion of the hearing conducted by the Panel, each Party shall submit to the Panel its proposal for resolution of the dispute. The Panel in its award shall be limited to selecting only one of the two proposals submitted by the Parties. The award shall be in writing (stating the amount and reasons therefore) and shall be final and binding upon the Parties, and shall be the sole and exclusive remedy between the Parties regarding any claims and counterclaims presented to the Panel. The Panel shall be permitted, in its discretion, to add pre-award and post-award interest at commercial rates. Judgment upon any award may be entered in any court having jurisdiction.

(vi) Expenses. Unless otherwise ordered by the Panel, each Party shall bear its own expenses and one-half of the cost of the Panel. Payments of the Panel's costs shall be made on a monthly basis prior to the Award.

(d) Exceptions to Arbitration. The obligation to arbitrate shall not be binding upon any Party with respect to (i) requests for preliminary injunctions, temporary restraining orders, specific performance, or other procedures in a court of competent jurisdiction to obtain interim relief deemed necessary by such court to preserve the status quo or prevent irreparable injury pending resolution by arbitration of the actual Dispute; (ii) actions to enforce an award of a Panel or otherwise to collect payments not subject to bonafide dispute; or (iii) claims involving third parties who have not agreed to participate in the arbitration of the Dispute.

(e) Survival of Arbitration Provisions. The provisions of this Section 23 shall survive any termination of this Agreement and shall apply (except as provided herein) to any disputes arising out of this Agreement.

24. NOTICES.

Delivery of Notices. All notices or other communications which may be or are required to be given by any party to any other party pursuant to this Agreement shall be in writing and shall be either (i) delivered by hand; (ii) mailed by first-class, registered or certified mail, return receipt requested, postage prepaid; (iii) delivered by a recognized overnight or personal delivery service; (iv) transmitted by facsimile (such transmission to be effective on the day of receipt if received prior to 5:00 pm local time on a business day or in any other case as of the next business day following the day of transmittal); or (v) transmitted by email if receipt of such transmission by email is specifically acknowledged by the recipient (automatic responses not being sufficient for acknowledgement), addressed as follows:

If to Host:

Todd Selig
Town Administrator
Town of Durham
15 Newmarket Road
Durham NH 03824
Email: tselig@ci.durham.nh.us

If to Provider:

William Behrens, Managing Member
Durham Solar, LLC and ReVision Energy, LLC
91 W. Main St., Liberty, ME 04949
Email: bill@revisionenergy.com

Notices shall be effective when delivered (or in the case of email, when acknowledged by the recipient) in accordance with the foregoing provisions, whether or not (except in the case of email transmission) accepted by, or on behalf of, the Party to whom the notice is sent.

Each Party may designate by Notice in accordance with this section to the other Party a new address to which any notice may thereafter be given.

25. MISCELLANEOUS.

(a) Governing Law. This Agreement shall be governed by the laws of the State of New Hampshire, including principles of good faith and fair dealing that will apply to all dealings under this Agreement.

(b) Rules of Interpretation. Section headings are for convenience only and shall not affect the interpretation of this Agreement. References to sections are, unless the context otherwise requires, references to sections of this Agreement. The words “hereto”, “hereof” and “hereunder” shall refer to this Agreement as a whole and not to any particular provision of this Agreement. The word “person” shall include individuals; partnerships; corporate bodies (including but not limited to corporations, limited partnerships and limited liability companies); non-profit corporations or associations; governmental bodies and agencies; and regulated utilities. The word “including” shall be deemed to be followed by the words “without limitation”. In the event of any conflict between the text of this Agreement and the contents of an Exhibit hereto, the text of this Agreement shall govern.

(c) Severability. If any non-material part of this Agreement is held to be unenforceable, the rest of the Agreement will continue in effect. If a material provision is determined to be unenforceable and the Party which would have been benefited by the provision does not waive its unenforceability, then the Parties shall negotiate in good faith to amend the Agreement to restore to the Party that was the beneficiary of such unenforceable provision the benefits of such provision. If the Parties are unable to agree upon an amendment that restores the Party’s benefits, the matter shall be resolved under Section 23(c) in order to restore to the Party that was the beneficiary of the unenforceable provision the economic benefits of such provision.

(d) Amendment and Waiver. This Agreement may only be amended by a writing signed by both Parties. Any waiver of any of the terms hereof shall be enforceable only to the extent it is waived in a writing signed by the Party against whom the waiver is sought to be enforced. Any waiver shall be effective only for the particular event for which it is issued and shall not constitute a waiver of a subsequent occurrence of the waived event nor constitute a waiver of any other provision hereof, at the same time or subsequently.

(e) Assignment. Neither Party may assign, sell, transfer or in any other way convey its rights, duties or obligations under this Agreement, either in whole or in part, without the prior written consent of the other Party which consent shall not be unreasonably withheld or delayed, except that without consent of Host, Provider (i) may assign its rights and obligations hereunder to an Affiliate of Provider and (ii) may sell or collaterally assign this Agreement in accordance with Section 21. For purposes of this Section 25(e), transfer does not include any sale of all or substantially all of the assets of Provider or Host or any merger of Provider or Host with another person, whether or not Provider or Host is the surviving entity from such merger, or any other change in control of Provider or Host, provided any such surviving entity assumes all obligations of Provider or Host, as appropriate, under this Agreement; provided however, with respect to Host, such surviving entity is acceptable to Financing Party in its sole discretion.

(f) Service Contract. This Agreement is a service contract pursuant to Section 7701(e)(3) of the Internal Revenue Code.

(g) No Joint Venture. This Agreement does not create a joint venture, partnership or other form of business association between the Parties.

(h) Counterparts. This Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument. Delivery of signature by fax, or scan delivered by email, receipt acknowledged, or electronic signature are effective to bind a Party hereto.

26. ENERGY PERFORMANCE CONTRACT.

Pursuant to New Hampshire R.S.A., 21-I:19-d(e), the Parties agree that continuation of this agreement is contingent upon the appropriation of funds to fulfill the requirements of the contract by Host. If Host fails to appropriate sufficient funds to provide for the continuation of the agreement, the agreement shall terminate on the last day of the fiscal year for which allocations were made. A non-appropriation termination prior to the original term of the agreement shall trigger the Host default provisions in Section 20(b) of this agreement.

(rest of page left blank intentionally – signatures appear on next page)

IN WITNESS WHEREOF, intending to be legally bound hereby, Provider and Host have executed this Power Purchase Agreement as of the date first set forth above.

Durham Solar, LLC

By: ___________________________________

Name (printed): William Behrens

Title: Managing Member

Town of Durham

By: ___________________________________

Name (printed):

Title:

Guaranty

As the sole owner of Durham Solar, LLC, ReVision Energy, LLC, unconditionally guarantees performance of Provider's obligations under the foregoing Power Purchase Agreement and any addendum thereto.

ReVision Energy, LLC

By: ___________________________________

Name (printed): William Behrens

Title: Managing Member

GLOSSARY OF TERMS

"Access Rights" means the rights provided in this Agreement for Provider and its designees, including Installer, to enter upon and cross the Site to install, operate, maintain, repair and remove the Project, and to interconnect the Project with the Local Electric Utility and to provide water, electric and other services to the Project.

"Affiliate" means, as to any Person, any other Person which, directly or indirectly, is in control of, is controlled by, or is under common control with, such Person. For purposes of this definition, "control" of a Person means the power, directly or indirectly, to direct or cause the direction of the management and policies of such Person whether by contract or otherwise.

"Agreement" means this Power Purchase Agreement, including all exhibits attached hereto, as the same may be amended from time to time in accordance with the provisions hereof.

"Applicable Law" means any constitutional provision, law, statute, rule, regulation, ordinance, treaty, order, decree, judgment, decision, certificate, holding, injunction, registration, license, franchise, permit, authorization, or guideline issued by a Governmental Authority that is applicable to a Party to this Agreement or the transaction described herein. Applicable Law also includes an approval, consent or requirement of any Governmental Authority having jurisdiction over such Party or its property, enforceable at law or in equity.

"Applicable Solar Program" means the program indicated on Exhibit H.

"Business Day" means a day other than Saturday, Sunday, or other day on which commercial banks in New York City are authorized or required by law to be closed.

"Change in Law" means that after the date of this Agreement, an Applicable Law is amended, modified, nullified, suspended, repealed, found unconstitutional or unlawful, or changed or affected in any material respect by any Applicable Law. Change in Law does not include changes in federal or state income tax laws. Change in Law does include material changes in the interpretation of an Applicable Law.

"Commercial Operation Date" means the date, which shall be specified by Provider to Host pursuant to Section 4(d), when the Project is physically complete and has successfully completed all performance tests and satisfies the interconnection requirements of the Local Electric Utility.

"Confidential Information" means information of a confidential or proprietary nature, whether or not specifically marked as confidential. Such information shall include, but not be limited to, any documentation, records, listing, notes, data, computer disks, files or records, memoranda, designs, financial models, accounts, reference materials, trade-secrets, prices, strategic partners, marketing plans, strategic or other plans, financial analyses, customer names or lists, project opportunities and the like, provided however that Confidential Information does not include information which (i) was in the possession of the receiving Party before receipt from the disclosing Party; (ii) is or becomes publicly available other than as a result of unauthorized disclosure by the receiving Party; (iii) is received by the receiving Party from a third party not known by the receiving Party with the exercise of reasonable diligence to be under an obligation of confidentiality respecting the information; or (iv) is independently developed by the receiving Party without reference to information provided by the disclosing Party.

"Dispute" means a controversy or claim arising out of or relating to this Agreement.

"Early Termination Amount" means an amount determined in accordance with Exhibit B, as of the applicable anniversary date set forth thereon, which includes all lost revenues from the sale or utilization of electrical energy, Environmental Attributes, or Tax Attributes.

"Electric Service Provider" means any person, including the Local Electric Utility, authorized by the State of New Hampshire to provide electric energy and related services to retail users of electricity in the area in which the Site is located.

"Environmental Attributes" means Renewable Energy Certificates, carbon trading credits, emissions reductions credits, emissions allowances, green tags, Green-e certifications, or other entitlements, certificates, products, or valuations attributed to the Project and its displacement of conventional energy generation, or any other entitlement pursuant to any federal, state, or local program applicable to renewable energy sources, whether legislative or regulatory in origin, as amended from time to time, and excluding, for the avoidance of doubt, any Tax Attributes and the Applicable Solar Program.

"Fair Market Value" means the price that would be paid in an arm's length, free market transaction, in cash, between an informed, willing seller and an informed, willing buyer (who is neither a lessee in possession nor a used equipment or scrap dealer), neither of whom is under compulsion to complete the transaction, taking into account, among other things, the age and performance of the Project and advances in solar technology, provided that installed equipment shall be valued on an installed basis and costs of removal from a current location shall not be a deduction from the valuation.

"Financing Party" means a Project Lessor or Lender.

"Force Majeure Event" means any act or event that prevents the affected Party from performing it obligations in accordance with this Agreement, if such act or event is beyond the reasonable control, and not the result of the fault or negligence, of the affected Party and such Party had been unable to overcome such act or event with the exercise of due diligence (including the expenditure of reasonable sums). Subject to the foregoing, Force Majeure Event may include but are not limited to the following acts or events: (i) natural phenomena, such as storms, hurricanes, floods, lightning and earthquakes; (ii) explosions or fires arising from lightning or other causes unrelated to the acts or omissions of the Party seeking to be excused from performance; (iii) acts of war or public disorders, civil disturbances, riots, insurrection, sabotage, epidemic, terrorist acts, or rebellion; and (iv) strikes or labor disputes. Force Majeure Events shall not include equipment failures or acts or omissions of agents, suppliers or subcontractors, except to the extent such acts or omissions arise from a Force Majeure Event. Changes in prices for electricity shall not constitute Force Majeure Events.

"Governmental Authority" means any international, national, federal, provincial, state, municipal, county, regional or local government, administrative, judicial or regulatory entity operating under any Applicable Laws and includes any department, commission, bureau, board, administrative agency or regulatory body of any government.

"Hazardous Materials" means all hazardous or toxic substances, wastes or other pollutants, including petroleum, petroleum hydrocarbons or petroleum products, petroleum by-products, radioactive materials, asbestos or asbestos-containing materials, gasoline, diesel fuel, pesticides, radon, urea formaldehyde, lead or lead-containing materials, polychlorinated biphenyls; and any other chemicals, materials, substances or wastes in any amount or concentration which are now included in the definition of "hazardous substances," "hazardous materials," "hazardous wastes," "extremely hazardous wastes," "restricted hazardous wastes," "toxic substances," "toxic pollutants," "pollutants," "regulated substances," "solid wastes," or "contaminants" or words of similar import, under any Applicable Law.

"Host" means the Town of Durham, New Hampshire, and all successors and assigns.

"Indemnified Person" means the person who asserts a right to indemnification under Section 15.

Indemnifying Party" means the Party who has the indemnification obligation under Section 15 to the Indemnified Person.

"Initial Period" has the meaning provided in Section 2.

"Installer" means the person designated by Provider to install the Project on the Premises.

"Land Registry" means the office where real estate records for the Site are customarily filed.

"Lender" means persons providing construction or permanent financing to Provider in connection with installation of the Project.

"Liens" has the meaning provided in Section 8(c).

"Local Electric Utility" means the entity authorized and required under Applicable Law to provide electric distribution service to Host at the Site.

"Losses" means any and all losses, liabilities, claims, demands, suits, causes of action, judgments, awards, damages, cleanup and remedial obligations, interest, fines, fees, penalties, costs, and expenses (including all attorney's fees and other costs and expenses incurred in defending any such claims or matters or in asserting or enforcing any indemnity obligation).

"Operations Period" has the meaning provided in Section 2.

"Operations Year" means a twelve month period beginning at 12:00 am on an anniversary of the Commercial Operations Date and ending at 11:59 pm on the day immediately preceding the next anniversary of the Commercial Operations Date, provided that the first Operations Year shall begin on the Commercial Operations Date.

"Party" means either Host or Provider, as the context shall indicate, and "Parties" means both Host and Provider.

"Point of Delivery" has the meaning set forth in Section 5(a) and Exhibit E.

"Premises" means the portions of the Site described on Exhibit D.

"Project" means an integrated system for the generation of electricity from solar energy consisting of the photovoltaic panels and associated equipment to be installed on each of the Premises in accordance with this Agreement.

"Project Lessor" means, if applicable, any Person to whom Provider transferred the ownership interest in the Project, subject to a leaseback of the Project from such Person.

"Provider" means Durham Solar, LLC, a New Hampshire limited liability company, and all successors and assigns.

"Relocation Event" means the relocation of the Project, starting at the shutdown of the Project pursuant to such relocation, and ending at the commercial operation of the Project when such relocated Project is reinstalled at a new location, as determined by the Provider in its reasonable discretion.

"Renewable Energy Certificate" or "REC" means a certificate, credit, allowance, green tag, or other transferable indicia, howsoever entitled, created by an applicable program or certification authority indicating generation of a particular quantity of energy, or product associated with the generation of a megawatt-hour (MWh) from a renewable energy source by a renewable energy project.

"Site" means the real property described on Exhibit C attached hereto.

"Tax Attributes" means the investment tax credits (including any grants or payments in lieu thereof) and any tax deductions or other benefits under the Internal Revenue Code or applicable federal, state, or local law available as a result of the ownership and operation of the Project or the output generated by the Project (including, without limitation, tax credits (including any grants or payments in lieu thereof) and accelerated and/or bonus depreciation.)

"Term" shall have the meaning provided in Section 2 hereof.

EXHIBIT A

ENERGY PURCHASE RATES

The purchase rate per kilowatt hour (kwh) of electricity from the generating facilities at 9 Old Piscataqua Road (Ice Rink), Durham, NH 03824, and at 49 Madbury Road (Library), Durham NH 03824 shall be indexed to the rate per kwh charged to Host by it's local electric utility for the electric meter serving the Durham Ice Rink and the Durham Public Library. The rate per kwh charged by Host's local electric utility shall be computed by adding per kwh charges for energy and delivery of energy. The average per kwh charge shall be known as Host's "avoided cost." Host shall notify Provider any time its avoided cost changes and the revised avoided cost shall apply as of the date the local utility's rates changed.

For the first six years of this agreement, Provider agrees to donate to the Town of Durham at no charge all energy generated by the facility at 86 Dover Road (Police Station) in Durham, NH 03824. Accordingly, the purchase rate per kilowatt hour (kwh) of electricity for thegenerating facility at the Police Station shall be zero cents per kwh for six years. For the seventh year, the purchase rate per kilowatt hour (kwh) of electricity for this generating facility shall be Host's avoided cost, as described above.

Host and Provider agree that as of the effective date of this agreement, for the Churchill Rink, Host's per kwh energy supply charges are $0.0721 (Constellation Energy, as of May 2013) and its average per kwh delivery charges are $0.022146, and therefore that the avoided cost for the Churchill Rink is $ $0.094246 cents/kwh.

Host and Provider agree that as of the effective date of this agreement, for the Durham Public Library, Host's per kwh energy supply charges are $0.0721 (Constellation Energy, as of May 2013) and its average per kwh delivery charges are anticipated to be $0. 0.029726115, and therefore that the avoided cost for the Durham Public Library is $0.101826115 cents/kwh.

Operations Year	Churchill Ice Rink*	Durham Public Library	Durham Police Station
1	Avoided Cost ($0.094246, initially)	Avoided Cost $0.101826115, initially)	Donation
2	Avoided Cost	Avoided Cost	Donation
3	Avoided Cost	Avoided Cost	Donation
4	Avoided Cost	Avoided Cost	Donation
5	Avoided Cost	Avoided Cost	Donation
6	Avoided Cost	Avoided Cost	Donation
7	Avoided Cost	Avoided Cost	Donation
8	Avoided Cost	Avoided Cost	Donation
9	Avoided Cost	Avoided Cost	Donation
10	Avoided Cost	Avoided Cost	Donation
11	Avoided Cost	Avoided Cost	Donation
12	Avoided Cost	Avoided Cost	Donation
13	Avoided Cost	Avoided Cost	Donation
14	Avoided Cost	Avoided Cost	Donation
15	Avoided Cost	Avoided Cost	Donation
16	Avoided Cost	Avoided Cost	Donation
17	Avoided Cost	Avoided Cost	Donation
18	Avoided Cost	Avoided Cost	Donation
19	Avoided Cost	Avoided Cost	Donation
20	Avoided Cost	Avoided Cost	Donation

EXHIBIT B

EARLY TERMINATION AMOUNTS

Operations Year	Early Termination Amount
1	Fair Market Value, plus Incentive Penalty (Recapture), if any
2	Fair Market Value, plus Incentive Penalty (Recapture), if any
3	Fair Market Value, plus Incentive Penalty (Recapture), if any
4	Fair Market Value, plus Incentive Penalty (Recapture), if any
5	Fair Market Value, plus Incentive Penalty (Recapture), if any
6	Fair Market Value, plus Incentive Penalty (Recapture), if any
7	Fair Market Value
8	Fair Market Value
9	Fair Market Value
10	Fair Market Value
11	Fair Market Value
12	Fair Market Value
13	Fair Market Value
14	Fair Market Value
15	Fair Market Value
16	Fair Market Value
17	Fair Market Value
18	Fair Market Value
19	Fair Market Value
20	Fair Market Value

<u>EXHIBIT C</u>

DESCRIPTION OF SITE

See Contract Appendixes

<u>EXHIBIT D</u>

DESCRIPTION OF PREMISES

See Contract Appendixes

<u>EXHIBIT E</u>

DESCRIPTION OF PROJECT
(Same as Contract Appendices)

<u>Churchill Rink</u>

Southerly Roof:

System Design:	99.45 kW;
Modules:	(390) Canadian Solar CS6P255M (255-watt) solar electric modules, or equivalent;
Inverters:	(1) Solectria PVI 100 kW 208 three-phase inverter, or equivalent;
Monitor:	Solectria with inverter direct online production portal, standard revenue grade meter, 10 years of revenue grade automatic agency reporting and flat screen web enabled television for patron production & environmental benefits review;
Annual Production:	104,820 kWh annual – Removal of pines to the east, south and west will increase annual production value.

<u>Durham Police Station</u>

System Design:	5.1 kW
Modules:	(20) Suniva Solar 260 watt black framed/black back-sheet (260-watt) solar electric modules, or equivalent
Inverters:	(1) Solectria PVI 5000 240V single-phase inverter, or equivalent
Monitor:	Solectria with inverter direct online production portal, standard revenue grade meter, 10 years of revenue grade automatic agency reporting and flat screen web enabled television for patron production & environmental benefits review.
Annual Production:	6,548 kWh annual

<u>Durham Police Station</u>

System Design:	15.6 kW
Modules:	(60) Suniva Solar (255 watt) solar electric modules, or equivalent
Inverters:	(3) Solectria PVI 5000 240 volt single phase inverters, or equivalent
Monitor:	Solectria with inverter direct online production portal, standard revenue grade meter, 10 years of revenue grade automatic agency reporting and flat screen web enabled television for patron production & environmental benefits review.
Annual Production:	18,235 kWh annual

The Point of Delivery for each project is specified in the one-line drawings (schematic layouts) in the attached contract appendices.

EXHIBIT F

INSURANCE REQUIREMENTS

1. General Liability

(a) Both Host and Provider will have a minimum level of commercial general liability insurance for the term of the Power Purchase Agreement of 1 million dollars ($1,000,000) for each occurrence, and 2 million dollars ($2,000,000) in the aggregate. Insurance coverage shall be at least as broad as the Insurance Services Office (ISO) Commercial General Liability Coverage “occurrence” form, with no coverage deletions.

2. Workers’ Compensation

Both Host and Provider will have Workers’ Compensation insurance indicating compliance with any applicable labor codes, acts, laws or statutes, state or federal, at the Site where the work is performed. Employers’ Liability insurance shall not be less than $500,000 for injury or death each accident.

3. Business Auto

Both Host and Provider will have not less than one million dollars ($1,000,000) each accident for bodily injury and property damage, and one million dollars ($1,000,000) in the aggregate.

4. Additional Insurance Requirements

Additional insurance requirements and terms, if any, are included in the Applicable Solar Program contract.

5. Additional Insurance Provisions

Host shall furnish Provider with certificates of insurance and endorsements of all required insurance, as may be reasonably requested, including for purposes of compliance with Applicable State Solar rebate program. The documentation must be signed by a person authorized by the insurer to bind coverage on its behalf.

EXHIBIT G

FORM OF NOTICE OF GRANT OF INTEREST IN REALTY

[Provider], LLC
[____________________]
[____________________]
[____________________]

NOTICE OF GRANT OF INTEREST IN REALTY

In accordance with the provisions of [_________]., notice is hereby given of that Power Purchase Agreement dated as of [_________] for purchase and sale of electrical energy (the "Agreement"). This notice may be executed in counterparts by the parties to the Agreement.

Parties to the Agreement:

Host: [________]
[________]
[________]

Provider: [________]
[________]
[________]

Date of Execution: [________]

Description of Premises: See Exhibit A

TERM OF AGREEMENT:

The term of the Agreement shall be until the last day of the calendar month in which the twentieth (20th) anniversary of the Commercial Operations Date (as that term is defined in the Agreement) occurs, subject to any extensions or early termination pursuant to the terms of the Agreement.

(signature pages follow)

Witness the execution hereof under seal by said parties to said Agreement this [_______] day of [_______].

Provider:

[_______], LLC,
a [_______]

By: ________________________________
Name (printed): _______________________
Title: ______________________________

Host:

[_______],
a [_______]

By: ________________________________
Name (printed): _______________________
Title: ______________________________

STATE OF ___________)
) SS.
COUNTY OF ____________)

On ___________ before me, ___________________________________, Notary Public, personally appeared __________________________________, personally known to me or proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her authorized capacity, and that by his/her signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of [___] that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

____

EXHIBIT H

APPLICABLE SOLAR PROGRAM

1. Federal Investment Tax Credit

Provider shall be exclusively entitled to the FEDERAL INVESTMENT TAX CREDIT, I.R.C. § 48.

2. Depreciation

Provider shall be exclusively entitled to any and all depreciation benefits, including accelerated depreciation benefits under THE TAX RELIEF, UNEMPLOYMENT INSURANCE REAUTHORIZATION, AND JOB CREATION ACT OF 2010 (H.R. 4853).

3. State Solar Rebates and Incentives

Provider shall be exclusively entitled to New Hampshire state photovoltaic solar project rebates, grants and other incentives.

4. Renewable Energy Credits

Provider shall be exclusively entitled to renewable energy credits awarded based on annual energy production from the project.

5. Other Solar Programs

Provider shall be exclusively entitled to any other solar or renewable energy programs that apply to this project or that may apply to this project in the future.

DEPARTMENT OF PUBLIC WORKS
TOWN OF DURHAM
100 STONE QUARRY DRIVE
DURHAM, N.H. 03824
603/868-5578
FAX 603/868-8063

AGENDA ITEM: # 9B

DATE: June 17, 2013

COUNCIL COMMUNICATION

INITIATED BY: Public Works Department

AGENDA ITEM: **PRESENTATION REGARDING THE DEVELOPMENT OF A NEW WATER ORDINANCE ADDRESSING EMERGENCY DROUGHT CONDITIONS AND UPDATE RELATIVE TO THE MOST RECENT DRAFT OF A WATER USE PLAN, DROUGHT MANAGEMENT PLAN, AND WATER CONSERVATION PLAN FOR THE LAMPREY RIVER – DAVID CEDARHOLM, TOWN ENGINEER**

CC PREPARED BY: David Cedarholm, Town Engineer

PRESENTED BY: Todd Selig, Administrator
David Cedarholm, Town Engineer

AGENDA DESCRIPTION:

The purpose of this Council Communication is to introduce the proposal to update the Town's Water Ordinance (Chapter 158 of the Town Code) and provide a summary of the proposed amendments. The ordinance update is intended to bring the Town in compliance with current regulatory requirements and allow the UNH/Durham Water System (UDWS) to operate more in accordance with current industry standards.

Background

The original Water Ordinance was adopted by the Water Department of the Town of Durham in 1951 and underwent its last significant update in 1981. Aside from a minor update that occurred last year relative to the Water Meter Upgrade Project, the current 5 page Water Ordinance is essentially unchanged from the 1951/81 ordinance. Attached is the current Water Ordinance. In the 32 years since the last major update, state and federal regulations governing the operation and standards pertaining to public water systems have become much more specific. In addition, the definition of a "public water systems" and what is considered "water infrastructure" has been broadened to include all water related systems such as drinking water, stormwater, as well as wastewater systems. Many more current water ordinances in New Hampshire and elsewhere have been updated to cover municipal authority and responsibilities related to all these public water systems as well as water resources and water supplies. Some communities, such as Portsmouth, NH have adopted Utility Ordinances to consolidate the overlapping regulations and customer needs of multiple infrastructure systems and enterprise funds.

This broadened perspective of public water systems approach is consistent with the Durham Town Council's recently adopted goals of economic and environmental sustainability and integrating multiple elements. The December 2012 Final Report of the New Hampshire Water Sustainability Commission entitled New Hampshire Lives on Water also takes a broadened view of water infrastructure. Attached is the Commission's Overview and Executive Summary.

Proposed Amendments
New sections being introduced in the proposed ordinance update include general provisions, definitions, water resource management, cross-connection and backflow prevention, enforcement and penalties, and design standards. A draft Table of Contents of the proposed updated Water Ordinance is provided below. Each one of the proposed ordinance sections is further described below:

Article I entitled "Administrative Provision" is completely new and is intended to make the Water Ordinance consistent with the format of the current Zoning Ordinance. In addition to General Provisions and Definitions, this article also includes language clarifying the UDWS partnership with UNH, and a new section entitled Water Resource Management. The Water Resource Management section will cover water resource protection to enable the regulation of illicit discharge contaminants that could potentially impact surface water and groundwater resources; provides the authority to implement water conservation measures and water use restrictions; and grants the authority to maintain and update a separate Water Resource Management Plan (WRMP). The WRMP will become the responsibility of the Durham Water/Wastewater/Stormwater Committee to maintain and update with the oversight of the Director of Public Works and approval of the Town Administrator.

The WRMP last underwent a complete update in 2007, and a partial update in 2010; however due to the general state of flux caused by uncertainty surrounding the completion of Lamprey River Instream Flow Study and the Lamprey River Water Management Plan, the 2010 WRMP update was put on hold but requires a considerable effort to complete. It is recommended that monies be budgeted in 2014 for completion of the WRMP, which is expected to contain chapters specific to management of the UDWS's water sources and dams, water supply and capacity, and water conservation. Maintaining the WRMP as a separate document allows for greater flexibility to adapt the plan as needed for efficient system operations and regulatory compliance. This is consistent with how the Department of Public Works maintains the Town's Road Regulations and similar to how Planning Board maintains the Site Plan Review and Subdivision Regulations.

Article II entitled "Service Terms and Conditions" was formerly the title of Article I and is a carryover from the original ordinance. The first three section numbers 158-1, -2, -3 from the original Article I were retained in the new Article I, however the ordinance language from these sections was moved to subheadings under new or renamed sections in Article II. New sections under Article II include Operating Rules and Procedures, Cross Connection and Backflow Prevention, Declaration of Emergency, and Enforcement and Penalties.

Article III entitled "Fees" was formerly Article III and includes all the original language from Article II plus updated language associated with new service connections and additional language pertaining to fees associated with flow testing and system impact analyses.

Article IV is completely new and contains sections specifying the design standards and specifications relative to the water distribution system, domestic water services, and stormwater drainage system. This article will contain language authorizing the Durham Water/Wastewater/Stormwater Committee to develop and maintain a separate Manual of Construction Procedures and Technical Specifications under the direction of the Public Works Director with approval of the Town Administrator.

The following is the Table of Contents of the proposed updated Water Ordinance for review by the Town Council and discussion purposes:

CHAPTER 158 - WATER ORDINANCE
***DRAFT* TABLE OF CONTENTS**

158-3. Water Resource Management [*formerly* "Service pipe standards"]
A. Resource Protection
B. Water Conservation and Use Restriction Authority
Article II - Service Terms and Conditions [*formerly Article I*]

158-4. Operating Rules and Procedures [*formerly* "Alterations in piping or fixtures"]. This section includes all the language from the original sections 158-2 and 158-4.

158-5. Service connections [*formerly* "Unauthorized connections"]
A. Applications
B. Responsibility of Owner
C. Domestic Water Service Connections
D. Stormwater Drainage System Connections

158-6. Hydrants [formerly "Use of hydrants"]
A. Authorized use of Hydrants
B. Flow testing
C. System flushing

158-7. Declaration of Emergency [*formerly* "Inadequate supply procedure"]

158-8. Water shutoffs [*formerly* "Water shut off fee"]
A. Shut off for repairs
B. Shut off for delinquent payment; responsibility of owner"

158-9. Access to customer premises

158-10. Cross Connection and Backflow Prevention [*Formerly* "Shut off for repairs"]

158-11. Enforcement and Penalties [*formerly* "Cutoff for delinquent payment; responsibility of owner" moved to 158-8]

158-12. Unauthorized modification of rules

158-13. Advance payment for work

158-14. Water main extensions

158-15. Extensions to new subdivisions

158-16. Meter reading

158-17. Billing

158-18. Amendments
Article III - Fees [*formerly* Article II – Initial Assessment and Fees]

158-19. Description of Fees [Formerly "Initial Assessment; exception"]
- A. New Service Connections
- B. Increase or Change in Use
- C. Flow Testing and System Impact Analyses
- D. Water Shut off

158-20. Fee Schedule

158-21. Disposition of payments

Article IV - Design Standards

158-22. Water Distribution System Specifications

158-23. Water Service Installation Specifications

158.24. Stormwater Drainage System Specifications

LEGAL AUTHORITY:

RSA 38:26 enables municipalities to adopt and amend public water system ordinances.
Section 3.8 "Ordinances" of the Durham Town Charter allows for the introduction of ordinances by any Town Council member at any regular or special meeting of the Council.

LEGAL OPINION:

The Town's attorney is advising the Town Engineer on this ordinance update will be reviewing all proposed amended language.

FINANCIAL DETAILS:

N/A

SUGGESTED ACTION OR RECOMMENDATIONS:

No formal action required. Receive the Town Engineer's presentation and ask questions as deemed appropriate. One question in particular is whether the Council desires the Town to pursue a tierd pricing approach for water use during drought conditions or possibly all year long.

CHAPTER 158

WATER

[HISTORY: Adopted by the Water Department of the Town of Durham: Art. I, effective 1-1-1951. Adopted by the Board of Selectmen (now Town Council) of the Town of Durham: Art. II, 10-26-1981. Sections 158-8, 158-9, 158-12, 158-14A, 158-15A and C, 158-16, 158-19A and 158-20 amended at time of adoption of Code; see Ch. 1, General Provisions, Art. I. Other amendments noted where applicable.]

Article I
SERVICE TERMS AND CONDITIONS

158-1. Applications.

All applications for the taking of water must be made at the Water Department office in the prescribed form and signed by the owner of the property or his duly authorized agent.

158-2. Responsibility for costs; maintenance.

A. On all streets and thoroughfares serviced by the water main, all costs incident to new service installations from the main to the building or meter shall be borne by the property owner, including all labor and materials required and costs of excavation and backfill. The entire installation shall be made in accordance with specifications prescribed by the Water Department and shall be subject to the strict supervision and inspection of the Water Department or its authorized representative.

B. That portion of the installation from the main to and including the curb stop shall become the property of and shall be maintained by the Water Department.

C. That portion of the installation from the curb stop to and including the building, excluding the meter, shall remain the property of and shall be maintained by the property owner in a condition satisfactory to the Water Department.

D. Necessary meters will be furnished by and remain the property of the Water Department. The Water Department, or its designated agent, may repair and/or replace meters when, in the sole opinion of the Water Department, replacement is necessary. The Water Department shall not be responsible for any repairs or modifications necessitated by the replacement of meters (other than repairs to the portion of the installation which is the property of the Water Department) absent negligence or intentional misconduct on the part of Water Department employees.

E. Users must provide an accessible space for water meters that are protected from vandalism and environmental conditions (frost and heat).

F. The Town assumes no liability for conditions which exist in consumer's pipes and cause trouble coincident with or following the repairs of main, service pipe, meter or other appliance belonging to the Water Department.

(Section 158-2 amended by Ord. #2012-09 dtd 8/6/12)

158-3. Service pipe standards.

All service pipes shall be of a size determined to be adequate by the Water Department, but in no event less than three-fourths (3/4) inch in diameter, and shall be of wrought iron, Type K underground copper tubing or other material satisfactory to the Water Department.

158-4. Alterations in piping or fixtures.

No alterations in any water piping or fixtures whereby the consumption of water shall be increased shall be made without the knowledge of the Water Department. Property owners desirous of employing any person or persons other than the Water Department employees to make additions to or repairs or alterations in any service line shall notify the Water Department prior to beginning any such work.

158-5. Unauthorized connections.

No person, except with the authorization of the Water Department, shall tap any water main or connect any service pipe to such main, nor shall any unauthorized person turn on or shut off the water from any water main.

158-6. Use of hydrants.

No person, except firemen in the actual discharge of their duty, employees of the Water Department and the Superintendent of Properties of the University of New Hampshire or his authorized agent for purposes of test, shall open any hydrant without the consent of the Water Department. Except in cases of actual emergency, the Water Department should be notified when any such action is contemplated.

158-7. Inadequate supply procedure.

In the event that a customer fails to receive an adequate supply of water through his service pipe, proof shall be furnished satisfactory to the Water Department that the portion within his own premises as far as the curb stop is in a satisfactory condition and free of any obstruction before any opening of the street is made by the Water Department.

158-8. Water shutoff fee.

Should the water be shut off at the request of the property owner, tenant or agent of either or for cause, a fee shall be collected for turning on the water again. The fees are set forth in a fee schedule adopted by the Town Council from time to time.

158-9. Access to customer premises.

The members of the Town Council or its agent or authorized employees of the Water Department shall have access to the premises of any customer between the hours of 8:00 a.m. and 6:00 p.m. for purposes of reading, testing, replacing, or repairing meters, to examine pipes and fixtures and to maintain and repair existing waterlines of the Water Department on private property.

(Section 158-9 amended by Ord. #2012-09 dtd 8/6/12)

158-10. Shut off for repairs.

The Durham Water Department shall have the right to shut off water from any pipes without notice to make repairs or additions of new work or installations or for other legitimate purposes. The Water Department will endeavor, however, to give reasonable notice in such cases. However, failure to give such notice shall not render the Water Department responsible or liable for any damages that may result for the shutting off of the water or any coincident conditions.

(Section 158-10 amended by Ord. #2012-09 dtd 8/6/12)

158-11. Cutoff for delinquent payment; responsibility of owner.

Any violations of the terms and conditions hereby established or failure on the part of any owner to pay any and all claims of the Water Department within thirty (30) days after they are due and payable shall be considered sufficient cause for cutting off the supply of water to such owner. Five (5) days after written notice has been given, the water shall be turned off, and the supply shall not be again turned on until all cause of complaint shall have been removed and, in addition, the regular charge for turning on the water shall have been duly paid to the Department. In all cases, the owner of the property will be held responsible for the payment of all Water Department bills against his premises, whether he is an occupant of the premises or not.

158-12. Unauthorized modification of rules.

No officer or employee of the Water Department has any authority to modify these terms and conditions unless specifically authorized by the Town Council.

158-13. Advance payment for work.

If the owner or his authorized agent requests the Water Department to do work, he shall be required to make an advance payment, before any work is begun, of such an amount of money as, in the judgment of the Water Department, will reimburse the Department for any and all expense incidental thereto for which the applicant is properly responsible. This regulation shall also apply to repairs of service piping and replacing and repair of meters in the event that such replacement or repair is, in the judgment of the Water Department, due in any way to negligence on the part of the property owner. Should the advance payment be insufficient to cover the costs of the installation or should the payment have been in excess, financial adjustment shall be made immediately upon completion of the work.

158-14. Water main extensions.

Petition for extension of the main water pipe signed by the abutting property owners will be received and referred to the Durham Planning Board for recommendations. Approval of petitions will be subject to the following:

A. When, in the judgment of the Town Council, a sufficient number of property owners have signed the petition to justify the installation of the new main, the main will be authorized and construction started as soon as feasible and as soon as the necessary funds are made available. The cost of the main may be prorated against all petitioners in direct ratio to the front footage of property of the petitioners. The charge will be set forth in a fee schedule adopted by the Town Council from time to time.

B. The excess cost of extension as set forth in Subsection A above shall be payable in cash or in not more than ten (10) annual payments, subject to an annual interest charge of five percent (5%) on the balance due.

158-15. Extensions to new subdivisions.

A. Extensions of water services to new subdivisions will be made only after a study of the proposed subdivision has been made by the Durham Planning Board and its recommendations have been submitted to the Town Council.

B. Water mains in new subdivisions to be served by the Durham Water Department shall be installed by the subdivider at his expense according to specifications established by the Water Department. When such installations are made and are accepted, they are to become the property of the Durham Water Department.

C. When deemed by the Water Department a prudent investment, the cost of extension of present water mains to the entrance of the proposed subdivision will be borne by the Water Department to the extent set forth in the fee schedule adopted by the Town Council, each connection to be guaranteed by the subdivider at the time of extension of town mains, provided that all other costs will be met by the subdivider and further provided that the subdivider will be required to guarantee to the Durham Water Department for a period of ten (10) years, in a manner satisfactory to the Water Department, the minimum annual water rental for the number of connections guaranteed at the time of extension or a quarterly fee equal to a percentage of the total cost of extension of the mains as set forth in the fee schedule, whichever is the greater.

158-16. Meter reading. [Amended 1963 by BOS]

Meters will be read on a semiannual basis, and billing will be made according to a rate per cubic foot of water consumption. The current rate is on file at the office of the Town Council.

158-17. Billing. [Amended 1963 by BOS]

Bills for water consumed will be rendered semiannually and are due and payable upon presentation.

158-18. Amendments.

The Durham Water Department reserves the right to amend or to add to these terms and conditions as experience may show to be necessary or advisable, and such changes shall be effective thirty (30) days after publication.

Article II
INITIAL ASSESSMENTS AND FEES

158-19. Initial assessment; exception.

A. The assessment for water service shall be determined for all classes of users on a per-gallon-of-water-used basis as established by the Water Policy Committee. (See 158-20.) The initial assessment shall be estimated by the Town Council on basis of similar use. After twelve (12) months of continuous service, under conditions of full occupancy, the town will adjust the initial assessments to the user based upon actual water meter readings. This assessment may be increased based on metered consumption or may be decreased to an established minimum as determined by the Water Policy Committee.

B. Exception. A flat fee, as determined by the Water Policy Committee, will be charged for single-family residences with a maximum of four (4) bedrooms. (See 158-20, Fee schedule.)

158-20. Fee schedule.

Fees shall be as set forth in the fee schedule, which is on file in the Town Hall.

158-21. Disposition of payments.

Payments on initial water entry assessments shall be placed in a water capital expenditures account for the purpose of waterline expansion, enlargement of treatment, storage or other facilities or payment of bonded indebtedness, as recommended annually by the Water Policy Committee.

NEW HAMPSHIRE LIVES ON WATER

December 2012

New Hampshire
Water Sustainability Commission - Final Report

Established by Executive Order 2011-02
By Governor John H. Lynch

NEW HAMPSHIRE LIVES ON WATER

NEW HAMPSHIRE WATER SUSTAINABILITY COMMISSION

FINAL REPORT - DECEMBER 2012

Contents

The Commission acknowledges with gratitude the support of the New Hampshire Charitable Foundation, the New Hampshire Rivers Council, The Switzer Foundation, and NH Listens, as well as facilities and technical assistance provided by the New Hampshire Departments of Environmental Services, Fish and Game, and Safety and the New Hampshire Higher Education Assistance Foundation.

COMMISSION OVERVIEW

The New Hampshire Water Sustainability Commission was created by Executive Order in April, 2011.[1] The Commission was composed of 14 citizens.[2] It was directed to make recommendations that will ensure that the quality and quantity of New Hampshire's water in 25 years is as good as or better than it is today.

At the outset, we asked three questions:

1. What do we need to know about water and how it is used – now and in the future?
2. What are the fundamental issues and challenges that if not addressed now will preclude the ability of future generations to ensure healthy ecological systems and enough clean water?
3. What actions are needed and who should be responsible for carrying them out?

Over the last 19 months, the Commission has sought to engage with and listen to the public at six public sessions around the state,[3] and has heard from those who have taken the time to write and e-mail us, and to come to our meetings.[4, 5, 6] We heard from approximately 500 individuals, and their thoughts and input are reflected in this report. The Commission listened to many experts on a variety of issues affecting New Hampshire's water[7] and studied the work of other water-related commissions.[8]

This report describes the work of the Commission and its findings. The Commission, through this report, presents a framework for action in seven goals with recommendations that, if met, will ensure the health and vitality of our state's ecological systems, the availability of good quality water for the health and economic vitality of future generations.

Most importantly, we learned that people in New Hampshire care and are knowledgeable about issues related to water. As a statewide community we know what we must do, but we need a coordinated voice and the initiative to do it. The work of the Commission is just the beginning of what will be required of our residents, businesses, nonprofits, public agencies and leaders in government and the private sector. That work must start with broad public engagement and collaborative partnerships. The Commission calls upon people in New Hampshire to become actively engaged as stewards of our water resources and to act upon the recommendations to achieve the goals presented in this report.

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[1] See Appendix A for the full text of the April 22, 2011 Executive Order.
[2] See Appendix B for a list of members of the Commission.
[3] See Appendix C for a summary of public input, and Appendices D and E for the reports of the May 8, 2012 NH Listens sessions and the July 9, 2012 listening event, respectively.
[4] See Appendices F and G for the summary of the online questionnaire, and mailed and e-mailed public comments, respectively.
[5] See Appendix H for a summary of the Commission's work process.
[6] See Appendix I for a description of the Commission's meeting schedule and minutes of those meetings.
[7] See Appendix J for web links to the materials used by the experts who presented to the Commission.
[8] See Appendix K for a list of water-related commissions and their recommendations.

Note: All appendices listed above are available online at: www.nh.gov/water-sustainability/.

EXECUTIVE SUMMARY

Water is our most valuable natural asset, and if we manage it well, our water offers New Hampshire a competitive advantage. It supports and is vital to a healthy environment, individuals, communities and the state economy. In short, New Hampshire lives on water.

A generation ago, issues involving water were primarily related to pollution that could be seen, smelled, and tasted. We learned where that pollution came from, and we figured out how largely to eliminate it. People learned about problems that impacted our water, they organized and acted, and as a result developed broad public support for public investments that resulted in remarkable improvements to the availability of clean, safe water. In the time since, scientific knowledge has grown greatly and has identified different and more complex problems involving water. We are learning more about how water connects us all.

The New Hampshire Water Sustainability Commission was created to develop a strategic action framework to ensure that the quality and quantity of New Hampshire's water in 25 years is as good as or better than it is today. The framework calls for partnerships and management of water across political boundaries, good science, and adaptive decision-making in managing our water resources. The Commission calls for the creation of a Water Advisory Task Force to advance work toward the goals outlined in this report and a multi-sector citizens' initiative to expand public engagement in and support for the specific recommendations offered by the Commission.

As a result of the Commission's work, we have come to understand the complexity of the responsibility facing us all concerning water. For example:

- Water infrastructure is part of New Hampshire's economic advantage. However, the condition of the systems that provide us with clean water and treat our waste may not be able to meet future demands, and many are, or will shortly be, in need of significant repair and upgrading. Unless investments are made, we will lose this competitive edge.

- The groundwater that 60 percent of the state's population drinks is contaminated in some areas by naturally-occurring or manmade chemicals, such as arsenic and MtBE, respectively (NHDES, 2008). The quality of groundwater used for private water supplies is often not known or tested.

- Growth and development within watersheds, as well as rising and changing demands for water, will affect whether we have enough good quality water when and where we need it, to support both the needs of the state's population and of the broader ecosystem.

- Some of the state's water management laws, policies and regulations should be reviewed and updated as necessary, to ensure that they reflect current scientific understanding and economic realities that best position us to comprehensively manage water in an increasingly global marketplace.

Strategic Goals

The Commission's efforts focused on highlighting the most important issues that we need to address and identifying those strategic goals and recommendations that will chart a course toward ensuring the long-term sustainability of our water resources. The seven strategic goals identified by the Commission are:

1. The people of New Hampshire will be knowledgeable, engaged, and careful consumers and stewards of our water resources.

2. Flexible and coordinated water management programs and practices will be designed and implemented to ensure that New Hampshire has an adequate quantity and quality of water to support ecological and human health and economic activity.

3. Management and planning for New Hampshire's water quality and quantity will be integrated at appropriate state, watershed and sub-watershed levels.

4. The infrastructure for delivering our drinking water, cleaning our wastewater, and managing storm water and water storage will protect human and environmental health and safety in an affordable manner.

5. Runoff from rain and snow, and the pollution it carries, will be minimized and effectively managed.

6. Our watersheds, communities, and built infrastructure will be robust, resilient, and able to adapt to changing weather patterns.

7. Adequate public and private funding will be available for managing water resources effectively and efficiently.

Resilience

Ensuring that our natural water systems (watersheds, groundwater, lakes, rivers, wetlands) and the systems we have built to manage, clean, and deliver water are able to tolerate disturbance, restore balance, and adapt to change.

As it concludes its work, the Commission believes that we can ensure that in 25 years the quality and availability of water will be as good as or better than it is today, provided we begin now to address several key areas of concern through very focused, intentional actions as follows:

- **Education** – We need a fully informed and engaged public where all sectors of New Hampshire life – individuals, businesses, organizations, and our public leaders – understand the importance of water to life and to our economy, how water works, and the challenges and consequences facing our water's future. These sectors must all be willing to take responsibility for and commit to action to ensure the quality and availability of water. We must respect private property rights while balancing a shared responsibility to ensure the quality and availability of water for future generations.

- **Infrastructure Investment** – The natural and built systems that provide recreational opportunities, support ecosystems, deliver our drinking water, manage our storm water, and clean our wastewater help provide New Hampshire with a competitive advantage over other states in terms of water availability and affordable water services. Without sustained investment in our water infrastructure, we may lose this edge. We need to renew and perhaps reinvent partnerships between and among individuals, communities, state and federal governments, and the private sector to provide the necessary levels of investment.

- **Future-Focused Management** – We need our state's policies, laws, regulations and programs to consider and balance long-term implications when addressing short-term needs, taking into account how water works, facilitating resilience, and adapting to change and new knowledge. In the face of uncertainty, we need to make thoughtful, prudent decisions that will protect the ability of our water systems to support our natural and human communities over the long-term.

- **Data and Monitoring** – We need sufficient, timely and accurate information upon which to base decisions. We need to know about the existing quality and quantity of our water as well as changes that are occurring. We need to know what actions are necessary to ensure that our lakes, rivers, groundwater, ponds, estuaries and wetlands remain the crown jewels of our state, able to support vibrant and healthy individuals, communities, economies and ecosystems.

The end of this Commission's work is but the beginning of work by all the people of New Hampshire to support and preserve their water. The work started by the Commission will need to be continued using a multi-sector approach, with a coordinated network of interests from across the state, to build upon the vision articulated in this report. We call on all New Hampshire residents to be active stewards of our water resources.

Keeping New Hampshire's water clean helps maintain our state's high quality of life.

UPDATED

WATER RESOURCES MANAGEMENT PLAN

TOWN OF DURHAM, NEW HAMPSHIRE
UNIVERSITY OF NEW HAMPSHIRE

Submitted by:
UNDERWOOD ENGINEERS, INC.
Portsmouth, New Hampshire
Concord, New Hampshire

MARCH 2000
REVISED: JULY 2000
REVISED: OCTOBER 2007

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APPENDIX D: Env-Ws 1900 – Instream Flow Rules

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SECTION 1 – INTRODUCTION

1.1. EXISTING WATER SUPPLY SOURCES

The Town of Durham and University of New Hampshire (UNH) are served by three existing water supply sources:

- ◊ Oyster River
- ◊ Lamprey River
- ◊ Lee Well

In addition to these sources, the Town and UNH own land necessary to develop a second groundwater supply source as listed below:

- ◊ Spruce Hole Aquifer Groundwater Supply

Therefore, in terms of planning, there are four separate water supply sources available to the Town of Durham and the University. The supply sources are shown in ***Figure 1-1*** and described in the following sections.

1.1.1. Oyster River Supply

The Oyster River is impounded by a concrete dam owned by UNH. The volume of the reservoir behind the dam has been variously reported to be 9 million gallons (MG) (CDM, 1965) and 14.7 MG (1984 bathymetric map – see ***Appendix A***). The true volume is not known. Water is withdrawn from the impoundment through an intake located at the dam and treated at the Arthur Rollins Water Treatment Plant (WTP), a conventional plant (chemical coagulation, flocculation, sedimentation, filtration and disinfection) owned and operated by UNH.

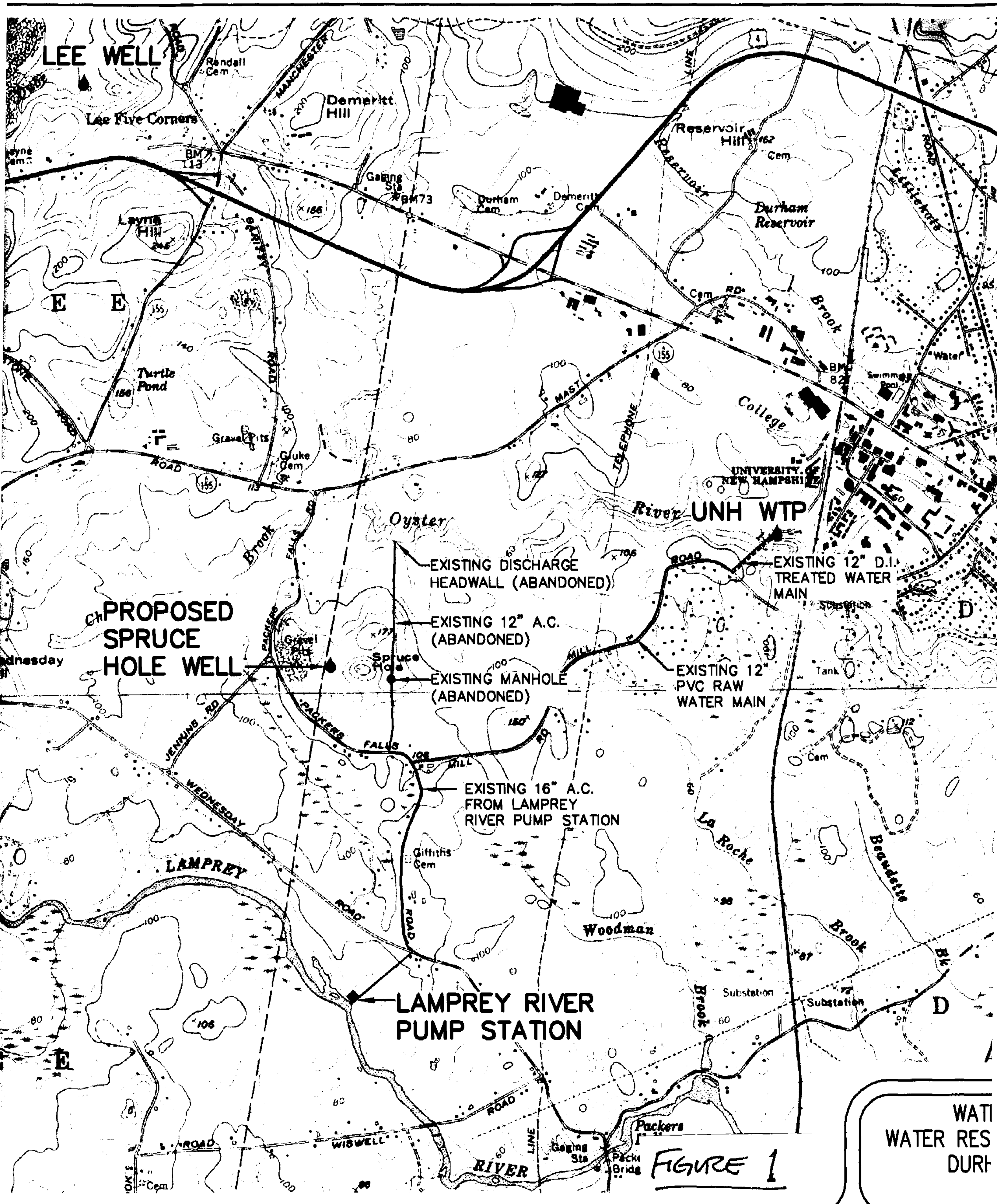

LEE WELL
Lee Five Corners
Demeritt Hill
Layne Hill
Turtle Pond
Gravel Pits
Reservoir Hill
Durham Reservoir
Durham Cem
Demeritt Cem
MAST ROAD
TELEPHONE LINE
College Brook
UNIVERSITY OF NEW HAMPSHIRE
Oyster River
UNH WTP
EXISTING DISCHARGE HEADWALL (ABANDONED)
EXISTING 12" D.I. TREATED WATER MAIN
PROPOSED SPRUCE HOLE WELL
EXISTING 12" A.C. (ABANDONED)
Spruce Hole
EXISTING MANHOLE (ABANDONED)
EXISTING 12" PVC RAW WATER MAIN
PACKERS FALLS RD
MILL RD
JENKINS RD
WEDNESDAY ROAD
EXISTING 16" A.C. FROM LAMPREY RIVER PUMP STATION
Giffiths Cem
La Roche Brook
Beaudette Brook
Woodman Brook
LAMPREY RIVER
LAMPREY RIVER PUMP STATION
WISWELL ROAD
Packers Falls
Substation
WAT
WATER RES
DURH

FIGURE 1

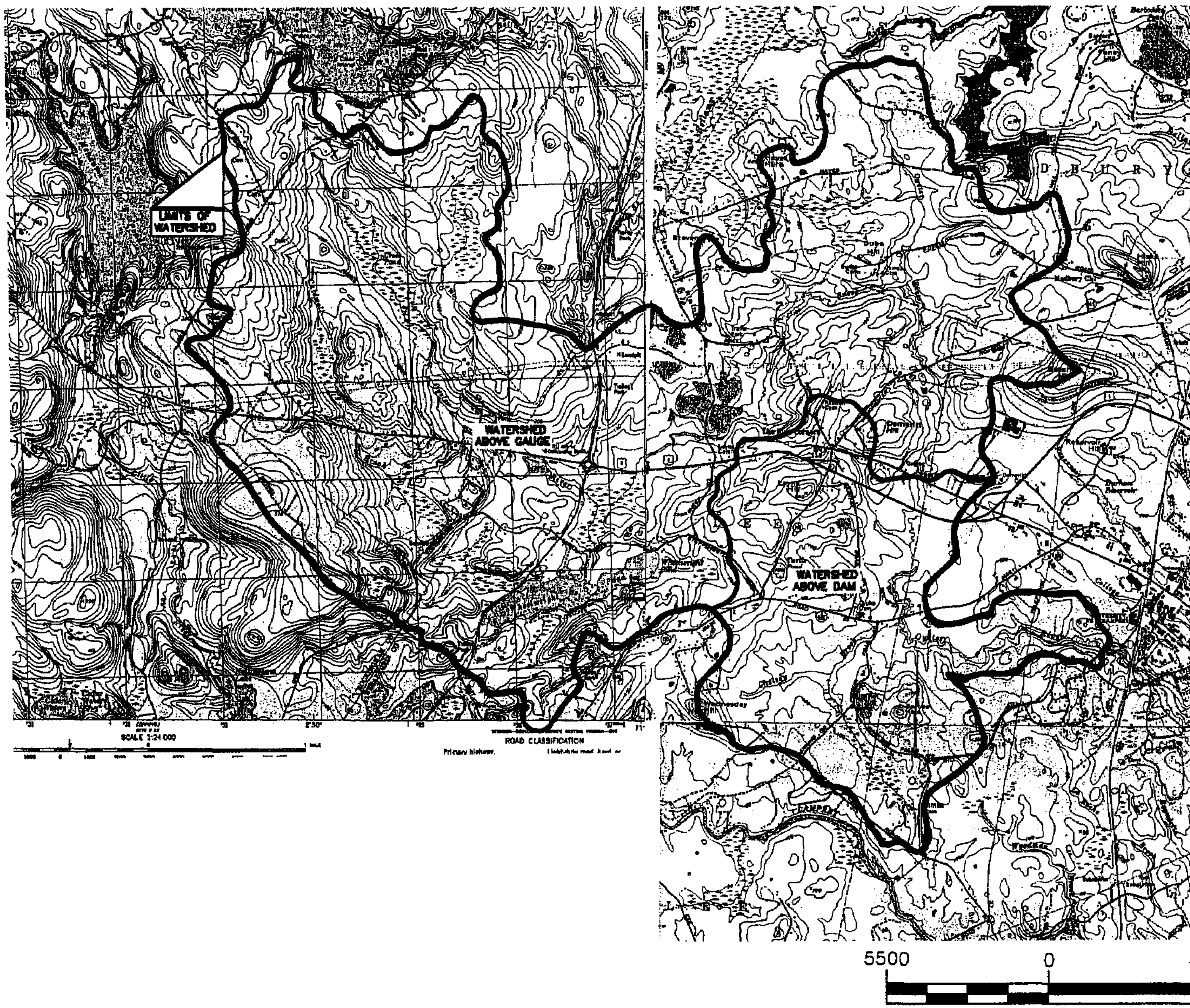
Above the reservoir, the Oyster River drains an area of approximately 16.5 square miles. About 2 miles northeast of the WTP, in the Town of Lee, just north of Old Concord Road, there is a USGS gauging station (No. 01073000) on the Oyster River. The drainage area above this gauge is 12.1 square miles (***Figure 1-2***). Flow records have been kept since 1935 resulting in a 71-year period of record through the end of 2006. The annual mean flow for this period is 19.4 cubic feet per second (cfs).

The additional watershed area of 4.4 square miles between the WTP intake and the USGS gauge means that, with no withdrawals, there is greater flow going over the dam than there is at the gauging station. Two tributaries, Chelsey Brook and an un-named brook draining the Lee Five Corners area flow into the Oyster River downstream of the gauge and upstream of the reservoir.

1.1.2. Lamprey River Supply

Lamprey River water is also treated at the UNH WTP. This supply was added as a supplemental source in 1971 in response to the extended drought of the mid-1960's. An intake, pumping station, and transmission main were constructed to transfer water from the Lamprey River to the Oyster River. The intake is located in a 36 MG impoundment formed by Wiswall Dam, a concrete dam owned by the Town of Durham that predates the use of the river for water supply purposes. The pump station originally contained a constant speed pump which transferred water at a rate of about 2,500 gpm through the transmission main to a headwall on the Oyster River about 1.5 miles upstream of the WTP intake. The transmission main was part force main and part gravity main. The force main went from the pump station to a manhole near Spruce Hole at the high point between the two river basins. From this point water flowed by gravity to the headwall. The route essentially followed the shortest, straightest path between the two rivers.

In 1990, a section of the Lamprey River in Lee and Durham was designated as a protected river under RSA 483, the State of New Hampshire Rivers Management and Protection Act. This section of the Lamprey River also received federal protection in



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WATER SUPPLY SOURCES
WATER RESOURCES MANAGEMENT PLAN
DURHAM, NEW HAMPSHIRE
1439-02

Underwood Engineers, Inc.

DATE	10/17/2007
FIGURE	1-2

1995 when it was designated as a recreational river under the Federal Wild and Scenic Rivers Program. The State program includes the eventual enactment of instream flow rules which will establish minimum flows that must be maintained to protect instream public uses which are held in trust by the State. Early draft versions of the instream flow rules made it apparent that these rules would result in limitations on the amount of water that could be pumped from the Lamprey during low-flow periods. The method of transfer from the Lamprey to the Oyster River was not very efficient since an unspecified amount of this water could be lost to evaporation and groundwater recharge in the 1.5 miles of river channel between the headwall and the impoundment. There was no way to measure the amount of Lamprey River water which was actually making it to the WTP. In response, the Town and the University decided to increase the efficiency of this water transfer by pumping water directly from the Lamprey River to the WTP. This also has the benefit of separating the sources, thereby allowing independent use of either one in case of contamination of one or the other.

In 2001, a new section of transmission main was connected to the existing main at the intersection of Packers Falls and Mill Roads and then laid along Mill Road and cross-country to the water treatment plant. The portion of the old main leading to the headwall was abandoned in place. A branch main off the new transmission main allows Lamprey River water to be diverted to the Oyster River reservoir at the dam, if desired. A new, smaller pump of about one-half the capacity of the old pump was installed in the Lamprey River Pump Station along with a variable frequency drive to vary the flow as needed.

Less than a mile downstream of Wiswall Dam is a USGS gauging station (No. 01073500) on the Lamprey River. The drainage area above this gauge is 183 square miles and flow records have been maintained since 1934, providing a 72-year period of record. There is about 0.58 square miles of drainage area between the dam and the gauging station. As this amounts to 0.32 percent of the 183 square mile watershed area, the flow at the gauge can be considered very close to the flow over Wiswall Dam. The mean annual flow at the gauge for the 72-year period of record is 281 cfs.

Table 1-1 gives monthly mean discharges at the Oyster River and Lamprey River gauge sites respectively. Also shown is the ratio derived by dividing the Lamprey River flow by the Oyster River flow. The average ratio is 15.7. This is fairly close to the ratio of the watershed areas above the respective gauge locations (183/12.1 = 15.1).

TABLE 1-1
MEAN MONTHLY DISCHARGE
OYSTER RIVER & LAMPREY RIVER

Month	Oyster River (cfs)	Lamprey River (cfs)	Ratio Lamprey:Oyster
January	19	288	15.2
February	22	304	13.8
March	47	598	12.7
April	49	690	14.1
May	26	371	14.3
June	13	206	15.9
July	5.0	95	19.0
August	3.4	71	20.9
September	4.3	70	16.3
October	8.2	139	17.0
November	18	264	14.7
December	22	337	15.3

1.1.3. Lee Well

The Lee Well is a 24 inch x 36 inch, 54 foot deep gravel-packed well located on land owned by the Town of Durham in the Town of Lee. It is jointly operated by Town and UNH personnel. The well and pumping station were constructed in 1986 as part of an economic development project that included the Technology Drive office/research park and the Beech Hill storage tank. The Lee Well pump was designed to lift water to this tank, which has an overflow elevation of 270 feet, about 58 feet higher than the overflow elevation of the Edgewood Road and Foss Farm tanks (211.6 ft) which serve the main system. Due to this difference in hydraulic grade line (HGL), the Lee Well-Beech Hill tank system is separated from the main system by a pressure reducing/sustaining valve in a vault near the head of Technology Drive. This vault also contains a booster pump should it be necessary to boost water from the main system to the Lee Well-Beech Hill tank system.

1.1.4. Spruce Hole Aquifer Groundwater Supply

While a Spruce Hole aquifer groundwater supply is not an actual existing supply source, this resource has been tested sufficiently to indicate that a well or wells can be located here and the Town and UNH have initiated the process to develop the supply and obtain the necessary permits. It is expected that this supply may be on-line and connected to the system within the next 2 to 3 years. It has, therefore, been included as part of the Water Resources Management Plan.

Spruce Hole is one of the few remaining Kettle Hole Bogs in southern New Hampshire. Due to the unique habitat provided by the bog, it is home to plant and animal species found in few, if any, other places. For this reason, the Spruce Hole Bog was designated as a National Natural Landmark by the U.S. National Park Service in 1972.

The Spruce Hole aquifer is a sand and gravel formation surrounding the bog which was initially tested in 1953 as part of the search for a water supply for the Portsmouth Air Force Base (Pease AFB). The formation was mapped by the USGS (Moore, 1991) as part of the State of New Hampshire stratified drift mapping program. Based on limited test well data, the USGS identified probably transmissivity and saturated depth contours. A copy of this mapping is contained in ***Appendix B***. As shown, the most promising area is between Spruce Hole Bog and the town gravel pit.

Extensive testing and research work has been conducted on the Spruce Hole Aquifer and Bog under the direction of Professors Thomas Bellestero and Thomas Lee of UNH. As part of this work, detailed evaluations of the plant and animal life of the bog were conducted. Geophysical surveys were conducted to determine the depth of the aquifer. An 8" PVC test well was installed in the favorable area on the edge of the Town gravel pit to perform a pump test. Observation wells, micro wells, and piezometers were installed in the aquifer and in the bog to study the effect of pumping on both the aquifer and the bog. An 8-day pump test was conducted with monitoring of the numerous observation wells, all in accordance with NHDES procedures. Using all the data collected from the pump tests, a three-dimensional groundwater model of the aquifer was developed. The model was used to simulate artificial recharge to study the volume of water that could be retained in the aquifer and pumped out again at a later date. The major conclusions of the study are listed below:

- A production well in the Spruce Hole Aquifer should be able to produce about 300,000-400,000 gallons per day
- Initial water quality testing indicates that the water met all primary (health related) and secondary (aesthetic related) standards as required by the Safe Drinking Water Act.
- The water level in Spruce Hole Bog is perched above the water table in the surrounding aquifer due to relatively impermeable sediments below the bog
- Pumping of the test well did not impact Spruce Hole Bog
- The primary source of recharge to the aquifer is through precipitation
- Artificial recharge can be applied to the aquifer and up to 90% of this water would still be in the formation three months later

1.2. 401 QUALITY CERTIFICATE

Section 401 of the federal Clean Water Act requires any applicant for a federal permit (i.e. a wetlands permit) to conduct any activity that may result in a discharge to surface waters of the state, to provide certification to the permitting agency that the discharge will meet state surface water quality standards. This certification must come from the state, which in the case of New Hampshire is the Department of Environmental Services (DES). This certification is known as a 401 Water Quality Certificate (401). The New Hampshire Code of Administrative Rules indicate that water quality standards shall apply to water withdrawals which may affect existing and designated uses including the protection and propagation of aquatic life.

Since a federal wetlands permit was required for a portion of the 2001 Lamprey River transmission main project, and since operation of the project involves water withdrawals from the river that could impact aquatic life, DES determined that 401 Water Quality Certification was required. The primary concern was water withdrawals during low flow periods and the resultant impact on aquatic life. The then current draft instream flow rules contained "trigger" flows for "hydrologic seasons" below which there would be limitations on withdrawals in order to maintain the integrity of the biological and aquatic community. Based on a process involving input from various local, state and federal agencies, it was determined that water quality certification conditions would include withdrawal restrictions based on the hydrologic summer season (June through October) trigger flows. These were the exceedance flows, Q_{60}, Q_{80}, and Q_{90}. Q_{60} for example, is the flow in the stream which, based on historical data, is exceeded 60% of the time. The higher the number following Q, the lower the flow. However, it was also recognized that in addition to the water which could be withdrawn from the "run of the river", some amount of water could be withdrawn from the storage provided by Wiswall Dam. The conditions of the final water quality certificate are summarized below. A copy of the 401 is attached in ***Appendix C.***

- Lamprey flow > 45 cfs – no withdrawal restrictions
- Lamprey flow > 21 cfs but < 45 cfs – withdrawal limited to 1.8 cfs (808 gpm)
- Lamprey flow > 13 cfs but < 21 cfs – withdrawal limited to 0.4 cfs (180 gpm)
- Lamprey flow < 13 cfs – withdrawal from storage in Wiswall Impoundment only
  - Impoundment inflow must equal impoundment outflow
  - No more than ½" drawdown per day
  - No more than 6" drawdown in total
- At Lamprey flow < 45 cfs, DES must approve a plan to measure or estimate inflow to the Wiswall impoundment and outflow from Wiswall dam
- At Lamprey flow < 13 cfs, DES must approve a plan to maintain Wiswall Reservoir outflow equal to inflow
- Records must be maintained of the pump station operation and Wiswall Reservoir pool elevation

The conditions related to measurement or estimation of river flows and pool levels are only in effect when the pump station is in operation.

The 401 has a significant impact on the ability to pump water from the Lamprey River precisely when it is needed the most, during the typical low-flow period of late summer and early fall.

1.3. OPERATION OF WATER SUPPLY SOURCES

1.3.1. Historical Operation

Prior to construction of the original Lamprey River transmission main in 1971 and the Lee Well in 1986, the Oyster River was the only supply source. Therefore, the WTP, drawing water from the Oyster River Reservoir, was operated as necessary to meet demands.

Even with the addition of the Lamprey River and the Lee Well, the Oyster River remained as the primary supply source. Before the 2001 completion of the new Lamprey River transmission main directly to the WTP, the method of operation was as listed below:

- Operate WTP using Oyster River as primary source of supply.
- During periods of low flow, as indicated by the failure of water to spill over the flashboards at the Oyster River Reservoir, the Lamprey River Pump Station (LRPS) was activated. This pumped about 2,500 gpm to the discharge point at the headwall in the bank of the Oyster River, about 1.5 miles upstream of the WTP.
- The combined Lamprey and Oyster River water flowed to the reservoir where it was drawn into the WTP by the raw water pump(s).

- The LRPS was run until system demand was satisfied and the raw water pump shut off. The LRPS was then shut down.
- The Lee Well Pump Station provided water to the main system based on the setting of the PRV in the vault at Technology Drive.

It is noted that the original PRV at Technology Drive was not capable of letting the small flow rate desired into the main system. It would either allow too much flow in or it would remain shut. As a result, prior to 1990, the Lee Well contributed very little water to the main system. In 1990, a piece of 2" copper was plumbed around the PRV which allowed more flow to reach the main system but only a maximum amount of about 200,000 gpd. In 1998, a new properly sized PRV was installed which allowed more flexibility in higher or lower flows going to the main system. The Town then increased the flow from the Lee Well into the main system. This was primarily due to an economic incentive since UNH billed the Town for water production over and above what was being used by UNH. If this amount was supplied by the Town, then there would be no payment to UNH.

After completion of the new Lamprey River transmission main, the WTP was run using the Lamprey River source for most of 2002 and 2003 so that the operators could start building a water quality data base for use of the Lamprey as the sole source. Up until this time, it had always been combined with Oyster River water. The balance of water required to meet demand came from the Lee Well.

1.3.2. Current Operation

The WTP can now be operated using either the Oyster River or the Lamprey River. When the Lamprey River flow is above 45 cfs, the Lamprey source is utilized as much as possible. As flow drops below 45 cfs, the Oyster River is used. One reason for this is that the 401 requires a DES-approved monitoring plan when the Lamprey River flow is less than 45 cfs as measured at the Packers Falls gauge. Currently there is no approved monitoring plan.

In 2002, the Lamprey River was used for an extended period when the flow was less than 45 cfs and even when it was below 13 cfs for 76 consecutive days. During this period, stream flow was measured on a weekly basis upstream of the reservoir while the Packers Falls gauge was used to determine the outflow from Wiswall Dam. A 10-inch siphon was installed to maintain the release from the Wiswall Reservoir. A valve on the siphon was adjusted to maintain out flow equal to inflow while river flow was less than 13 cfs. The siphon was installed as an alternative to using the Wiswall Dam flood gates as referenced in the 401 conditions since there were concerns about debris getting stuck in one of the gates making it impossible to close. This could result in loss of the reservoir. The level of the reservoir was monitored by measuring the distance to the water surface each day from a reference mark on one of the dam abutments.

y" ?

or was it less

While these monitoring efforts met the requirements of the 401, refinements were needed for the reasons listed below:

and is located +/ mile upstream of the reservoir and two tributaries

- The cross-section used to measure inflow to the reservoir was only suitable at flows less than about 20 cfs. There are few, if any, viable accessible cross-sections within a reasonable distance upstream of the reservoir for flow measurement.
- There was no meter in the siphon so it was necessary to rely on the Packers Falls gauge and the latter is not accurate at flows less than about 5 cfs.
- It is difficult to measure 1/2-inch changes in water level in the Wiswall Reservoir.

The Town has attempted to satisfy the flow monitoring requirement by treating the dam as an ogee crested weir and developing an appropriate relation using the height of water over the weir. While open to the possibility, DES had concerns about the accuracy of this method based on past experience. Until there is an approved monitoring plan, the Oyster River will continue to be used when the Lamprey River is below 45 cfs.

Describe problems w/ operating pump station during winter and difficulty of switching from one source to other. Also describe limitations of blending sources.

In the July 2000 Water Resources Management Plan, it was recommended that the Lee Well be used more sparingly in the non-low flow months so that it could be used more heavily in the low-flow period when the surface supplies may be limited. ***Figure 1-3*** shows the monthly average production from the Lee Well for 2000 through 2006. While not completely consistent, there is a definite pattern of greater production from the Lee Well in the typical low-flow months of August, September, and October.

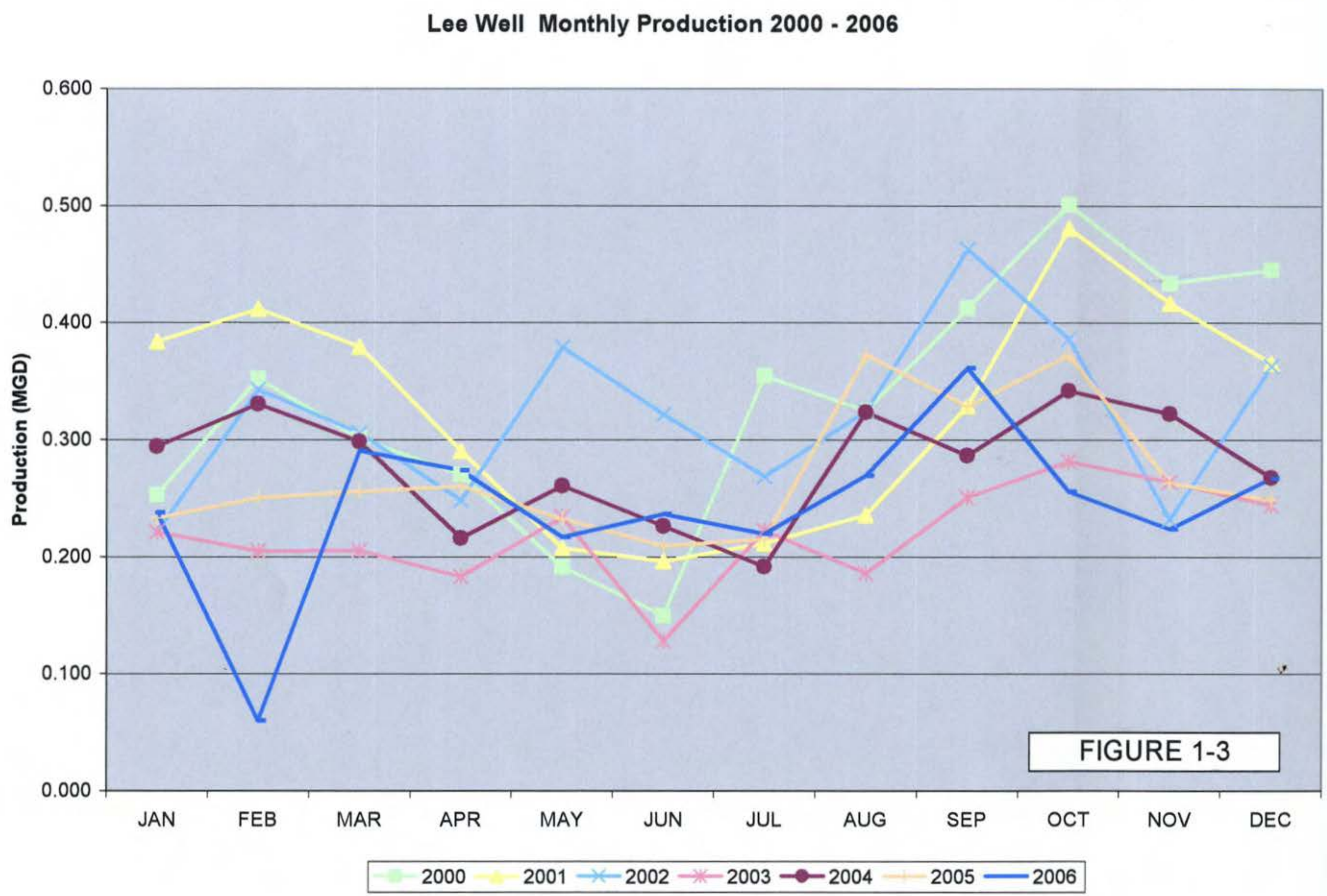
Currently, Town personnel check the Technology Drive PRV vault daily and adjust the PRV setting as necessary to increase or decrease the flow to the main system.

Under the present mode of operation, the 2006 monthly flows into the system from the supply sources are as shown in ***Table 1-2***.

TABLE 1-2
MONTHLY FLOWS FROM SUPPLY SOURCES
2006

Month	**WTP PRODUCTION (MGD)**	**%**	**LEE WELL PRODUCTION (MGD)**	**%**	**TOTAL (MGD)**
January	0.496	68	0.238	32	0.734
February	0.876	94	0.060	6	0.936
March	0.585	67	0.290	33	0.875
April	0.695	72	0.274	28	0.969
May	0.579	73	0.217	27	0.795
June	0.431	65	0.237	35	0.668
July	0.491	69	0.220	31	0.711
August	0.522	66	0.269	34	0.791
September	0.717	67	0.361	33	1.079
October	0.784	75	0.256	25	1.040
November	0.635	74	0.224	26	0.859
December	0.396	60	0.267	40	0.663
AVERAGE	**0.601**	**71**	**0.243**	**29**	**0.843**

As shown, in 2006, the WTP provided about 71 percent of the water to meet system demand while the Lee Well provided the other 29 percent of the water. This compares to



Lee Well Monthly Production 2000 - 2006
Production (MGD)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
2000
2001
2002
2003
2004
2005
2006
FIGURE 1-3

about 60 percent from the WTP and 40 percent from the Lee Well in 1999 as shown in the July 2000 Report.

This reflects a positive change in management of the water resources. The production from the Lee Well is no longer being dictated by economics. The production rate was kept reasonably low in preparation for heavier use during the low-flow period which, in Durham, coincides with the high-use period. Since 2006 was a relatively wet year, it was not necessary to over pump the Lee Well during the historical low-flow period.

1.3.3. Drought Operations

Until a Lamprey River Flow Monitoring Plan is approved

The Town and UNH are currently revising their Drought Response Plan. The approach is to use the Oyster River as the primary source with the Lamprey River to be used as an emergency supply. The response plan has stages which are based on the level of the Oyster River Reservoir as described below:

- Drought Watch
  - ◊ Criteria
    - Oyster River Reservoir at top of flash boards
    - No precipitation expected for four (4) days
  - ◊ Action
    - Mailings to public and necessary people on the UNH Campus
    - Voluntary Conservation
- Drought Warning
  - ◊ Criteria
    - Oyster River Reservoir 12 inches below the top of the flash boards
    - No precipitation expected for four (4) days
  - ◊ Action
    - Issue drought warning through mailings and news media notification
    - Mandatory Conservation

- Drought Pre-Emergency
  - ◊ Criteria
    - Oyster River Reservoir at top of concrete of dam
  - ◊ Action
    - Pre-Emergency issued by mailings and news media notification
    - Announcements on radio and TV several times per day for duration of Pre-Emergency
- Drought Emergency
  - ◊ Criteria
    - Edgewood Road tank level falls to 80% of capacity
  - ◊ Action
    - Activate Lamprey River Pump Station
    - Mandatory Conservation
      - No watering of lawns or gardens
      - No pool make up water
      - No pure water systems for UNH labs
      - Shut off all water cooled systems
      - No ice makers
      - No commercial laundry facility operation
      - No daily water permits
      - Residents on system to have usage limits (gpd) determined by UNH/Durham officials

Under this scenario, the Lamprey River pump station would not be activated until declaration of a drought emergency. This may change once an approved flow monitoring program is in place. To enable the Town to enforce mandatory conservation measures, a Water Use Restriction Ordinance would need to be adopted.

1.4. STATUS OF INSTREAM FLOW RULE

Protection of flow-dependent instream public uses on designated rivers was established under RSA 483. The public uses are defined as:

- Navigation
- Recreation
- Fishing
- Conservation
- Maintenance and enhancement of aquatic life
- Fish and wildlife habitat
- Protection of water quality and public health
- Pollution abatement
- Aesthetic beauty
- Public water supply
- Hydropower production

(401)

The July 2000 report described several versions of draft instream flow rules starting with the original April 1996 Draft and ending with a July 2000 schedule proposed by DES for development of final rules. This schedule was not met and none of the early drafts were adopted. The current *401 Water Quality Certificate* is based on the methodology proposed for instream flow protection in the March 16, 1999 version of the rules, making the Durham/UNH system the only one in the state subject to any form of instream flow rules.

In 2002, compromise legislation was passed to establish a pilot program for instream flow protection on two of the fourteen rivers designated under RSA 483, the Lamprey River and the Souhegan River. Based on input from the statewide Rivers Management Advisory Committee, DES adopted instream flow rules (Env-Ws 1900) that apply only to the Lamprey and Souhegan Rivers. These rules became effective May 29, 2003.

The rules describe the process for conducting a Protected Instream Flow Study (PIFS) and developing a Water Management Plan (WMP) to implement the study results. This process is summarized below:

The purpose of the PIFS is to establish scientifically-based protected instream flows. The study involves identification and cataloging of the following:

- Instream public uses
- Designated uses under the Clean Water Act
- Resources for which the river segment was designated
- Documents and reports related to the preceding

Field studies must be conducted to directly observe the uses and resources listed above and must include an on-the-water stream survey of fish, wildlife, macroinvertebrates, plants and recreational uses.

The recommended protected instream flows from the PIFS must go through a public hearing and comment process. As part of this process, both the Town and UNH would be notified as "Affected Water Users". In addition, the Town would be considered an "Affected Dam Owner". Once DES establishes the protected instream flows, the rules contain procedures for petitioning for a change in the flows.

Once the protected instream flows are finalized, a WMP must be completed to delineate how these flows will be maintained. The WMP includes the following elements:

- Conservation Plan
- Water Use Plan
- Dam Management Plan

Descriptions of each of these plans are contained in a copy of Env-Ws 1900 which is included in ***Appendix D.***

Each of these plans will be applied to every Affected Water User or Affected Dam Owner, as applicable, within the Water Management Planning Area (WMPA). The WMPA is defined as the "tributary drainage area to a designated river for which a water management plan is required". In the case of the designated segment of the Lamprey River, we interpret this to mean the entire watershed area upstream of the Lee-Newmarket town line.

The rules state that these plans will be based on meetings with and input from the Affected Water Users or Dam Owners. There will be an implementation schedule and an economic assessment of the cost to implement the plans. Participation by Affected Water Users and Dam Owners is strongly encouraged. As with the PIFS, there will be a public hearing and comment process as well as the opportunity to petition for changes to the adopted WMP.

The PIFS is currently being completed by a team consisting of UNH, UMass, and Normandeau Associates. A final report on Instream Public Uses, Outstanding Characteristics and Resources (IPUOCR) has been completed as have several seasons of field work. The final field season is in 2007.

The scope of work for the team includes recommendations on protected instream flows and completion of a WMP to implement the recommendations. A schedule for completion was not available when this report was being finalized but we assume that the process will extend into 2008 and perhaps 2009.

1.5. NEED FOR PLAN

When the Oyster River was the only supply source, operation was straight forward – run the WTP to meet demand. After the drought of the 1960's and the addition of the Lamprey River pump station, operation was still relatively simple – run the WTP on the Oyster River until the water level drops below the flashboards, then turn on the LRPS as needed. The addition of the Lee Well did not change this method of operation, although it provided more flexibility by eliminating complete reliance on the WTP.

The need for a water resources management plan is driven by a combination of increased and competing demands for water, increasingly limited water supply sources, and the desire to protect rivers. This has in turn led to increased regulation on both the Federal side (Clean Water Act, Wild and Scenic Rivers Act), and the State side (Rivers Protection and Management Act). These regulations have placed limitations on the timing and volume of surface water withdrawals. This in turn has made it necessary to manage groundwater resources in a manner to balance and overcome surface water withdrawal restrictions.

Water resources management is also called for due to the increased complexity of the system. This includes connection of the Lamprey River directly to the WTP and additional operational steps which will be introduced with potential artificial recharge of a new Spruce Hole groundwater supply.

Perhaps one of the most compelling needs for a management plan is the situation faced by the Durham/UNH system each fall when thousands of students return to the UNH campus. As developed in the following chapter, this consistently results in the highest water demands of the year. Unfortunately, this high demand coincides with the typical low-flow period in the Oyster and Lamprey Rivers when withdrawal restrictions may be in effect. Proper management of water resources at this time of year is essential.

1.6. NEED FOR UPDATING PLAN

The July 2000 Water Resources Management Plan was the first attempt to develop an overall approach, or plan, to deal with the changes that were facing the UNH/Durham water supply. These included limitations on withdrawals from the Lamprey River and completion of the transmission main to the WTP. The goal of that plan, was, among other things, to lay out a framework for monitoring and understanding the available water supply resources so that they could be both utilized and conserved in the best possible manner to meet a variety of conflicting needs and regulations.

The current update of the plan has been driven by potential development that will increase system demands. This has necessitated a fresh look at the current status of available water supply compared to demand for water, especially during the critical fall period when demands increase and supplies may be limited.

A new factor to be considered is the addition of a Spruce Hole aquifer groundwater supply. Possible artificial recharge of the aquifer may change the way the Lamprey River pump station is operated.

The plan will need to be updated again when the Lamprey River Protected Instream Flow Study is complete and a Water Management Plan for the Lamprey River is adopted.

The Town and UNH must remain cognizant of the changes that cannot be seen or predicted at this point. Therefore, this plan must be considered a work in progress that will need to be modified as future events occur that change the need for, or focus of the plan.

SECTION 2 – WATER SUPPLY AND DEMAND

2.1. SUPPLY CAPACITY

As part of managing the water resources it is necessary to understand the available supply capacity and how that compares with the demand for water.

2.1.1. Maximum Supply Capacity

The maximum supply capacity is the combined capacity of the water supply sources during non-low flow periods. For Durham and UNH this is essentially from November through July.

The capacity of the surface water supplies is limited by the treatment capacity of the WTP. In 1999 a test was run on the WTP to see what the maximum capacity of the plant was without compromising finished water quality. This was found to be 1.55 million gallons per day (MGD). The test was done using the Oyster River source during the late spring. Under circumstances of cold water and poor water quality, this capacity would decrease somewhat. It is noted that a test has not been conducted using Lamprey River water.

The capacity of the Lee Well site was determined by an extended pumping test conducted on an 8-inch test well in 1985. As a result of this test, the safe sustainable yield of this site was estimated to be 375 gallons per minute (gpm) or about 540,000 gpd (based on 24 hour/day pumping).

True to its name, the Lee Well is located in the Town of Lee on land owned by the Town of Durham. Under a 1984 agreement between both towns, a reserve must be set aside for the Town of Lee. A copy of this agreement is included in ***Appendix E***. This agreement was drawn up before the yield of the well was established so it covered several possible outcomes as indicated below:

- If the "daily maximum safe yield" of the well is less than 0.7 mgd, a reserve of 10% must be set aside (70,000 gpd maximum)

- If the "daily maximum safe yield" of the well is greater than 0.7 mgd, a reserve of 15% must be set aside (150,000 gpd maximum)

- If Lee starts to consume 75% or more of the 10% reserve, it must be renegotiated to 15% of every 0.1 mgd produced daily up to a maximum yield of 1.0 mgd (150,000 gpd maximum)

Based on the preceding, the reserve for Lee should be 10% of 0.54 mgd or 54,000 gpd.

There are four residential services connected in Lee. We obtained meter readings for these services for 2006 and the first half of 2007. This information is shown in ***Table 2-1.***

TABLE 2-1
TOWN OF LEE USE OF LEE WELL
2006-2007

	Water Use in Gallons Per Day		
Address	**1st Half 2006**	**2nd Half 2006**	**1st Half 2007**
15 Old Concord Rd	201	0	0
16 Old Concord Rd	0	0	0
37 Old Concord Rd	213	103	107
49 Old Concord Rd	86	86	82
Total	500	189	189

As shown, two of the connections in Lee are not currently in use and the remaining two are using about 189 gpd. Data developed later in this report indicates that an average service connection in Durham uses about 250 gpd. Even if all four services were using this amount the total use would be 1,000 gpd or about 1.9% of the 54,000 gpd reserved for Lee. There are no plans for development in Lee that would require use of the Lee Well. It therefore seems extremely unlikely that renegotiation to 15% will occur in the foreseeable future. Therefore, at most the reserve for Lee should be maintained at 10% or 54,000 gpd.

It should be noted that paragraph 2.B. of the agreement indicates the following: *"The Town of Lee recognizes that Durham is only responsible to its pre-determined reserve as defined in this agreement on a daily basis, based on the well design and safe consumption parameters which would not have an adverse impact on the capacity of the well field at any time. The Town of Durham is not responsible for holding reserves if the Town of Lee does not consume its proportionate share on a daily basis, said share is forever lost to the Town of Lee."* This statement would seem to indicate that if Lee does not use its reserve, it may be forfeited. While no timeframe is given for such an eventuality, it has been about 21 years since the well went on line and in that time, Lee has used very little of the reserve as noted above.

In addition to the reserve amount for the Town of Lee, there is a 15% reserve set aside for the Technology Drive office/research park and potential economic development activities in the western portion of the Town. Therefore, an additional 81,000 gpd of the Lee Well capacity is also held in reserve.

There is one business currently located on Technology Drive, Goss International, a company involved in print media. There are four water meters for this facility. Data from these meters for 2006 and 2007 is shown in ***Table 2-2.***

TABLE 2-2
TECHNOLOGY DRIVE USE OF LEE WELL
2006-2007

	Water Use in Gallons Per Day			
Business/Meter	**1st Half 2006**	**2nd Half 2006**	**1st Half 2007**	**Average**
Goss Meter 1	2,019	3,840	2,026	2,628
Goss Meter 2	212	221	3,197	1,210
Goss Meter 3	2,049	1,144	14,660	5,951
Goss Meter 4	10,009	5,368	34,311	16,563
Total	14,289	10,573	54,194	26,352

On average, the Goss facility used about 26,000 gpd in 2006 and the first half of 2007, leaving about 55,000 gpd of the reserve for future Technology Drive businesses and/or economic development in the western portion of Durham.

Given the preceding figures, the maximum supply capacity for the Town and UNH is as shown in ***Table 2-3***.

TABLE 2-3
MAXIMUM SUPPLY CAPACITY
(Gallons Per Day)

Source	Total Capacity	Reserved Volume	Maximum Capacity
Arthur Rollins WTP	1,550,000	0	1,550,000
Lee Well	540,000	135,000[1]	405,000
TOTAL	**2,090,000**	**135,000[1]**	**1,955,000**

[1]54,000 gpd for Town of Lee plus 81,000 gpd for Technology Drive office/research park

As shown, the maximum system supply capacity with the Lee Well and Technology Drive reserves in place is 1,955,000 gpd.

2.1.2. Critical Supply Capacity

The critical supply capacity is the combined capacity of the water supply sources during low flow periods. For Durham and UNH this is usually during August and September but this period can potentially start in July and extend well into October.

During the low flow period the limiting supply factor for the surface supplies becomes stream flow and/or withdrawal restrictions embodied in the 401 Water Quality Certificate (401) instead of WTP capacity. A copy of the 401 is attached in ***Appendix C***.

The 401 comes into play when the Lamprey River flow drops below 45 cubic feet per second (cfs) as measured at the USGS gauge near Packers Falls in Durham. Fortunately, the 401 recognizes the role of the Wiswall Reservoir as water storage and this is reflected in the conditions of the certificate. These are summarized in the following as they relate to water supply withdrawals from the Lamprey River:

- Pool Elevation in Wiswall Reservoir
    - May be drawn down no more than 0.5 inches in a 24-hour period
    - 0.5 inches from reservoir equals 513,000 gallons
    - Maximum drawdown shall be 6 inches below the dam crest

- Flow between 45 and 21 cfs
    - Maintain outflow from Wiswall Dam equal to inflow minus 1.8 cfs
    - Allowed withdrawal
        - 1.8 cfs = 808 gpm or about 1,163,000 gpd
        - 0.5 inch drawdown or 513,000 gpd
        - Total = 1,676,000 gpd

- Flow between 21 and 13 cfs
    - Maintain outflow from Wiswall Dam equal to inflow minus 0.4 cfs
    - Allowed withdrawal
        - 0.4 cfs = 180 gpm or about 259,000 gpd
        - 0.5 inch drawdown or 513,000 gpd
        - Total = 772,000 gpd

- Flow less than 13 cfs
    - Maintain outflow from Wiswall Dam equal to inflow
    - Allowed withdrawal
        - 0.5 inch drawdown or 513,000 gpd

The volume of 513,000 gallons in 0.5 inches of storage in the Wiswall Reservoir was determined by actual measurements associated with refilling the reservoir after an April 14, 2006 drawdown to inspect the dam. The flow at the Packers Falls gauge was monitored as the flood gates were shut. The difference in the original inflow to the reservoir and the flow reaching the gauge during the refilling process was being retained behind the dam. The volume of this inflow was determined over 15-minute increments.

Simultaneously, the rise in the level of the Wiswall Reservoir was carefully monitored. It was determined that the top 6 inches of the reservoir holds 6,160,678 gallons. This works out to about 513,000 gallons for each 0.5 inches of reservoir level in the top 6 inches. As noted previously, the flows of 45 cfs, 21 cfs and 13 cfs are the summer hydrologic season Q_{60}, Q_{80} and Q_{90} flows respectively. However, it is likely that the PIFS currently underway will result in the setting of new protected instream flows.

Since it was recognized that the flows in the 401 might change, DES included a "re-opener" clause which allows DES to add additional terms and conditions or amend the existing ones to "ensure compliance with Water Quality Standards" if new protected instream flows are established. This would impact the critical supply capacity figures given in this report.

In a 2004 Water Supply and Demand report, an important assumption was that as flow in the Oyster and Lamprey Rivers decreases during low flow periods, it is not possible to meet demand with the Oyster River. In that case the Lamprey River becomes the primary surface supply and the determining factor in the critical supply capacity. However, recent experience indicates that this is not necessarily the case.

The preceding assumption was based on the sole use of the Lamprey in 2002, an extremely dry year, and the impression that withdrawals could no longer be made from the Oyster River. However, the primary motivation for use of only the Lamprey River in 2002 and 2003 was to develop a data base of Lamprey River water quality and treatability since it had never previously been used as the sole supply. Once this data had been gathered, the Oyster River once again became the primary supply. Plentiful rainfall in 2004 through 2006 made use of the Lamprey River a non-issue. In fact, flooding of the station made it unusable for a period. In addition there were some equipment problems. In 2007, however, August and September have been fairly dry and flow in the Lamprey dropped below 13 cfs for a period of 16 days while flow in the Oyster River dropped to as low as 0.81 cfs. Plots of the flow in both the Lamprey and Oyster River for this timeframe are contained in ***Appendix F.*** For this entire period, the WTP drew only from the Oyster River while maintaining some downstream flow. A table showing the average flow for the day and the amount produced from the WTP is also shown in ***Appendix F***. On some of the days, more water was produced than was measured at the gauge. However, as noted in ***Section 1.1.1***, there is an additional 4.4 square miles of watershed draining to the Oyster River reservoir below the gauge. Based on the preceding, withdrawal from the Oyster River should be added to the critical supply capacity developed in 2004.

It is difficult to set a specific flow that would be available from the Oyster River during the critical period as there is no established minimum release from the reservoir and the amount which can be produced would vary with the flow in the river. We, therefore, looked for a relatively simple way to relate the trigger flows on the Lamprey River to flows in the Oyster River. A common method to relate flows between nearby watersheds is using the area of the watersheds and assuming that the flow contributed by a square mile in one watershed could be similar to the flow contributed by the same area in the nearby watershed. As noted in ***Section 1.1.2***, the ratio of watershed areas above the Lamprey and Oyster River gauges is 15.1.

Using this ratio, we have estimated preliminary "trigger flows" for the Oyster River as shown in ***Table 2-4***.

TABLE 2-4
ESTIMATED OYSTER RIVER TRIGGER FLOWS

Lamprey River Trigger Flow (cfs)	Oyster River Trigger Flow at Gauge (cfs)	Oyster River Trigger Flow at Gauge (MGD)	Estimated Additional Flow at Dam[1] (cfs)
Q_{60}: 45/15.1 =	3	1.94	1.1
Q_{80}: 21/15.1 =	1.4	0.90	0.5
Q_{90}: 13/15.1 =	0.9	0.58	0.31

[1] Estimated by getting cfs/mi^2 above gauge and multiplying by 0.44 mi^2 below gauge and above dam

While this is a rough way of estimating trigger flows for the Oyster River, it allows one to predict the flow available at the WTP as well as the flow that would be going over the dam based on the additional 4.4 mi^2 above the dam but below the gauge. As developed in the demand portion of this section, the current average production rate from the WTP is 525,000 gpd. At all three Oyster River "trigger flows" shown in ***Table 2-4***, there is sufficient flow to produce this amount while still maintaining flow downstream of the dam.

To establish an available withdrawal for extremely low flows we reviewed minimum and mean flows in the Oyster River from 1998 to 2006 as shown in ***Table 2-5***.

TABLE 2-5
OYSTER RIVER LOW FLOW DATA

Year	Min Flow (cfs)	Min Flow Month	Mean for Month (cfs)
1998	0.87	Sep	1.55
1999	0.01	Sep	11.4
2000	0.83	Sep	2.22
2001	0.52	Aug	0.65
2002	0.15	Sep	0.40
2003	0.20	July	1.47
2004	0.66	July	3.64
2005	-	Sep	1.31
2006	-	Sep	3.33

Setting the withdrawal on the minimum flows in ***Table 2-5*** does not seem practical. For example, in 1999, the lowest flow of 0.01 cfs was recorded but the mean flow at 11.4 cfs was considerably higher. For the purposes of this report, we propose setting the low threshold of critical available flow from the Oyster River equal to the lowest monthly mean flow of 0.4 cfs in ***Table 2-5***. This equates to a production rate of about 260,000 gpd. It is noted that communication with the WTP operators indicates that the minimum flow that the WTP can be run at is about 200,000 gpd, so the proposed amount exceeds the minimum. As has been noted, the additional 4.4 mi^2 below the gauge will provide downstream flow estimated at 0.15 cfs using the methodology given in ***Table 2-4*** and assuming the WTP is processing the 0.4 cfs.

Given the preceding, the critical supply capacity for each flow condition is shown in ***Table 2-6***.

TABLE 2-6
CRITICAL SUPPLY CAPACITY
(Gallons Per Day)

	Lamprey River Flow		
Supply Source	**45 – 21 cfs**	**21 – 13 cfs**	**< 13 cfs**
Lamprey River	1,676,000	772,000	513,000
Oyster River	525,000	525,000	260,000
Lee Well	405,000	405,000	405,000
TOTAL	**1,955,000**[1]	**1,702,000**	**1,178,000**

[1]While the sum of the supply capacity from each source is greater, this amount is based on the capacity of the WTP and the Lee Well from Table 3

As shown in ***Table 2-6***, the critical supply capacity drops as the flow in the Lamprey and Oyster Rivers drop and withdrawal restrictions become more stringent.

2.1.3. Potential Supply Capacity

In the early 1990's, the Town and the University acquired land overlying the Spruce Hole Aquifer to protect it and save it as a future source of supply. Extensive testing and research work has been conducted on this aquifer under the direction of Professor Thomas Ballestero, Ph.D., P.E. of UNH. Based on an extended pumping test on an 8-inch test well, it has been indicated that the aquifer can supply between 300,000 gpd and 400,000 gpd. The Town and University have initiated a project to develop this supply, obtain the required permits under Env-Ws 379 (Site Selection of Large Production Wells for Community Systems) and Env-Ws 388 (Major Groundwater Withdrawals) and design and construct the necessary infrastructure to pump the water to the system. It is expected that this supply could be available in about two years.

Another important aspect of this project is an artificial recharge component using water pumped from the Lamprey River via the existing pump station and, for the most part, existing piping. The concept is to pump water from the river during high flows in the late fall, winter and spring and store it in the aquifer for withdrawal via the well during the low flow months of the year. This would allow more continuous pumping during periods of low natural recharge to this aquifer which is relatively isolated from rivers, and therefore receives recharge mainly from precipitation. The capacity of a new Spruce Hole groundwater supply could be added directly to the critical supply capacity since the aquifer is considerably further from the Lamprey River than any presently known distance which might cause it to be impacted by instream flow rules.

2.2. SYSTEM DEMAND

2.2.1. Existing Demand

Demand is often intuitively thought of as the water actually used by the customers so that the source of data should be water meters at the end user locations. However, this does not account for unmetered uses such as water distribution system flushing, leaks, or water used for fire fighting, construction and the replacement of water drawn from storage. In order to get a true picture of the overall system demand, one must look at the production data.

To determine the system demand, we have reviewed production data from the WTP and the Lee Well from 1990 through July of 2007. In 1998 it was discovered that the WTP master meter had been reading significantly higher than the actual flow due to a build up of manganese in the throat of the venturi. After repair of the meter, the flow readings dropped by around 20%. This can be seen in a plot of annual average demand from 1990 to 2007 (***Figure 2-1***). Therefore, our analysis only uses data recorded after the 1998 repair of the WTP master meter.

Table 2-7 contains production data from the WTP and the Lee Well from 1999 through July of 2007. This data is also shown graphically in ***Figure 2-1***.

As shown, the average daily demand has remained relatively stable since 1999. The average for this nine year period is 800,000 gpd with surprisingly little variation. This is a decrease of 15,000 gpd from the average calculated in the study conducted in 2004. The plot also shows that the output of the WTP is dependent on the output of the Lee Well. As previously described, the Lee Well pumps into a system governed by the overflow elevation of the Beech Hill Tank which is at a hydraulic gradeline about 58 feet higher than the main system to which the WTP pumps. The WTP input to the main system is controlled by the level in the Foss Farm and Edgewood Road tanks. The contribution of the Lee Well to the main system beyond the Technology Drive office/research park is controlled by the pressure reducing/sustaining valve in the vault near the head of Technology Drive. If this valve is adjusted to let more flow into the system, the Foss Farm and Edgewood Road tanks will fill more quickly and less water will be required from the WTP.

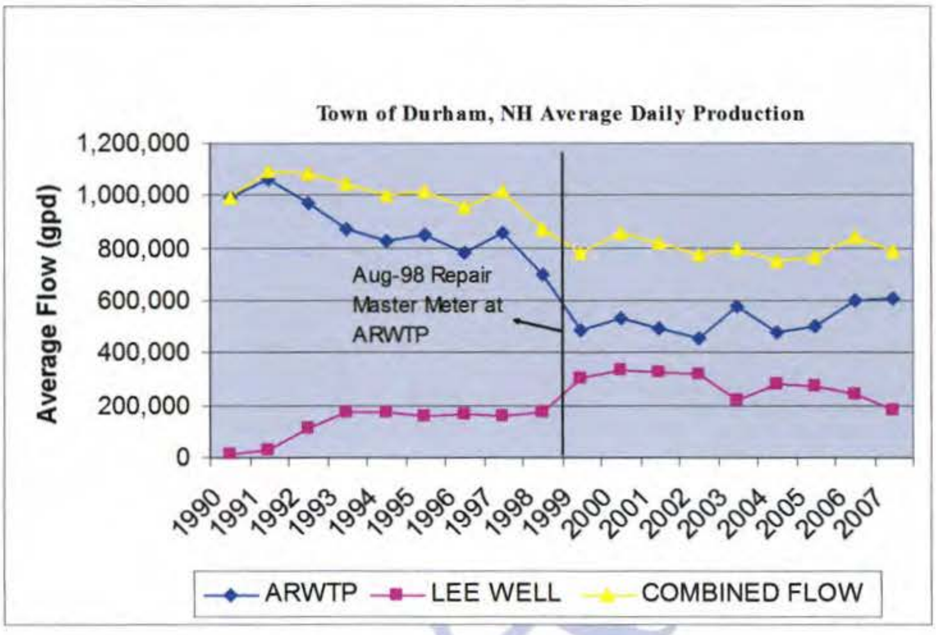
TABLE 2-7
WATER PRODUCTION
1999 - 2007[1]

Year	Avg Daily Flow ARWTP (gpd)	Avg Daily Flow Lee Well (gpd)	Avg Daily Flow Combined (gpd)
1999	485,000	301,000	786,000
2000	528,000	332,000	860,000
2001	492,000	326,000	817,000
2002	457,000	321,000	778,000
2003	577,000	219,000	796,000
2004	475,000	280,000	755,000
2005	500,000	270,000	770,000
2006	601,000	243,000	843,000
2007	609,000[1]	184,000[1]	793,000[1]
AVG	**525,000**	**275,000**	**800,000**

[1] 2007 data is only from January to July

FIGURE 2-1
WATER PRODUCTION
1990 – 2007

Durham/UNH Average Daily Production from 1990-2007



The relationship between the outputs of the Lee Well and the WTP can also be seen in annual plots of the average monthly flow from each source. Plots for 1999 through 2006 are contained in ***Appendix G.*** These plots also display a fairly consistent pattern of higher demand in April and especially September and October. The April peaks are most likely associated with system flushing but the September – October peak is directly correlated with the return of students each fall to the UNH campus. Since the September – October peak demand occurs simultaneously with the critical low flow period, we have broken these months out separately for the period from 2004 through 2007 as shown in ***Table 2-8***.

TABLE 2-8
SEPTEMBER – OCTOBER DEMAND
2004 – 2007

Year	September Demand (gpd)	October Demand (gpd)
2004	934,328	887,456
2005	1,095,509	949,893
2006	1,078,505	1,039,971
2007	1,045,396	1,016,934[1]
Average	**1,038,435**	**973,564**

[1] October 2007 data is through October 10th

The critical supply capacity must be capable of meeting the higher September demands as well as the maximum day demand as presented in the following section.

2.2.2. Maximum Day Demand

We looked at the annual maximum day demand for 2004 through September of 2007. This was done by adding the daily output of both the WTP and the Lee Well and noting the highest production values. The results are shown below.

- 2004 - 1,409,510 gpd on May 16
- 2005 - 1,717,170 gpd on September 25
- 2006 - 1,522,920 gpd on October 27
- 2007 - 1,447,460 gpd on September 26

To determine whether these days represented actual high demands or whether they were an artifact of the way the data was recorded, we plotted the daily production for each of the months noted above. These plots are shown respectively in ***Figures 2-2, 2-3, 2-4, and 2-5.*** Study of these plots reveals that the noted high demand day is often preceded or succeeded by a day when the WTP was not running. It is assumed that the plant and well had to be run longer on the following day to refill the storage tanks. Therefore, although production was higher on these days, it was not a reflection of actual system demand. The plots also show that demand rarely exceeds 1.4 MGD.

FIGURE 2-2
WATER PRODUCTION – MAY 2004

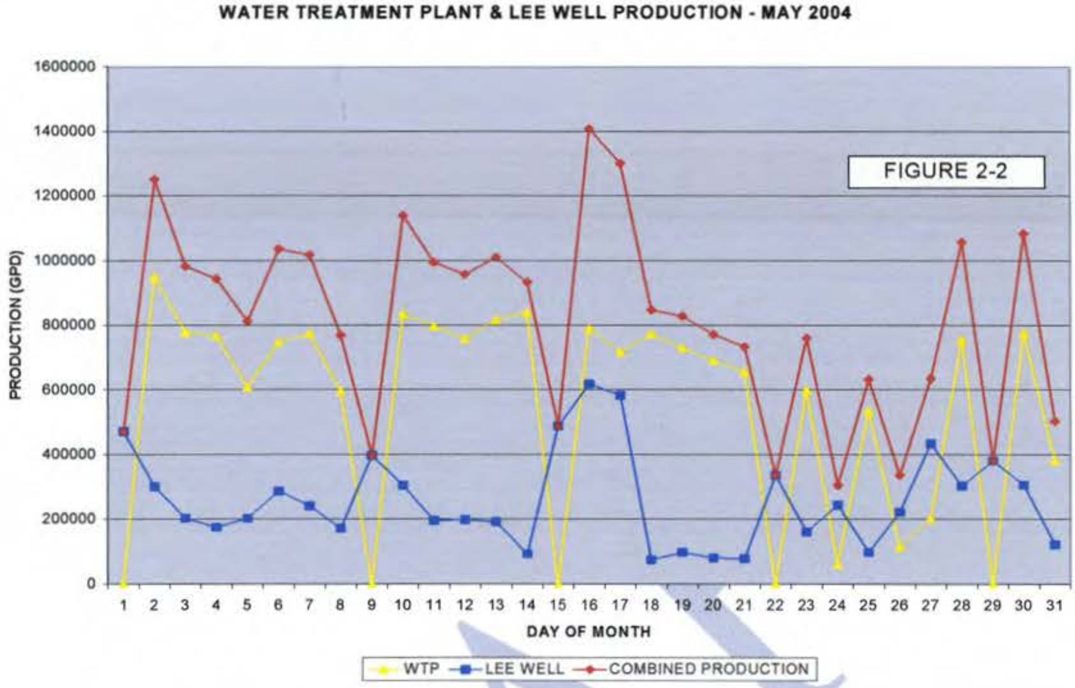


FIGURE 2-3
WATER PRODUCTION – SEPTEMBER 2005

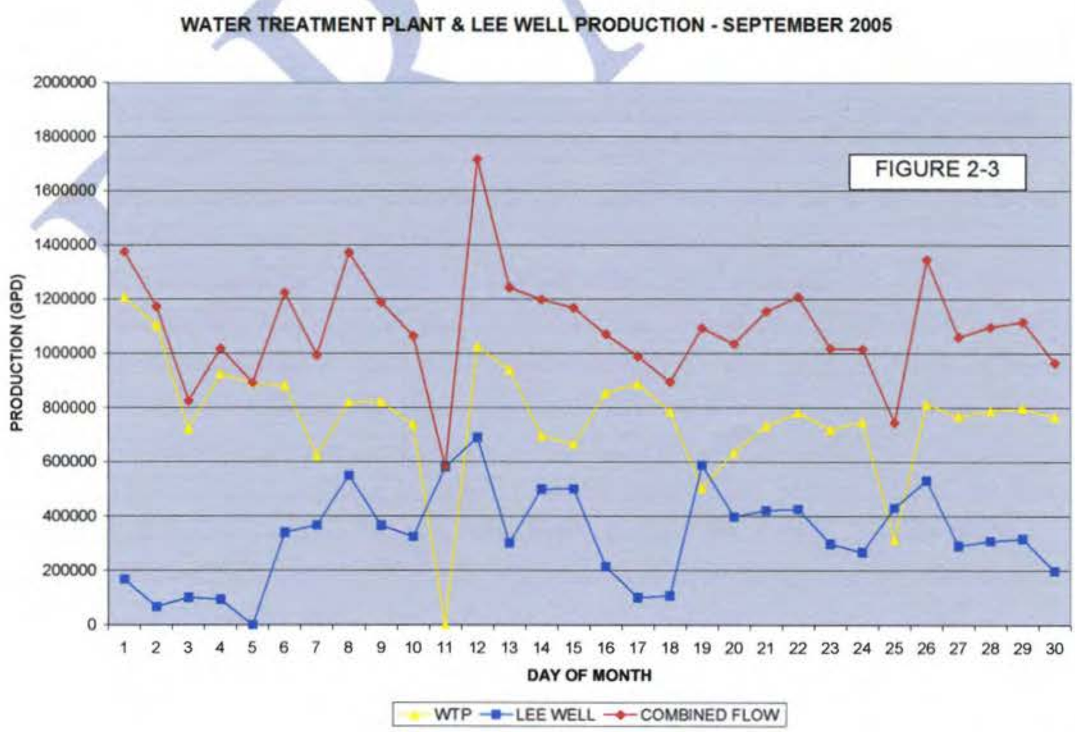


FIGURE 2-4
WATER PRODUCTION – OCTOBER 2006

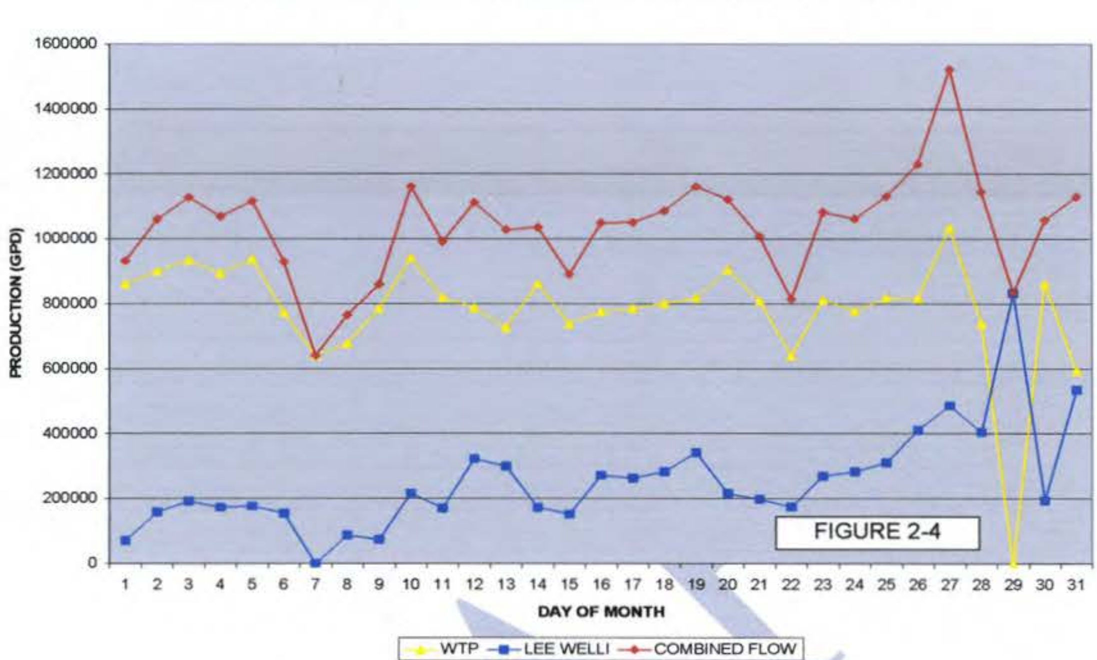
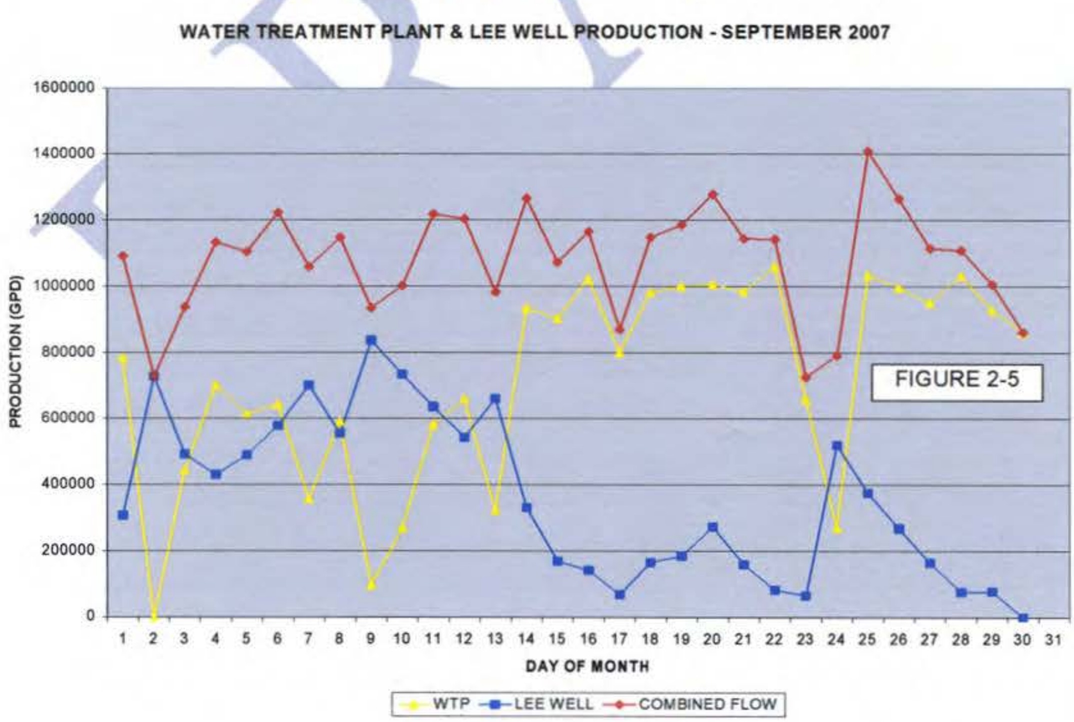


FIGURE 2-5
WATER PRODUCTION – SEPTEMBER 2007



We estimate the "true" maximum day demand to be about 1,450,000 pgd. Given the data plotted, Durham and UNH officials should expect this demand to occur in the months of September or October.

The current demands which must be met by the system are summarized below:

- **Present Annual Average Day Demand: 800,000 gpd**
- **Present Average September Demand 1,038,000 pgd**
- **Present Maximum Day Demand 1,450,000 gpd**

The peaking factor (P.F.) from average day demand to maximum day demand is determined by dividing the maximum day flow by the average day flow. This can then be used to estimate the future maximum day demand based on an estimate of future average day demand. **Using the figures above yields a P.F. of 1.81.**

2.2.3. Town of Durham and UNH Demand Components

For purposes of estimating future demand, it is useful to break up the water demand into Town and University components since each entity has its own planning department and growth in one is not necessarily reflected in growth of the other.

In a document entitled *Water Supply Capacity and Demand Estimates* completed in May of 1999, a per capita water use of 102.5 gallons per capita per day (gpcd) was estimated based on a user population of 8,301 and a water production figure of 851,000 gpd. In addition to normal domestic demand, this figure encompassed commercial, lost water and all other demand components. The breakdown of Town and UNH demand was based on the respective number of students and Town residents served by the system as shown below:

1999 UNH Demand	Population in UNH Housing	5760 ppl @ 102.5 gpcd=590,400 gpd
1999 Town Demand	Town Population on System	2541 ppl @ 102.5 gpcd=260,600 gpd
	TOTALS	**8301 ppl 851,000 gpd**

The UNH component (69%) was based on information from the UNH Housing Department and the Town component (31%) was based on 941 connections and the figure of 2.7 people/household from the 1990 census.

In the 2004 Water Supply and Demand Report it was indicated that the number of students in UNH Housing had not changed from 1999. Although a new 350-bed dorm had been constructed, the students housed there were shifted from other locations that were over-crowded. In 2003 there were a total of 992 connections on the Durham portion of the system. The 2000 census indicates a figure of 2.8 ppl/household, yielding a total Town population of 2,778 on the system. However, system demand had not increased since 1999 and had in fact decreased. This was attributed to location and repair of leaks, and on the UNH campus; rehabilitation of old buildings, installation of water saving devices, construction of central dining with water recirculation, reduced irrigation of playing fields from the system, and efforts to reduce water consumption. Based on the 2003 average day demand of 815,000 gpd and a total of 8,538 people on the system, the per capita use was estimated to be 95.46 gpcd. Using this figure, the 2003 breakdown of Town and UNH demand was as estimated below:

2003 UNH Demand	Population in UNH Housing	5760 ppl @ 95.46 gpcd=549,800 gpd
2003 Town Demand	Town Population on System	2778 ppl @ 95.46 gpcd=265,200 gpd
	TOTALS	**8538 ppl 815,000 gpd**

Based on these numbers, UNH accounted for about 67% of demand in 2003 while the Town accounted for about 33%.

Current information from the UNH housing department indicates that as of the fall semester of 2007 there are 6,878 students and staff in campus housing. Additionally there are 78 occupied family apartments with 171 for a total UNH on-campus population of 7,049.

There are currently 1,057 meters or connections on the Town portion of the system. A breakdown of meter sizes is given in ***Table 2-9.*** The 5/8 and 1 inch meters are all most likely single family residential units which comprise 96% of the connections. The 1-1/2 and 2 inch meters are mostly for commercial and multi-unit connections while the 3 and 4 inch meters are mostly for fire protection connections. Using the same methodology employed in 2004 of assigning the 2000 census figure of 2.8 ppl/household to each connection yields a current Town service population of 3,091.

TABLE 2-9
METERS ON DURHAM SYSTEM
2007

Size (inches)	Number
5/8	947
1	54
1-1/2	10
2	23
3	1
4	3
Unknown	19
Total	1057

The past estimated per capita demand figures were based on the annual average day demand. While this is useful for projecting the future annual average demand based on population, it is not reflective of the influx of students and UNH faculty and staff in September of each year. We have, therefore, calculated two per capita demand figures for use in projecting the future demand.

- **Annual Per Capita Demand** = $\dfrac{\textbf{800,000 gpd}}{\textbf{10,140 ppl}}$ = **78.9 gpcd**
- **September Per Capita Demand** = $\dfrac{\textbf{1,038,000 gpd}}{\textbf{10,140 ppl}}$ = **102.4 gpcd**

It must be stressed that these figures do not reflect the actual use by each individual connected to the system. The lower number does not account for the higher population when UNH is in session. The higher number does not account for summer conditions, when many students and staff are gone.

What are Alternatives to this approach?

Additionally, these figures incorporate commercial use and assume that all people use water similarly which is not the case. However, they are useful predictors for each demand condition based on an estimate of the future number of people connected to the system.

Using these figures, the current breakdown of Town and University demand is as given below:

- **Annual Average Day**

UNH:	7,049	ppl	x	78.9	gpcd	=	556,000	gpd
Town:	3,091	ppl	x	78.9	gpcd	=	244,000	gpd
							800,000	**gpd**

- **September Average Day**

UNH:	7,049	ppl	x	102.4	gpcd	=	722,000	gpd
Town:	3,091	ppl	x	102.4	gpcd	=	316,000	gpd
							1,038,000	**gpd**

Based on these figures, UNH comprises 70% of the current demand while the Town accounts for 30% of the demand.

2.2.4. Future Estimated Demand

UNH Demand Component

In the 2004 Water Supply and Demand report, it was noted that estimates of the University's future water demand through 2010 were based on figures in the 1998 UNH Utility Master Plan. These estimates were based on the type and number of new buildings planned in the previously completed UNH Master Plan. The Master Plan divides the University up into four quadrants created by the Boston and Maine Railroad which runs in a north-south direction and Main Street/Old Concord Road which runs in an east-west direction. The plan was laid out in phases ending in 2000, 2005 and 2010 with specific development planned in each quadrant. The projected demand for the new development in each quadrant and phase was based on published values for the type of facility. New facilities included student housing, classroom buildings with lab and office space, dining halls, shops, barns, greenhouses, and other institutional buildings. It was noted in the 2004 report that the published values were conservative to ensure that planners and designers do not undersize future facilities. It was further noted that a continuing comparison should be made between the estimates and actual use as new construction is completed so that decisions on water supply are not based on inflated data. Our current review of demand indicates that the Master Plan estimates do appear to be much higher than actual use. ***Table 2-10*** contains a comparison of the estimated UNH demand based on the number of students housed on campus versus the Master Plan projections.

It can be seen in ***Table 2-10*** that while the Master Plan estimates showed relatively large increases in demand for water based on proposed construction, demand at UNH has actually decreased from 1999 through 2006. Some of the differences in the figures can be attributed to proposed construction that has not taken place in this timeframe. Also, decreases in water use can be attributed to tightening of the system, newer water saving technologies put in place, and more emphasis on water conservation as mentioned earlier in this section.

TABLE 2-10
COMPARISON OF ESTIMATED UNH DEMAND FROM MASTER PLAN VERSUS ESTIMATED DEMAND FROM HOUSING POPULATION

Year	Master Plan Phase	Estimated Increase in Demand in Master Plan	Projected UNH Demand Using Master Plan	Actual Estimated Demand Based on Housing Pop.
1999				590,400
2000	2	155,800	746,200	
2003				549,800
2005	3	248,000	797,800	
2006				556,000
2010	4	229,000	1,026,000	

Based on the preceding analysis we have decided to use the estimated future number of beds and apartments to project future UNH demand. The 2004 update to the UNH Master Plan indicates a maximum of 1,300 additional beds and 180 family apartments through the year 2024. Assuming the present average of 2.2 ppl/apartment, the increase in the number of people on the UNH portion of the water system would be 1,696. Using the previously calculated per capita demands gives the following projected increases in UNH demand.

- **Annual Average Day (Increase)**
  1.696 ppl x 78.9 gpcd = 134,000 gpd
- **September Average Day (Increase)**
  1.696 ppl x 102.4 gpcd = 174,000 gpd

Town of Durham Demand Component

In the 2004 study the method used to project the Town demand component involved estimating the demand of potential development that could be connected to the system without major extensions. Based on a meeting with the Town Planner, we have updated the list of potential developments. The following is a list of approved or potential developments that might be connected to the water system.

Residential/Student Housing	Units/Apts	Beds/Residents/Students
Fitts Farm (remaining out of 67 units)	12	34
Spruce Woods (elderly housing)	92	184
Bagdad & Canney Road (Sophie Lane)	9	25
Gangwar Land (low potential)	30	84
99 Madbury Road (elderly housing)	66	132
Strafford Ave (16 apartments)	16	45
Old Concord Road (Rivers Edge)	48 (2 Bed Rm)	96
Old Concord Road (married students)	25	50
Bryant Development	36 (4 Bed Rm)	144
MacNeil Development (student housing)	unknown	1400
Garvey/Farrell Development	unknown	650
911 Madbury Road	9 (4 Bed Rm)	36
Jenkins Court	3 (4 Bed Rm)	12
Anderson downtown infill	13 (4 Bed Rm)	52
Edgewood Rd Ext (elderly housing)	12 units	24
Mill Plaza	150 units	420
TOTAL		**3,388 Beds/ppl**
Commercial/Retail/Offices		**Square Feet**
Durham Business Park	-	50,000 ft^2
Stone Quarry Drive Professional Park	-	15,000 ft^2*
Strafford Ave (retail/offices)	-	4,000 ft^2
Anderson downtown infill	-	10,000 ft^2
Mill Plaza	-	200,000 ft^2
TOTAL		**279,000 ft^2**

* Information was 15 units. It is assumed each unit is 1,000 ft^2

An increase of 3,388 people on the Town portion of the system is over six times the increase of about 507 people estimated in the 2004 report. The difference is due to proposed student housing not associated with UNH and fairly significant elderly housing increases. While an increase of this size seems unlikely, this number is reflective of everything that has been proposed so it has been used to estimate the potential increase in the Town's water demand.

The list of commercial, retail and office space which could be developed totals to 279,000 ft^2. The NH Code of Administrative Rules indicates about 15 gpd /100 ft^2 for unspecified office space for wastewater flow estimation. Using this value on the water use side would result in about 42,000 gpd additional use.

Using the previously calculated per capita demands and adding the increased commercial demand results in the following increase in Town use.

- **Annual Average Day (Increase)**

3,388	ppl	x	78.9	gpcd	=	267,000	gpd
Commercial Demand					=	42,000	gpd
						309,000	gpd

- **September Average Day (Increase)**

3,388	ppl	x	102.4	gpcd	=	347,000	gpd
Commercial Demand					=	42,000	gpd
						389,000	gpd

Combined Town of Durham and UNH Future Demand

The combined estimated future (2024) demand of the Town and UNH is given in ***Table 2-11***. For the purposes of this report, we have assumed that the listed development will be complete by 2024 and that both the Town and University portion of demand will increase linearly. The peaking factor of 1.81 developed earlier was used to estimate the future maximum day demands.

TABLE 2-11
COMBINED TOWN OF DURHAM & UNH FUTURE WATER DEMAND
(gpd)

Demand Component	Actual Data 2006[1]	2012	2018	2024
Annual Average Day:				
UNH	556,000	601,000	645,000	690,000
Town	244,000	347,000	450,000	553,000
Total	**800,000**	**948,000**	**1,095,000**	**1,243,000**
September Average Day:				
UNH	722,000	780,000	838,000	896,000
Town	316,000	446,000	575,000	705,000
Total	**1,038,000**	**1,226,000**	**1,413,000**	**1,601,000**
Max Day:	**1,450,000**	**1,715,000**	**1,983,000**	**2,249,000**

[1]2006 data based on average from 1999 to 2006

2.3. SUPPLY CAPACITY AND DEMAND COMPARISON

Tables 2-12, 2-13, and 2-14 respectively compare supply capacity with present annual average September average and maximum day demands. For each demand condition, the supply capacity is shown as a function of the flow status of the Lamprey River. The demand is compared to the changing supply capacity and the resultant surplus or deficit in capacity is shown.

TABLE 2-12
SUPPLY CAPACITY vs. EXISTING AVERAGE DAY DEMAND
(gpd)

Lamprey Flow Status	Supply Capacity	Average Day Demand	Surplus/ (Deficit)
>45 cfs	1,955,000	800,000	1,155,000
45 – 21 cfs	1,955,000	800,000	1,155,000
21 – 13 cfs	1,702,000	800,000	902,000
<13 cfs	1,178,000	800,000	378,000

TABLE 2-13
SUPPLY CAPACITY vs. EXISTING AVERAGE SEPTEMBER DEMAND
(gpd)

Lamprey Flow Status	Supply Capacity	Average September Demand	Surplus/ (Deficit)
>45 cfs	1,955,000	1,038,000	917,000
45 – 21 cfs	1,955,000	1,038,000	917,000
21 – 13 cfs	1,702,000	1,038,000	664,000
<13 cfs	1,178,000	1,038,000	140,000

TABLE 2-14
SUPPLY CAPACITY vs. EXISTING MAXIMUM DAY DEMAND
(gpd)

Lamprey Flow Status	Supply Capacity	Maximum Day Demand	Surplus/ (Deficit)
>45 cfs	1,955,000	1,450,000	405,000
45 – 21 cfs	1,955,000	1,450,000	405,000
21 – 13 cfs	1,702,000	1,450,000	252,000
<13 cfs	1,178,000	1,450,000	(272,000)

As shown, the supply capacity is sufficient to meet both the existing annual average day demand and the September average day demand under all conditions. However, as the flow drops below 13 cfs, the supply capacity is not sufficient to meet maximum day demand.

Review of available flow statistics for the Lamprey River since 1998 indicates the number of days when daily mean streamflow, as measured at the Packers Falls gauge in Durham, was less than 21 cfs and 13 cfs respectively. This is shown in ***Table 2-15***.

TABLE 2-15
LAMPREY RIVER LOW FLOW DATA
PACKERS FALLS GAGING STATION

Water Year[1]	Days <21 cfs	Days < 13 cfs
1998	34	12
1999	90	68
2000	7	1
2001	62	28
2002	85	72
2003	34	17
2004	2	0
2005	27	11
2006	3	0

[1] Water Year runs from October to September of following year
(i.e. Water year 2002 ran from October 2001 to September 2002)

The data in ***Tables 2-12, 2-13, and 2-14*** indicates that the existing supplies are capable of meeting current annual average day demand and average September demand even during low flow periods. As the flow in the Lamprey River drops to below 13 cfs, given the portion of the Lee Well capacity which is reserved, and the 401 Water Quality Certificate on the Lamprey River, the maximum day demand of the system exceeds supply capacity. ***Table 2-15*** indicates that, depending on the dryness of the year, the system can not meet the maximum day demand for periods ranging up to nearly 10 weeks.

It is noted that the system has been able to meet all system demands to date, even in 2002 when at times, the measured flow of the Lamprey River upstream of the reservoir was between 2 and 3 cfs. This was due primarily to running the Lee Well at a greater daily capacity than that required to maintain the noted reserves and at times, greater than the safe sustainable yield. However, this is made up for by running the well at less than that needed to maintain the reserves at other times of the year.

Tables 2-16, 2-17, and 2-18 show a comparison of existing supply capacity and the projected 2024 annual average, September average, and maximum day demands respectively.

TABLE 2-16
SUPPLY CAPACITY vs. FUTURE (2024) AVERAGE DAY DEMAND
(gpd)

Lamprey Flow Status	Supply Capacity	Average Day Demand	Surplus/ (Deficit)
>45 cfs	1,955,000	1,243,000	712,000
45 – 21 cfs	1,955,000	1,243,000	712,000
21 – 13 cfs	1,702,000	1,243,000	459,000
<13 cfs	1,178,000	1,243,000	(65,000)

TABLE 2-17
FUTURE SUPPLY CAPACITY vs. FUTURE (2024) AVERAGE SEPTEMBER DEMAND
(gpd)

Lamprey Flow Status	Supply Capacity	Average Day Demand	Surplus/ (Deficit)
>45 cfs	1,955,000	1,601,000	354,000
45 – 21 cfs	1,955,000	1,601,000	354,000
21 – 13 cfs	1,702,000	1,601,000	101,000
<13 cfs	1,178,000	1,601,000	(423,000)

TABLE 2-18
SUPPLY CAPACITY vs. FUTURE (2024) MAXIMUM DAY DEMAND
(gpd)

Lamprey Flow Status	Supply Capacity	Maximum Day Demand	Surplus/ (Deficit)
>45 cfs	1,955,000	2,249,000	(294,000)
45 – 21 cfs	1,955,000	2,249,000	(294,000)
21 – 13 cfs	1,702,000	2,249,000	(547,000)
<13 cfs	1,178,000	2,249,000	(1,071,000)

As shown, the existing supply capacity will continue to meet annual average day and September average day demands through the year 2024 except when the Lamprey River flow drops below 13 cfs. However, it will become increasingly difficult to meet maximum day demands if the supply capacity remains unchanged.

The data presented in the preceding supply versus demand tables is shown graphically in ***Figure 2-6.*** This figure illustrates the following points:

- When the Lamprey River flow is greater than 21 cfs, all demand conditions can be met by existing supply sources through the year 2016.
- When the Lamprey River flow is greater than 13 cfs but less than 21 cfs, the annual average and average September demand can be met by existing supply sources through the year 2024, but maximum day demand will exceed capacity around 2012.
- When the Lamprey River flow is less than 13 cfs, the annual average day demand can be met by existing supply sources through about the year 2021. September average day demand will exceed supply capacity around the year 2010. Current maximum day demand exceeds the existing supply capacity.

2.4. IMPACT OF SPRUCE HOLE GROUNDWATER SUPPLY

Development of a new Spruce Hole groundwater supply will add an estimated 300,000 to 400,000 gpd to both the maximum and critical supply capacity. The impact of adding this supply, assuming a pumping rate of 0.35 MGD, is shown in ***Figure 2-7.*** As shown, this would eliminate all current supply deficits including a maximum day demand that occurs when the Lamprey River is below 13 cfs. This would also:

- Eliminate future average day demand deficits through the year 2024
- Allow projected September average day demand to be met through the year 2021
- Allow projected maximum day demand to be met at Lamprey River flows above 13 cfs through the year 2019

FIGURE 2-6
WATER SUPPLY CAPACITY vs DEMAND – EXISTING SUPPLIES

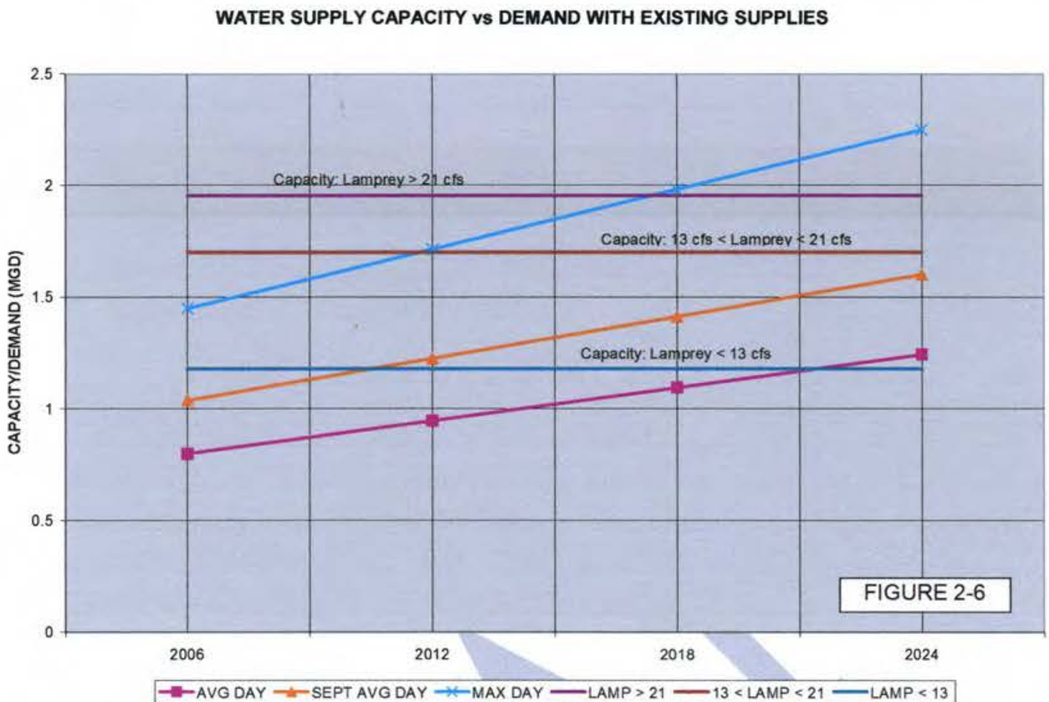
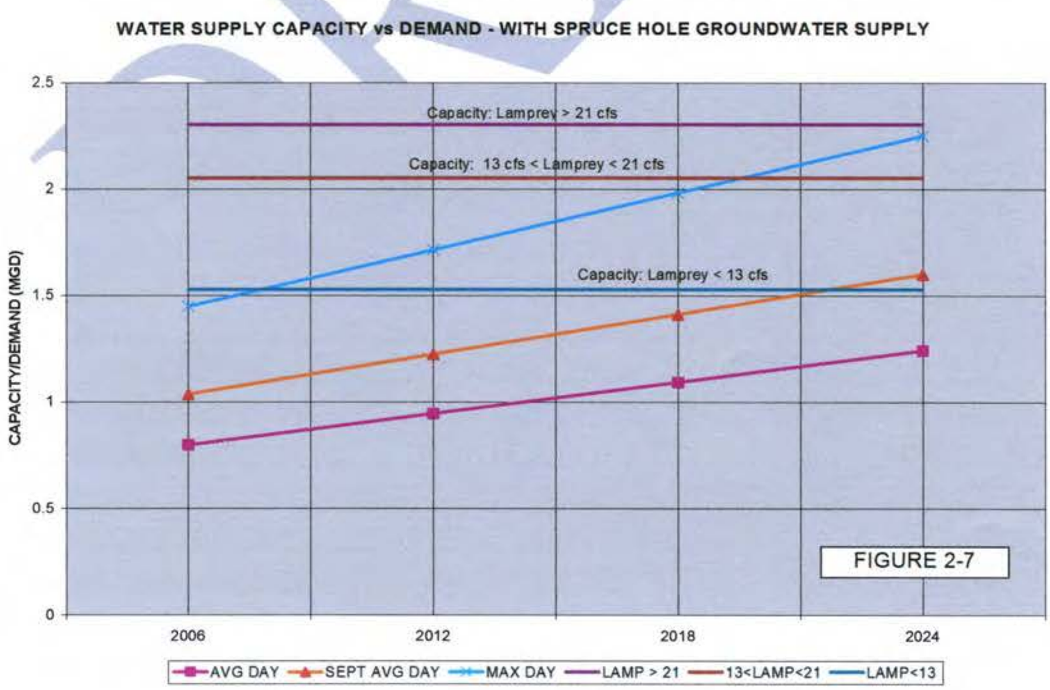


FIGURE 2-7
WATER SUPPLY CAPACITY vs DEMAND – WITH SPRUCE HOLE GROUNDWATER SUPPLY



2.5. MEETING DEMAND

The analysis in ***Section 2.3*** indicates that at most times of the year other than the critical late summer and fall period, there are no issues with meeting both existing and projected increased demands of the Town and UNH. Even during this period, the major concern is with maximum demand days.

While a strict interpretation of the numbers related to supply and demand indicates that current maximum day demand cannot be met when the Lamprey River flow is less than 13 cfs, demand has always been met by the system, even under these conditions. Prior to the establishment of the 401, this could be done by activating the Lamprey River pump station, regardless of the flow in the Lamprey River. With this said, there has never been an instance that we are aware of where running the pump station in that manner caused a large drawdown in the Wiswall Reservoir. Since enactment of the 401 conditions however, the primary means of meeting demand greater than the numerical supply capacity has been by increasing the output of the Lee Well. This is possible since the Lee Well has a 700 gpm pump physically capable of producing up to 1.0 MGD and, as described further in ***Section 3.2.4***, the aquifer can supply water greater than the established safe sustainable yield for short periods of time.

Addition of a Spruce Hole groundwater supply will improve the supply situation. Since that will take several years, however, it will be necessary to continue to vary the flow of the Lee Well to meet new or increased demand. In the case of new demands coming on the system, there should be no issue with using the Town of Lee reserve of 54,000 gpd and the unused portion of the Technology Drive reserve (estimated at 55,000 gpd) until this capacity can be replaced by a Spruce Hole Well. As has been noted, it appears unlikely that the Town of Lee reserve will ever be used and it would therefore be overly conservative to not utilize it if needed in the short term by the Town or UNH. With regard to use of the Technology Drive reserve, the Town has the option of continuing that reserve or using it to meet other needs at its discretion.

SECTION 3 – PROPOSED MANAGEMENT PLAN

3.1. PLAN FUNDAMENTALS

The purpose of the plan is to properly manage the water resources available to the Town and University so that a reliable supply is provided to system users while not over-stressing any one resource and complying with all applicable regulations. The focal point of the plan is how to manage the water resources during the critical period, namely late summer and early fall, when surface supplies may be limited and demand is high due to the returning student population. Our approach to managing the water resources can be summarized by the following list of plan fundamentals.

- Monitoring
- Seasonal use of supplies and using a source selection process in critical period
- Maximizing water storage
- Utilization of Spruce Hole aquifer
- Public Education
- Conservation program

The major facets of the plan are discussed in the following sub-sections.

3.2. MONITORING

3.2.1. GENERAL

To best manage the water resources, the Town and UNH must have as much information as possible in order to make informed decisions. This involves knowing the flow of the Lamprey and Oyster Rivers, the volume in the Wiswall and Oyster River Reservoirs at any given water level, and the levels of the Lee Well and Spruce Hole Aquifers.

3.2.2. OYSTER RIVER

The flow into the Oyster River Reservoir can be determined by getting the flow data from the upstream USGS gauging station near Route 155A (Station 01073000 – Oyster River Near Durham, NH) and correcting it for the increase in watershed area between the gauging location and the reservoir. The drainage area at the gauge location is 12.1 mi^2 while downstream at the Oyster River Dam, it is about 16.5 mi^2. Therefore, there are an additional 4.4 mi^2 upstream of the dam and downstream of the gauge.

The Real-Time flow (i.e. the current instantaneous flow rate) can be seen by going to http://waterdata.usgs.gov/nwis/uv?01073000 on the internet. The instantaneous flow is recorded every 15 minutes and can be seen in graph or table form for up to the previous 30 days. Dividing the current flow by 12.1 mi^2 yields a value for cfs/mi^2 of watershed which can then be multiplied by the 16.5 mi^2 to determine the flow into the Oyster River Reservoir. It would be a simple matter to set this up in a spreadsheet to both calculate and record the flow.

The flow leaving the Oyster River Reservoir can be determined by installing a staff gauge at a suitable cross-section downstream of the dam and developing a rating curved for the gauge. This is done by measuring the flow at a given cross-section and recording the staff gauge reading for that flow. This is done over a wide range of flows so that a curve can be plotted of flow versus staff gauge reading. Once the curve is established, it is no longer necessary to measure the flow. One can simply take the level from the staff gauge and use the curve to determine the flow. An alternative to installing a staff gauge and developing a rating curve is to assume that the calculated inflow equals the outflow minus whatever is drawn through the raw water meter at the WTP. This would be an approximation since it doesn't account for evaporation or loss to groundwater. However, it would be much simpler to collect data this way.

In 1984, a bathymetric survey of the Oyster River Reservoir was conducted ***(Appendix A)*** and reportedly it was done again in 1996. The resulting maps can be used to develop a stage-storage curve which yields the reservoir volume for a given water surface level.

With the data from the gauges and the stage-storage curve, system operators will know at any point in time the volume in the reservoir, the flow in, and the flow out.

3.2.3. LAMPREY RIVER

In the July 2000 Water Resources Management Plan, it was stated that to properly manage pumping from the Lamprey River, the following information should be known:

Wiswall reservoir

- Inflow into ~~impoundment~~
- Storage in ~~impoundment~~ above the elevation of the LRPS intake for a given water surface elevation
- Outflow from ~~impoundment~~
  - With sluice gates in Wiswall Dam shut
  - At any given position of the dam sluice gates

It was further stated that to provide this information, the following should be done:

Consider deleting or revising to reality

- Install a staff gauge and develop a rating curve at a suitable cross-section near the inlet to the impoundment reservoir
- Install a staff gauge and develop a rating curve at a suitable cross-section immediately downstream of Wiswall Dam
- Develop an operating curve for Wiswall Dam using the staff gauge and rating curve just downstream of the dam together with the sluice gates.
- Conduct a bathymetric survey of the Wiswall ~~Dam~~ Reservoir such that a stage-storage curve can be developed. This survey should include the elevation of the LRPS intake pipe (invert and top of pipe), the dam crest and the sluice gate openings.

The April 2001 401 Water Quality Certificate conditions also call for monitoring inflow to the reservoir, outflow from the dam, the level of the reservoir and providing a means to maintain inflow equal to outflow at flows below 13 cfs.

When the 2000 Management Plan was completed, the only information on the Wiswall Reservoir volume was an estimate of 90 MG by CDM. There was no information on inflow to the reservoir. Since that time, much work has been done relative to volume, inflow, and the dam.

Much of the work was related to fish passage around the dam. Historically, the Lamprey River supported a significant anadromous fishery. These are fish that live in the ocean and migrate to freshwater spawning areas. Creation of fish passage around Wiswall Dam is part of the management plan created in concert with both the State Rivers Management and Protection Program and the Federal Wild and Scenic designation. Under the Section 206 Aquatic Ecosystem Restoration Program, the Army Corps of Engineers (ACOE) conducted a bathymetric survey of the Wiswall Reservoir and development of a computer model (HEC-RAS) of the river to allow estimation of water surface elevations. Based on this work, the volume of the reservoir is now known as given in ***Table 3-1***.

TABLE 3-1
WISWALL IMPOUNDMENT STORAGE

FLOW (cfs)	FLOW DESCRIPTION	W.W. EL. (ft)	STORAGE/VOLUME (Acre-Ft)	STORAGE/VOLUME (MG)
283	Mean Ann. Q	56.90	133	43.33
21	Q_{80}	56.25*	111	36.17
13	Q_{90}	56.25*	111	36.17

* Wiswall Dam Crest El.

The work done by ACOE provides much more information to the Town and UNH than was available in 2000. From the original construction plans it is known that the centerline of the Lamprey River Pump Station intake is at 45.7 feet and the top is estimated at 46.7 feet (see ***Appendix H)***. From ***Table 3-1***, there are 9.55 feet (56.25 – 46.7) of water above the intake at a flow of 13 cfs.

It is also known that the intake is located in a natural pool created by high river bottom 1,500 feet upstream from the dam. This pool stretches from about 2,300 feet to 3,800 feet above the dam, with the intake located about 2,500 feet from the dam. This is shown in a profile from the HEC-RAS model included in ***Appendix H.*** Using the bathymetric map which should be available from ACOE, the volume above the intake can be calculated. This could be useful if a water supply emergency is declared and the Wiswall Reservoir must be utilized below the 6-inch drawdown proscribed by the 401.

Efforts have been made since 2001 to monitor the inflow to and outflow from Wiswall Reservoir. The reservoir ends at Hook Island Falls. In 2002, when flows were very low, the river was inspected from Hook Island Falls to the Lee Hook Road bridge. One section just upstream of Hook Island Falls was noted as a potential, but not very good location. The river was deemed either too rocky and shallow or ponded and sluggish for accurate flow measurement. One section was noted about 700 feet downstream of Lee Hook Road as a potential site at low flows and a number of measurements were made there (see ***Appendix H).*** However, at flows over about 20 cfs, the section was not suitable since the water rose into a rocky section where it could not be measured. Additionally, this site could only be accessed by crossing private property in the Town of Lee.

Later work associated with the PIFS discussed in ***Section 1.4*** established gauging sections above Hook Island Falls and below Wiswall Dam. Information from these locations was not available when this report was being prepared.

The Town has made efforts to establish flow relationships using the Wiswall Dam crest as a weir and applying a weir equation. DES officials had concerns over the accuracy of this method but were willing to consider it. The Town is continuing to develop this approach with a consultant who is working on issues related to Wiswall Dam.

Rehabilitation work is scheduled for Wiswall Dam that will replace the current sluice gates. The opportunity exists to incorporate a means of flow measurement in these improvements. An additional opportunity for flow monitoring at the dam exists with improvements related to construction of a nature-like bypass or fish ladder for passage of fish around the dam.

Inspection of the dam in the last year indicates that there is a fair amount of seepage. Not true Therefore, methods of flow monitoring that measure flow over the dam or through a control structure would miss this. Downstream of the dam there is a suitable cross section for velocity-area measurements. The flow narrows and has good velocity – ideal for flow measurement. This location is also accessible from Town property.

It is noted that the USGS gauging station at Packers Falls referenced in ***Section 1.1.2*** could be used in lieu of a new cross section. The difference in watershed area is about 0.58 mi^2 in a watershed of 183 mi^2 which is a difference of about 0.32 percent. However, this gauge is not accurate at flows less than about 5 cfs which could make it problematic to use when trying to maintain outflow equal to inflow at low flows. Still, this gauge provides valuable flow information and should be monitored by the Town and UNH. Similar to the Oyster River gauge this site has a real time flow internet site at http://waterdata.usgs.gov/nwis/uv?01073500.

While there is no monitoring system currently in place, there are a number of possible options as presented herein and the Town is continuing to pursue them to find the most feasible and economical method. With an accurate system in place, the Town and University will have all quantitative information necessary to manage pumping from the Lamprey River.

3.2.4. LEE WELL

In monitoring the Lee Well, there are two major items of interest. The first is how much water is being pumped from the aquifer, and the second is the response of the aquifer to this pumping.

The output from the Lee Well is measured by a meter at the pump station. This records all water produced including the amount used in the Technology Drive Industrial park. In ***Section 2***, it was developed that an almost negligible amount is being used by the Town of Lee while about 26,000 gpd of the average production rate of 275,000 gpd is being used by the single tenant of the Technology Drive office/research park. This means that between 9% and 10% of the Lee Well flow is not flowing to the main system. Presently, the daily meter readings taken at the pump station are used to represent the water flowing into the UNH/Durham system. Based on the preceding, the flow going to the main system is less, but not enough to impact management decisions. If more development occurs in the industrial park, it may become necessary to also use the PRV vault meter information, which is recorded daily to determine what is flowing into the rest of the system. However, for managing the Lee Well as a supply source, the pump station meter should continue to be used.

The response of the aquifer should be monitored by recording the water level at various points in the aquifer. The Town has been monitoring the aquifer by recording the level in the pumping well and twelve monitoring wells since January 1990. Contained in ***Appendix I*** are copies of the site plan showing the well locations and plots of water levels in five of the monitoring wells from January 1990 to January 1998. These plots were contained in the July 2000 report. Also contained in ***Appendix I*** are plots of water levels from the same wells from 2003 to 2005.

It was noted in the July 2000 report that a marked increased in use of the Lee Well in 1992 and 1993 was accompanied by a corresponding drop in water level which can be seen in all of the monitoring wells. Some of these plots seemed to indicate a steady, but very slight, downward trend in aquifer levels but this was not the case for all of the plots.

Study of the more recent plots and the average production from the Lee Well (***Table 2-7***) shows a slight decline in use accompanied by a slight increase in water levels in some wells. Comparison of the water levels in certain wells shows that there has been a drop in the level of the aquifer from 1998 to 2005. This would be expected given the greater use of the Lee Well.

This brief analysis of pumping records and well levels illustrates that the Lee Well aquifer is responding to changes in pumping over time as one would expect.

As part of the overall management of the water supplies, the daily Lee Well production volume and the aquifer response should continue to be monitored.

3.2.5. SPRUCE HOLE

The Spruce Hole Aquifer has been studied extensively by UNH graduate students under the direction of Professor Thomas Ballestero, Ph.D., P.E. Many observation wells have been installed and monitored, including:

- Eight 2-inch drilled wells
- Thirteen ½-inch steel wells (small diameter or SDW wells)

A location plan for the 2-inch drilled wells (W101-W108), an 8-inch test well, and some of the SDW wells is contained in ***Appendix B***.

These wells are still in and available for monitoring. As part of a Hydrologic Monitoring Class, Professor Ballestero's students continue to monitor the level in some or all of these wells. This data is available in spreadsheet form and should be obtained by the Town.

In the next several months, work is scheduled to begin on siting and permitting of a new Spruce Hole groundwater supply as well as evaluation of artificial recharge of the aquifer. Additional monitoring wells will most likely be installed to determine the effects of pumping on existing wells and to determine the impact of applying Lamprey River water to the aquifer for artificial recharge. A great deal of data will be developed and compiled for this work. The Town and UNH should ensure they have this data in electronic format for comparison with operating data of the new supply source.

When the new supply source and aquifer recharging facilities are in place and operational, it will be necessary to monitor the amount pumped from the aquifer, the amount applied to the aquifer and the aquifer levels associated with both activities.

3.2.6. MONITORING SUMMARY

The monitoring program discussed in this section will provide the following:

- Oyster River
  - Flow into reservoir
  - Reservoir volume at varying levels
  - Out flow over dam
  - Daily volume withdrawn for water supply

- Lamprey River
  - Flow into reservoir
  - Reservoir volume at varying levels
  - Out flow from dam
  - Daily volume withdrawn for water supply

- Lee Well Aquiver
  - Daily volume withdrawn for water supply
  - Aquifer level response to pumping

- Spruce Hole Aquifer
    - Daily volume withdrawn for water supply (in future)
    - Daily volume applied for aquifer recharge (in future)
    - Aquifer level response to pumping and recharge

This information should be entered into a database and a running plot should be kept showing the following plotted against time on the x-axis:

- WTP discharge (MGD)
- LRPS discharge (MGD)
    - To Spruce Hole Aquifer
    - To WTP
- Lee Well discharge (MGD)
- Oyster River level (Ft above MSL)
- Oyster River Reservoir inflow (cfs)
- Oyster River Reservoir out flow (cfs)
- Wiswall Reservoir level (Ft above MSL)
- Wiswall Reservoir inflow (cfs)
- Wiswall Reservoir outflow (cfs)
- Lee Well Aquifer Level (Ft above MSL)
- Spruce Hole Aquifer Level (Ft above MSL)

By plotting this data, seeing the inter-relationships and comparing with historical records, the Town and University will have hard data on which to make water resource management decisions. These will include when to initiate pumping from one given source while reducing use of another.

3.3. SOURCE SELECTION IN CRITICAL PERIOD

The critical period is late summer and fall when stream flows are typically the lowest of the year and withdrawal from the surface supplies may be problematic due to environmental conditions and/or regulatory restrictions. The situation comes to a head during September when the demand for water is the highest of the year due to the start of the fall semester at UNH and the influx of students and staff. Meeting the increased demand without over stressing any one particular resource while still complying with the 401 Water Quality Certificate is arguably the greatest water resource management challenge for the Town and the University.

The question faced by the system operators in this period is what combination of sources should be used and at what production rates?

3.3.1. Seasonal Approach

In the July 2000 plan a seasonal use of sources was recommended with heavier use of the Lee Well during the critical period and less reliance on the surface supplies. The basic approach which is still recommended is given below:

- Reduce the production from the Lee Well during the non-critical period in order to maintain as high an aquifer level as possible.
- Run the WTP at a high capacity within reasonable bounds of the equipment and available stream flow during the non-critical period
- Based on monitoring data, increase production from the Lee Well when stream flows drop and decrease production from the WTP

This approach is predicated on the fact that although both surface water and groundwater sources are subject to seasonal variations, aquifers have a delayed response to drought conditions and are therefore better suited to meeting demand during the historical low flow months. Additionally, the Lee Well is thought to be capable of providing water in excess of the current estimated safe sustainable yield of 0.54 MGD for short durations as described in the following paragraphs.

In 1953, when the site was first identified, an 11-day pump test was run on an 8-inch well at a pumping rate of 353 gpm. Based on the test results, it was estimated that the site was capable of continuously providing 0.5 MGD, but could provide 1.0 MGD for limited durations. No well was installed however, and in 1984, a 5-day pump test was conducted on a new 8-inch well installed 25 feet east of the 1953 site. The pumping rate was 550 gpm and, based on the results, it was estimated that the site was capable of continuously providing 700 gpm (1 MGD). Due to concerns over what the actual sustainable yield was, another contractor was hired in 1985 to conduct a test on a new 8-inch well installed at the same site as the 1984 8-inch well which had been removed. The well was pumped for 27 days at 457 gpm, and then another 8 days at 361 gpm. The aquifer did not stabilize during either portion of this extended test. Based on this data, the estimate of safe sustainable yield was 375 gpm or 0.54 MGD.

As indicated by this testing history, on two different occasions, it has been estimated that the site could provide 1.0 MGD, either continuously or at lest for short durations. The Lee Well has a 700 gpm pump, so it is physically capable of providing 1 MGD if the aquifer can supply the water. On occasion when the WTP has been off line, all demand in the UNH/Durham system has been met by the Lee Well.

Given the preceding, it seems reasonable to assume that for short durations during the critical period, the Lee Well should be able to meet a large part of the system demand.

This proposed method of seasonal use of the supplies will have to be carefully monitored. A critical aspect of this approach is the Lee Well aquifer level. The data discussed in ***Section 3.2.4*** indicates that the aquifer has a measurable response to changes in pumping rate. For this approach to be successful, the aquifer level should increase in response to reduced pumping, not decrease too much due to heavy pumping in the critical period, and recover in the late fall and winter when pumping is reduced again.

3.3.2. Supply Source Decision Making

With the current supply sources and given the 401 Water Quality Certificate, it is a given that the Oyster River and Lee Well will be used on a regular basis. Therefore the initial decision to be made is when to use the Lamprey River. There are two basic approaches.

1. Only use the Lamprey River when the flow is greater than 45 cfs or when a water supply emergency is declared.
2. Use the Lamprey River at all flow rates in concert with the other supply sources within the confines of the 401.

The first approach is the one currently being used and embodied in the draft Drought Response Plan summarized in ***Section 1.3.3***. The main reason for taking this approach is the lack of an approved monitoring plan which is needed to comply with the conditions in the 401 that require measurement of flow into and out of Wiswall Reservoir at flows less than 45 cfs. The Town is continuing to pursue options for monitoring the Lamprey flow as discussed in ***Section 3.2.3***.

We have developed a preliminary example decision tree for use in source selection in the critical period based on the first approach given above and assuming that it is necessary to meet the current September average day demand of 1.038 MGD. This is shown in ***Table 3-2.*** If the Lamprey River flow is above 45 cfs, the Lamprey River pump station (LRPS) would be activated. The flow rate would be a function of what the Lee Well was being run at and whether or not artificial recharge was being diverted to the Spruce Hole aquifer. In this example, we have assumed that the Lee Well was set to deliver the average of 0.275 MGD given in ***Table 2-7.*** The WTP would then need to be run at 0.763 MGD to meet demand.

If the Lamprey Flow was less than 45 cfs, the WTP would be run off the Oyster River Reservoir. It is likely that with the Lamprey flowing less than 45 cfs, the Oyster River

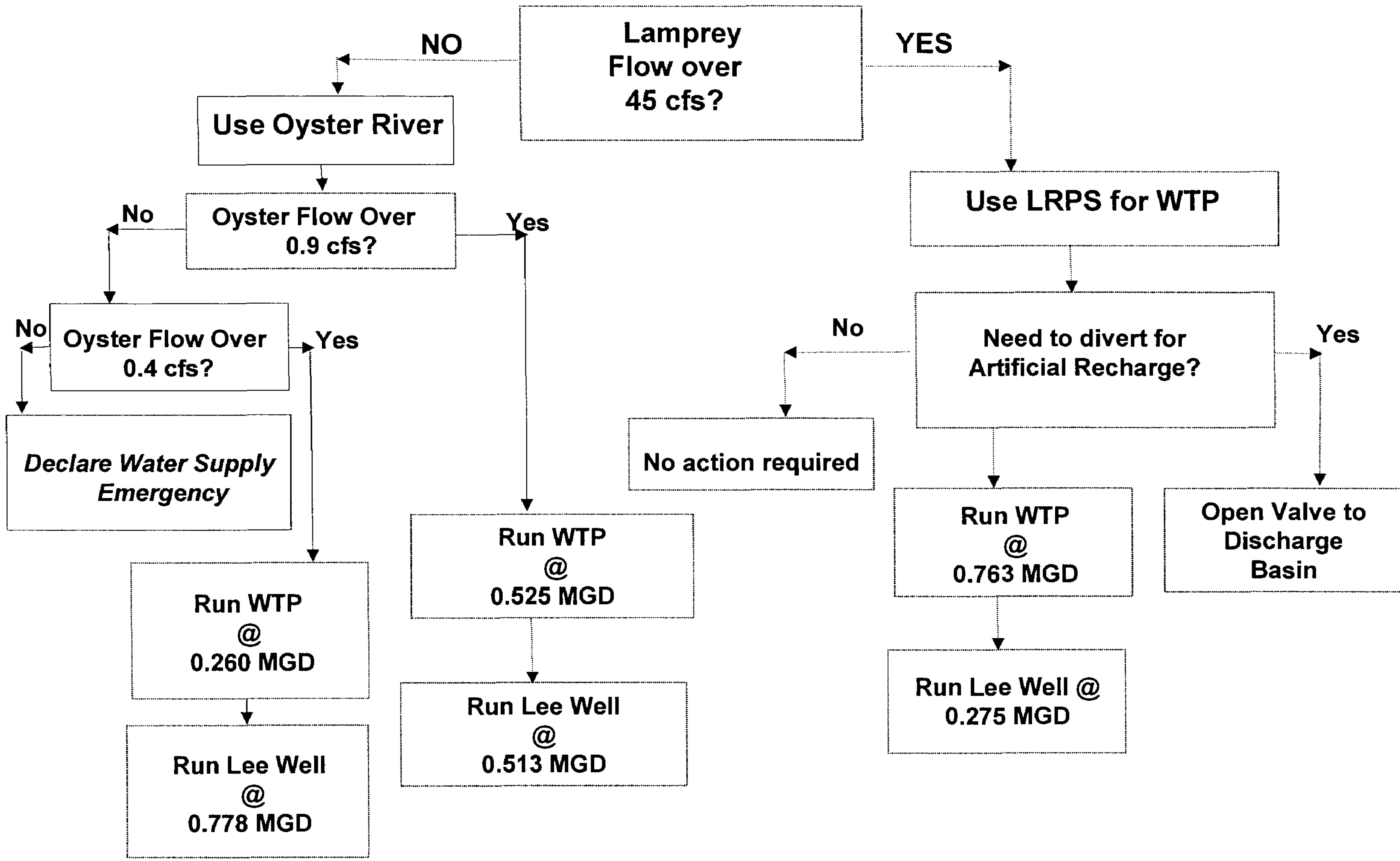


TABLE 3-2

PRELIMINARY EXAMPLE DECISION TREE FOR MEETING DEMAND OF 1.038 MGD USING LAMPREY ONLY OVER 45 CFS AND FOR EMERGENCY SOURCE will be at 3 cfs or less based on the data developed in ***Table 2-4.*** If the flow is over the calculated "trigger flow" of 0.9 cfs from ***Table 2-4*** then there would be sufficient flow to run the plant at the average flow of 0.525 MGD from ***Table 2-7***, so that the Lee Well production would need to be increased to 0.513 to meet demand. If the Oyster River flow is less than 0.9 cfs but greater than 0.4 cfs, which was picked as the low threshold of critical supply availability based on the data in ***Table 2-5***, then the WTP could still be run at 0.260 MGD. The Lee Well production would then need to be increased to 0.778 MGD to meet demand. This is a high rate for the well and could not be sustained for long periods. If the Oyster River flow was less than 0.4 cfs, it is assumed that the level of the Oyster River Reservoir and therefore the Edgewood Road tank would be at or approaching the levels leading to declaration of a water supply emergency.

While we have included a potential diversion for artificial recharge in the decision tree, we have assumed in this example that a Spruce Hole groundwater supply is not on line as this is the current situation faced by the Town and UNH. Having this supply available will improve the water supply situation, and in this example, would make it unnecessary to declare a water supply emergency since the current projected yield would exceed the minimum amount supplied by the WTP.

The second approach to using the Lamprey will depend on getting an approved monitoring plan in place. This would provide system operators with more flexibility and is the more desirable option in our opinion. A preliminary example decision tree for this approach is shown in ***Table 3-3.*** The portion of the decision tree if flow is over 45 cfs would remain the same. However, if the flow is below 45 cfs, under this approach, the Lamprey is still available at up to 1.676 MGD between 45 and 21 cfs, up to 0.772 MGD between 21 and 13 cfs and up to 0.513 MGD below 13 cfs by withdrawing ½ inch of storage. With the current piping arrangement, the operators have the option of running the WTP directly off the Lamprey, or blending Lamprey River water with Oyster River water via a branch main and using the Oyster River intake. In the example, with the Lamprey flow over 13 cfs, we have kept the Lee Well at the 0.405 MGD capacity which maintains the reserves for Lee and the Technology Drive office/research park. The WTP

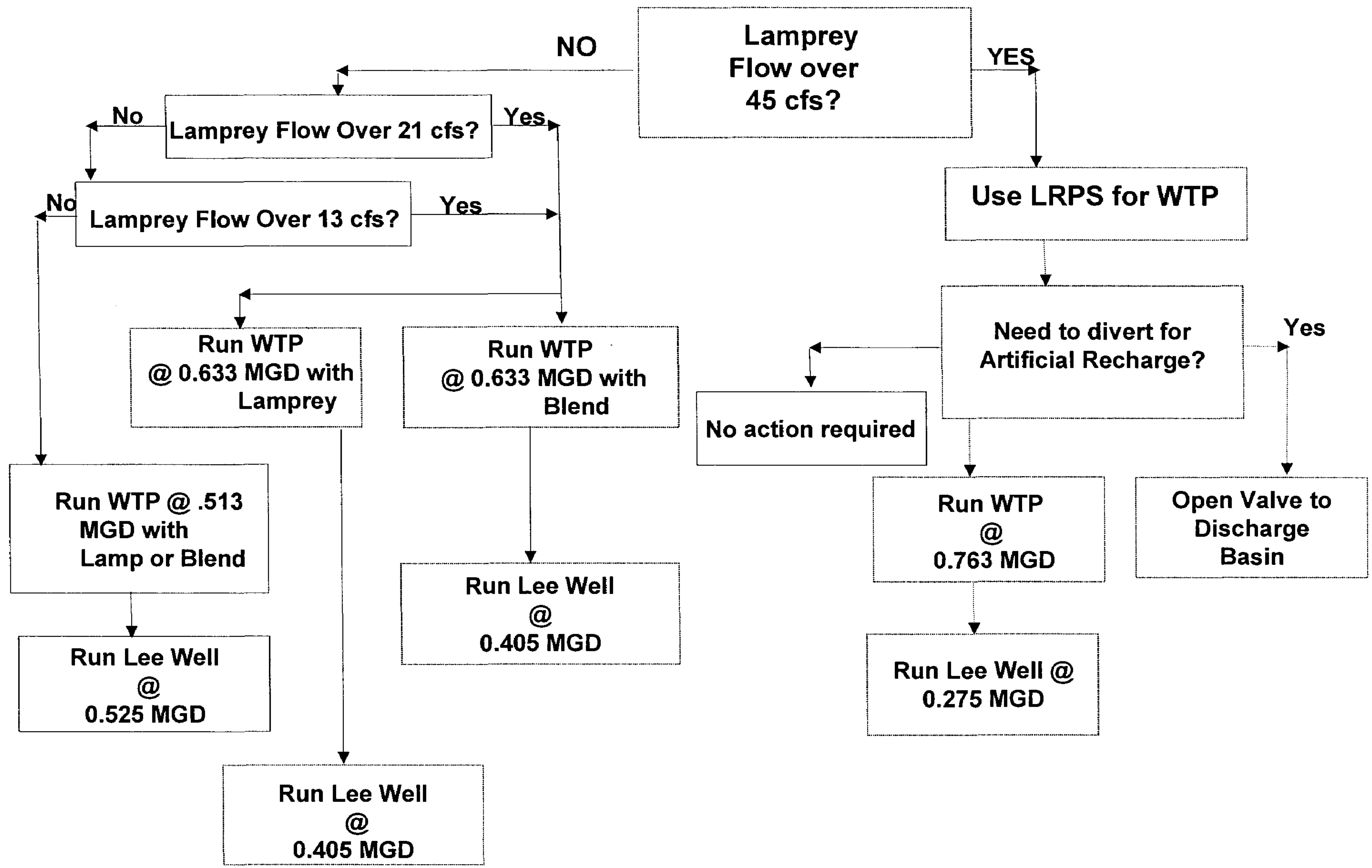


TABLE 3-3

PRELIMINARY EXAMPLE DECISION TREE FOR MEETING DEMAND OF 1.038 MGD
USING LAMPREY AT ALL TIMES UNDER 401

would then need to produce 0.633 MGD either with a blend or straight Lamprey River water to meet demand. If the Lamprey flow dropped below 13 cfs, then the output from the Lee Well would need to be increased as the capacity available from the Lamprey would drop to 0.513 MGD.

These decision trees illustrate only one method of operating the sources to meet demand. The intent is to show the process of making the decision given the parameters.

3.4. MAXIMIZE STORAGE

The need for a water resource management plan is driven by a number of factors, but a major reason is the seasonal low flow of the Oyster River combined with the small size of the Oyster River Reservoir. These two factors result in the need for pumping from the Lamprey River, which, is in turn limited by the 401 Water Quality Certificate.

If there were sufficient storage, the problem of limited withdrawals from the Lamprey River could be met by pumping to storage when there were no restrictions and then withdrawing from storage during the period of use limitations or cessations.

One way to maximize storage would be to physically increase the available storage volume. Construction of a storage tank or tanks would not be cost effective for this use. The simplest way to increase storage would be to increase the volume of the existing impoundments. This could be done through either through dredging or excavation or the use of flashboards.

It was noted in the 1965 Report on Additional Water Supply that the flowage rights of the Packers Falls (Wiswall) Dam included the use of 24 inches of flashboards and that this would increase the storage volume to about 112 MG. This volume was based on the belief that the Wiswall Reservoir held about 90 MG. It has since been shown to hold less than half this amount (***Table 3.1***). The point is that it would increase the volume considerably. These rights were conveyed to the Town of Durham in Paragraph 332:2 of

Chapter 332 of the Laws of 1965. A copy of this document is contained in ***Appendix J***. However, the designation of the Lamprey River as a protected river under the State of New Hampshire Rivers Management and Protection program (RSA 483) and as a "Recreational River" under the Federal Wild and Scenic Rivers Act may affect these rights. It is stated in the Lamprey Wild and Science River study that: "The Wild and Scenic Rivers Act explicitly prohibits any new dam or other project licensed by the Federal Energy Regulatory Commission (FERC) on or directly affecting a designated river segment, and requires that all other proposed federally assisted water projects in the area be evaluated for their potential impacts on the river's special features. Any project that would result in adverse effects to the designated segment is precluded under the Act."

It would, therefore, need to be determined whether increasing the depth of the impoundment by up to two feet would adversely impact the river. The effects on the structural integrity of the dam, the bridge over the river and the affected property would also need to be assessed. It is our opinion that neither flashboards nor excavation in the Wiswall Reservoir is a realistic option given the level of protection.

Similarly, increasing the volume of the Oyster River impoundment by installation of additional flashboards may also be a possibility. Once again, the integrity of the dam and the effects on the adjacent property would need to be assessed. In this case, most of the property belongs to UNH. On the other hand, the land is part of the College Woods Natural area and an increase in water depth may not be acceptable in this environmentally sensitive area.

There has been some work done indicating sediment build up in the Oyster River Reservoir. The actual volume of this material is not known but increasing the storage volume of the reservoir would be beneficial since it is much more cost effective to increase storage where the infrastructure already exists to utilize it. Prior to connection of the Lamprey River directly to the WTP, it would not have been possible to take the reservoir off line long enough to conduct such an operation unless it was done in such a manner as not to impact the water quality reaching the WTP. Now, however, it may be possible to conduct work in this reservoir while drawing off the Lamprey River. A thorough survey involving borings should be made to determine the status of the reservoir to see if it would be feasible and worth the cost of dredging or excavating any material that has been deposited.

Another way to maximize storage without necessarily creating new storage is through strategic pumping. This involves pumping from the Lamprey River to fill the Oyster River impoundment, or, as addressed in ***Section 3.5***, artificial recharge of the Spruce Hole Aquifer. As previously noted, the piping to the WTP from the Lamprey has a branch line to allow direct filling of the Oyster River Reservoir with Lamprey River water. The pump at the LRPS has a variable frequency drive (VFD) to allow efficient pumping at various rates.

One of the problems with pumping from one river to the other is that both rivers have similar flow patterns such that when pumping is needed to fill the Oyster River Reservoir there may be withdrawal restrictions on the Lamprey River due to the 401. The similarity of the flow patterns in the two river systems can be seen by studying hydrographs from each river for the same time period. As an example we have included hydrographs for both rivers from 1997 ***Appendix K.*** Both hydrographs exhibit similar peaks and low flows, with the exception that the base flow of the Lamprey is greater than that of the Oyster River.

The 1997 flow data can also be used to illustrate the utility of monitoring flows and comparing them to historical data. For both the Lamprey and Oyster Rivers, we have shown a plot of the flow data from May 1 to September 30, 1997. On the Lamprey River graph, we have shown the spring and summer trigger flows as they were proposed in the 1999 version of the instream flow rules which were used to establish the current 401. The flow can be seen to be dropping through the proposed spring instream flow rule trigger flows in May. Between June 1, the start of the hydrologic summer, and about June 18, there is an 18-day "window" before the flow drops to below the first proposed summer trigger flow (Q_{60}) of about 45 cfs. During the same period, the Oyster River flow dropped from about 8 cfs to 3 cfs.

A study of historical data shows that this rapid drop in flow occurs in May of most years. Therefore, a decision maker in 1997, knowing the river flows, the reservoir volumes and the historical trends could have made an informed decision on when to start and/or stop pumping from the Lamprey River. With the current Lamprey River piping, this could have involved direct treatment at the ARWTP or diversion of Lamprey River water to maintain a full Oyster River Reservoir.

The basis premise is to use the monitoring data to initiate pumping as soon or as late as conditions dictate to supply water to meet demand while keeping both reservoirs full.

The Lamprey River piping, along with the monitoring data, provides additional flexibility in keeping the reservoirs full. By directing Lamprey River water directly into the WTP, the full flow of the Oyster River can be used to fill that reservoir. This may involve pumping from storage behind the Wiswall Dam and thereby lowering the reservoir (within the acceptable limits of the 401). Once the Oyster River fills the reservoir at the WTP, pumping from the Lamprey River would stop so that the Wiswall Reservoir could fill. With careful control of the pumping, this back and forth methodology could help to maintain both reservoirs in as full a condition as possible, even during times of low flow.

3.5. *UTILIZATION OF SPRUCE HOLE AQUIFER*

3.5.1. WATER SUPPLY DEVELOPMENT

The Water Resources Management Plan is directed at managing the existing water supply sources to meet increasing demands with limited supplies. This situation would be greatly improved by adding a new independent supply source capable of 0.3 to 0.4 MGD. Seasonal use of the Lee Well during low flow periods has been recommended due to the drought resistant nature of groundwater supplies as compared to more flashy surface water supplies. A Spruce Hole groundwater supply will add needed capacity during the low flow period. We highly recommend that the Town and University move ahead with protection and development of this valuable resource.

3.5.2. ARTIFICIAL RECHARGE

with the restrictions imposed by the 401 certificate

It was previously noted that, if there were sufficient storage to allow pumping from the Lamprey River prior to the occurrence of low flows, all demand during the low-flow period could be withdrawn from storage. The problem was that there is insufficient storage. Artificial recharge of the Spruce Hole aquifer is a potential solution to this problem.

Artificial recharge would be accomplished by pumping water from the Lamprey River and applying it to the Spruce Hole Aquifer. The water would be recovered by a production well as recommended in the preceding sub-section. This system would require careful planning and design. Lamprey River water would not simply be pumped onto the ground. Structures such as recharge basins would need to be designed and constructed to "introduce" the water to the aquifer. Dover, NH has successfully used artificial recharge from both the Bellamy River and the Isinglass River to recharge several of their groundwater supplies for many years. Newmarket, NH is currently studying use of artificial recharge from the Lamprey River for their Plains aquifer.

One question to be answered is, "What will the effect be on water quality at the wellhead, since Lamprey River water requires treatment whereas the groundwater presumably would not?" It is noted that Lamprey River water applied to the aquifer would have to travel a significant distance at extremely slow velocities before reaching the pumping well. The aquifer will act as a natural filter and there will be dilution with existing groundwater. The time from application to withdrawal and, therefore, the time of filtration will be on the order of months. This is a great deal of treatment when compared to the residence time in a rapid sand filter of less than 30 minutes. Even a slow sand filter has a residence time on the order of eight hours. It is anticipated that water quality at the pumping well would not be a problem.

The concept of artificial recharge was addressed in the UNH Report on Spruce Hole. If water were applied to the aquifer south of the bog, it would naturally flow north and west toward the area favorable for the location of a well or wells. Initial computer modeling indicated that, after three months, 90 percent of the water would still be in the formation and anywhere from 30 percent to 75 percent could be recovered depending on the final well(s) location(s) and the pumping rate(s).

However, after submission of the draft report, Hurricane Bob came through the Durham area and deposited over 11 inches of rain in about 16 hours. All observation wells were still being monitored and the research team recorded daily water levels before, during, and for two weeks after the event. This was, in essence, an ideal natural "artificial recharge" experiment. Based on the data collected and 3-dimensional computer modeling, the researchers found that 99 percent of the water applied to the aquifer in late May or early June would still be in the aquifer three months later in August and September. A model pumping well was able to recover 90 percent of this amount.

The results noted above indicate that artificial recharge and use of the Spruce Hole aquifer as a "storage reservoir" is a viable concept. This lends more weight to our recommendations to proceed with development of the Spruce Hole aquifer as a fourth source of supply for the Town and University.

3.6. PUBLIC EDUCATION

An educated public that understands what is involved with a given situation and what their public officials/water suppliers are doing about it is an asset to solving the problem. Presently, there appears to be a wide range of understanding about use of the Lamprey River, the need for using the Spruce Hole aquifer and the water supply situation in general. This understanding ranges from well informed to uninformed and misinformed.

In our opinion, building an awareness of the water supply situation among the townspeople, UNH students and faculty and staff, both on and off the water system, will reduce or eliminate much misunderstanding and hopefully garner support for the actions being taken by Town and University officials.

Important items to include in educating the public with regard to the Lamprey River are listed below:

- Oyster River has been primary water supply source since 1935
- Lamprey River Pump Station (LRPS) and transmission main constructed in 1971 in response to drought of mid-1960s
- The 2001 Lamprey River Transmission main or "Hard Piping" project :
  - Allows more efficient transfer to Lamprey River water directly to the WTP and eliminates waste due to evaporation
  - Cut the existing pump rate in half to about 1,400 gpm
  - Provides an independent source in the event of contamination of the Oyster River
  - Provides an alternate source during any required maintenance of the Oyster River Dam
- Lamprey River is subject to a 401 Water Quality Certification that limits withdrawals when water is most needed – during Oyster River low flow period
- Use of LRPS to help meet summer and early fall demand has been absolutely necessary in dry years such as 1999 and 2002.
- Given increased water demand and seasonal low flow of Oyster River, Lamprey River will continue to be needed as supplemental water supply source
- Lamprey River is protected river under NH Rivers Management and Protection Act (RSA 483) and as a Recreational River under the Federal Wild and Scenic Rivers Act
- Conservation efforts may be necessary during low flow months to minimize pumping from the Lamprey River. This will require user cooperation.

- The Lee Well can help alleviate the water supply situation, but it cannot solve the problems
- A groundwater supply in the Spruce Hole Aquifer will greatly help alleviate the situation
- The Town and University are jointly addressing the situation including moving ahead with development of a well in the Spruce Hole aquifer and updating of the Water Resource Management Plan to provide a framework for managing all of the Durham/UNH supply sources

Some of these issues can be expanded upon or reduced. The intent is to provide the public with the "big picture" of Durham's and UNH's water supply situation.

The public education process can be handled in a number of ways. Some of these are listed below:

- Bill Inserts

  This would consist of an informational letter or bulletin inserted into water users bills. Naturally, this only reached the system users and may be discarded as junk mail, as often happens with this type of insert.

- Newsletters

  An informational newsletter could be published and distributed to key groups, such as the Conservation Commission, Lamprey River Advisory Committee, ~~Durham Rotary~~, etc.
  Oyster River Watershed Association

- Public Hearings/Community Group Presentations

  Information can be put out in a Public Hearing format or in presentations to key community groups, such as some of those mentioned above.

- Print and Broadcast Media

Articles can be placed in local papers, as well as advertising of public hearings or community group presentations. Perhaps a program could be developed and aired on New Hampshire Public Television, since it is located in Durham and the subject would be of both local and regional interest. Another option, ~~if available~~, would be ~~a local~~ the Durham cable access channel.

➢ Internet Site

A great deal of information can be posted on a local website. This would allow any interested party to get as much detail as the Town and University wish to put in such a venue.

3.7. CONSERVATION PROGRAM

Water is a valuable resource and conservation should be practiced as a matter of course. As part of the Management Plan, a certain level of conservation should be encouraged year-round, with stronger measures put in place during the low flow months.

Similar to monitoring river flows and impoundment volumes for management of use of supply sources, a conservation program should start with identifying how much water is produced, how much is used, what the uses are, how much is metered, and how much is unaccounted for. The first step is, therefore, to conduct a water audit, which is a review of all water production, metering, and billing data. Historically, there seemed to be a large percentage of unaccounted for water in the Durham/UNH system. Much of this "loss" turned out to be artificial, as the WTP master meter had been over-registering by about 20 percent. This was corrected in 1998.

A water audit was ~~currently~~ underway at the time this DRAFT report was being completed. Once the audit is complete, a leak detection program may be warranted if the audit indicates a large percentage of unaccounted-for water. The goal of the program would be to locate and repair leaks to further reduce the unaccounted-for water component.

Revise according to Audit Report.

The New Hampshire Code of Administrative includes Water Conservation Rules (Env-Ws 390). Any applicant for a new large groundwater supply source, such as a new Spruce Hole Well, will be subject to these rules. The basic requirements of these rules are listed below:

- Install and maintain meters for all water withdrawals and service connections
- Implement a water audit, leak detection, and leak repair program in accordance with the "Manual of Water Supply Practices, Water Audits and Leak Detection", (AWWA M36)
- When applicable, development and implementation of response plans to reduce unaccounted for water to less than 15%
- Implement a rate structure that encourages efficient water use
- Implement a water conservation educational outreach initiative

In addition to these requirements which the Town and UNH will be subject to as part of the Spruce Hole groundwater supply project, there is the conservation plan referenced in Section 1.4 of the Instream Flow Rules (***Appendix D***)

Following are elements of a typical conservation plan:

a. Customer metering
b. Leak detection and repairs
c. Requiring low-flow plumbing fixtures and/or flow-restricting devices
d. Restricting non-essential uses such as watering lawns, washing cars, and filling swimming pools
e. Encouraging industrial reuse and recycling
f. Adopting a water conservation rate structure which can include surcharge penalties
g. Conducting or requiring residential, commercial, and industrial water audits
h. Public education
i. Any other measure determined by the public water supplier to be cost-effective

This could be set up as a two-tier conservation plan. The first tier would be a year-round effort including such items as a, c and e above. The second tier would be for the low-flow period and would include elements of items d and f above. The present status of the University and the Town with regard to these conservation measures is addressed in the following paragraphs.

REALLY?

The Town and University have customer metering (a) and a water audit (g) is currently underway. UNH presently requires use of low-flow plumbing fixtures and flow restricted devices (c). The Town is instituting a similar policy. The efforts for public education addressed in the preceding section should include informational material on ways to conserve water (h) ~~and~~ as well as the need for this conservation. Encouraging industrial reuse and recycling (e) should be a relatively simple matter in Durham, given that there is little industrial use.

Restrictions of non-essential uses (d) would belong in the second tier of the conservation program which would be tied to the critical low-flow period. The proposed Drought Response Plan given in ***Section 1.3.3*** addresses both voluntary and mandatory conservation and notes some restrictions that would be implemented and when, based on the level of the Oyster River Reservoir. In addition to the Drought response plan, we suggest a combined approach of imposing restrictions at a given flow, or by a given date, whichever comes first. With this method, the Town and University would be in a better position to deal with unusually early low flows, but for most years, users could expect restrictions after a certain date.

These restrictions could take the form of the following:

- Institution odd/even watering days for odd and even numbered addresses
- Limiting automatic irrigation systems or manual water sprinkling to the period from 3:00 a.m. to 6:00 a.m. and
- ~~Limiting manual water sprinkling to the period~~ from ~~8~~ 7:00 p.m. to 10:00 p.m.
- Prohibiting washing of cars

- Prohibiting filling of swimming pools from the system.

Adoption of a water conservation rate structure (f) would also fall in the second tier of the conservation plan. The paradox of encouraging and/or enforcing conservation is that the reduction of water use, which is a goal, results in a reduction of revenue required to operate the system. This may be dealt with by drawing on financial reserves or instituting a rate structure designed to recover revenue shortfalls. However, the latter must be done prudently with proper public education to avoid a backlash. In general, customers expect to be rewarded for their conservation efforts rather than penalized by an increase in their cost.

There are a number of alternative rate designs that can be instituted to meet the definition of a conservation rate structure. Some of these are listed below.

- Increasing Block Rates

  In this structure, "blocks" or brackets of water use are defined for different customer classes. The volumetric rate increases for each higher block. Therefore, the more water a customer uses, the higher the cost. This is a conservation-oriented rate structure typically used in supply limited communities where commercial and industrial growth is not desired.

- Seasonal Rates

  This is a structure that establishes different rates for varying demand seasons and usually reflects the increased cost of providing service during those periods. In this case, a higher rate would be instituted during the summer low-flow season to both encourage conservation and cover the increase in cost associated with close management of the surface and groundwater supplies during this time-frame.

- General Rate Surcharge

  With this method, all volume rates (regardless of the rate structure) would be increased by a specific percentage designed to both reduce demand and still generate the required revenues. The surcharge could be implemented based on flow thresholds in the Lamprey or Oyster River or on dates usually associated with the low-flow season. This method treats all customers equally and is easy to explain and implement. A disadvantage is that it may not target those users most likely to be able to reduce demands or most likely to respond to price increases.

- Class-Based Rate Surcharges

  This is a variation on the surcharge approach in which quantity limits per customer are established for different classes of users (i.e. single family home, multi-family residential units, commercial users, industrial users, etc.) and a surcharge is applied to any user exceeding the limit for that class. This approach requires that reasonable limits be set for each class and does not penalize users who are already conserving water.

Implementation of one of these conservation rate structures can be complicated and time-consuming to administer. This is compounded by the nature of the billing system in Durham with the University providing one bill to the Town while the Town reads meters and bills individual customers. Therefore, a simple approach such as the General Rate Surcharge is recommended.

Include a discussion of the benefits of using automatic meter reading (AMR), to ~~more easily~~ track use trends and monitor for leaks. AMRs also allow for more frequent meter reading with less labor. ~~which can usually more in line with~~

SECTION 4 – CONCLUSIONS AND RECOMMENDATIONS

4.1. CONCLUSIONS

The following are our conclusions in regard to the Durham/UNH water supply situation.

- The Oyster River supply and the ARWTP successfully met the water demands of the Town and UNH for many years including the drought of the mid-1960s.
- The mid-1960s drought resulted in the construction of the LRPS and transmission main to supplement the Oyster River supply with Lamprey River water. Prior to the 1990s, however, there was not much need for this supplemental source.
- Construction of the Lee Well in 1986 added another source of supply to the system.
- The increased output from the Lee Well starting in 1992 most likely forestalled the need to utilize the Lamprey River supply more extensively.
- Even with the Lee Well contribution, use of the Lamprey River supply has been necessary to meet system demand in dry years.
- With demands continuing to increase, use of the Lamprey River supply source will become increasingly necessary in the future.
- The time of highest demand and, therefore, the need to use the Lamprey River occurs when students return to UNH in late August and September. This coincides with the period of minimum low flows in the Oyster and Lamprey Rivers and is the "critical" period.
- The segment of the Lamprey River in Durham and Lee is designated ~~as a~~ protected river under the New Hampshire Rivers Management and Protection Act (RSA 483), and as a Recreational River under the Federal Wild & Scenic Act. RSA 483 includes ~~This requires~~ the protection ~~setting~~ of instream flows which will limit withdrawals during low flow periods. [handwritten: thru … established rules;]
- In 2001 the Lamprey River transmission main was modified to transmit water directly to the WTP instead of a headwall upstream of the Oyster River Reservoir. This project was intended to provide the Town and University with more

flexibility in the use of the Lamprey River and reduce the total amount pumped from the river during low-flow situations.

- As a result of the Lamprey River Transmission Main project, a 401 Water Quality Certificate which was issued. This limits withdrawals as flow in the Lamprey River decreases below 45 cfs and also limits the amount that can be withdrawn from storage in the Wiswall Reservoir.
- The Lamprey River Protected Instream Flow Study (PIFS) currently underway will establish new protected instream flows and a Water Management Plan (WMP) which will address how those flows will be maintained. The current 401 is expected to ~~will~~ be modified to incorporate changes coming out of the PIFS and WMP.

The WMP will also include a Dam Management Plan for Wiswall Dam

New Bullet

- The schedule for completion of the PIFS and WMP is indefinite but completion is expected in 2008 or 2009.
- During the "non-critical" period, supply capacity is a function of the WTP and Lee Well capacities.
- During the critical period, supply capacity from the surface supplies is a function of flow in the rivers and the 401 conditions.
- The Lee Well supply capacity remains the same in both critical and non-critical periods:
  - There are reserves held for the Town of Lee and the Technology Drive office/research park that reduce the available supply capacity
  - For periods of short duration, the Lee Well can be pumped at rates greater than the established safe sustainable yield
- Demand can be divided up into three categories:
  - Average day demand based on the average from the whole year,
  - September average demand which is higher than average day demand,
  - Maximum day demand which is the highest demand condition,
- Existing supplies can meet all current and projected demands during the "non-critical" period with the exception of future maximum day beyond the year 2016.
- During the critical period, the extent to which existing supplies can meet demands depends on the flow of the Lamprey River, ~~and~~ the resultant 401 limitations, and the estimated rate of population growth.

- At flows greater than 13 cfs (Q_{90}), both average day and September average day demand can be met through 2024 and maximum day demand can be met through the year 2012.
- At flows less than 13 cfs, average day demand can be met through the year 2021 and September average day demand can be met through the year 2010. Maximum day demand exceeds supply capacity.

➢ Adding a Spruce Hole groundwater supply will greatly improve the ability of the supplies to meet existing and future demand.

➢ To meet new demands on the system, the reserves on the Lee Well capacity for the Town of Lee and the Technology Drive office/research park could be used with the understanding that these would be put back in place when the Spruce Hole Well comes on line.

➢ A management plan is necessary to coordinate use of all existing supplies and a potential future Spruce Hole aquifer supply.

4.2. RECOMMENDATIONS

A management plan as detailed in Section 3 of this report is recommended. This plan would have the following major components.

> Operations

➢ Monitoring
➢ Seasonal use of supplies and using a source selection process in critical period
➢ Maximizing water storage
➢ Utilization of Spruce Hole aquifer
➢ Public Education
➢ Conservation program

Specific recommendations for the plan are given below:

Monitoring

- Use Oyster River gauging station and area calculations to monitor inflow to Oyster River Reservoir
- Install a stream flow monitoring station downstream of Oyster Reservoir dam
- Continue to investigate best means to monitor inflow to and out flow from Wiswall Reservoir in association with other ongoing and upcoming projects (PIFS flow monitoring, dam rehabilitation, nature like bypass)
- Install ~~Consider~~ stream flow monitoring station downstream of Wiswall Dam
- Develop Stage-Storage curves for the Oyster River Reservoir and Wiswall Dam Impoundment
- Monitor pumping rates and water levels in Lee Well and Spruce Hole aquifers

Seasonal Use of Supplies and Use of a Source Selection Process

- Use WTP more heavily in non-critical period while using Lee Well less during this timeframe
- Increase Lee Well output during critical period and reduce withdrawals from surface water supplies
- Develop appropriate decision trees to help in selection and operation of supply sources in critical period

Maximizing Water Storage

- ~~Investigate ability to increase storage at Oyster River Reservoir through addition of flashboards and/or dredging or excavation of reservoir~~
- Use Lamprey River pumping station, transmission main and branch line to Oyster River Reservoir to maintain full Oyster River Reservoir to the degree possible

Utilization of Spruce Hole Aquifer

- Develop a new groundwater supply in the Spruce Hole aquifer
- Use the Spruce Hole aquifer as a storage reservoir via artificial recharge to hold water pumped from the Lamprey River during high flows to be recovered by the well(s) during low flows

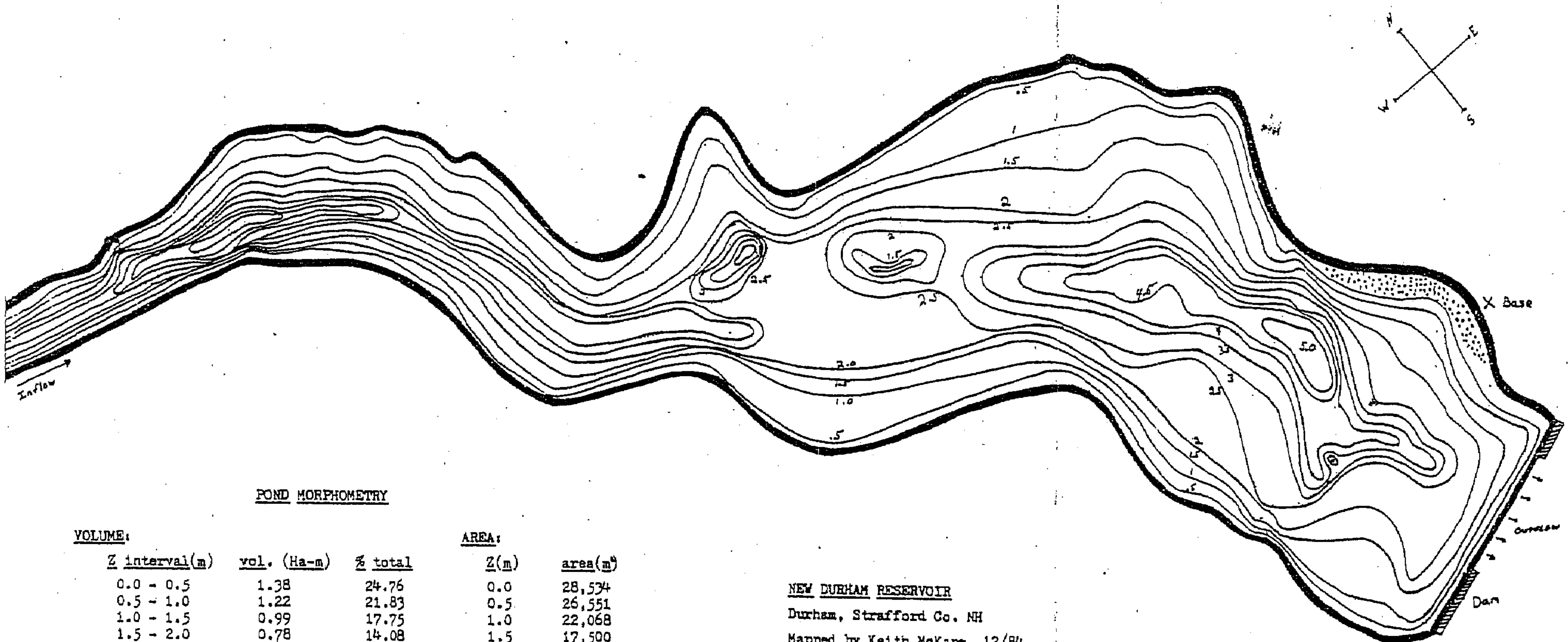
Public Education

- Educate the public on the Durham/UNH water supply situation, steps that are being taken to manage the supplies, the need for new supplies, and the need for conservation

Conservation

- Develop a conservation program in accordance with the requirements of Env-Ws 390 as well as the provisions for a Conservation Plan in Env-Ws 1900 (Instream Flow Rules)
- Adopt a water use restriction ordinance to allow the Town enforce mandatory conservation

APPENDIX A



POND MORPHOMETRY

VOLUME:

Z interval(m)	vol. (Ha-m)	% total
0.0 - 0.5	1.38	24.76
0.5 - 1.0	1.22	21.83
1.0 - 1.5	0.99	17.75
1.5 - 2.0	0.78	14.08
2.0 - 2.5	0.55	9.81
2.5 - 3.0	0.31	5.61
3.0 - 3.5	0.17	3.05
3.5 - 4.0	0.10	1.81
4.0 - 4.5	0.06	1.06
4.5 - 5.0	0.01	0.23
Total:	5.56	

AREA:

Z(m)	area(m²)
0.0	28,534
0.5	26,551
1.0	22,068
1.5	17,500
2.0	13,879
2.5	8,189
3.0	4,482
3.5	2,413
4.0	1,638
4.5	776

Total Surface Area: 2.85 Ha.

Total Volume: 5.56 Ha-m

Maximum Depth: 5 Meters

Mean Depth: 1.95 Meters

Relative Depth 2.63 (Zmax as a % of mean surface area)

NEW DURHAM RESERVOIR

Durham, Strafford Co. NH

Mapped by Keith McKane 12/84

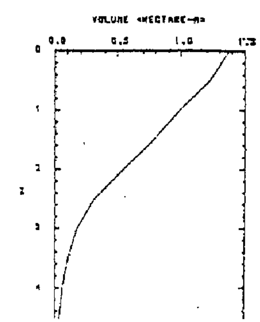
Scale:

0 25 50
meters

Key:

Submerged contours: .5m

Emergent vegetation: (cattails)



Zoology 719
Course project
Fall 1984

APPENDIX B

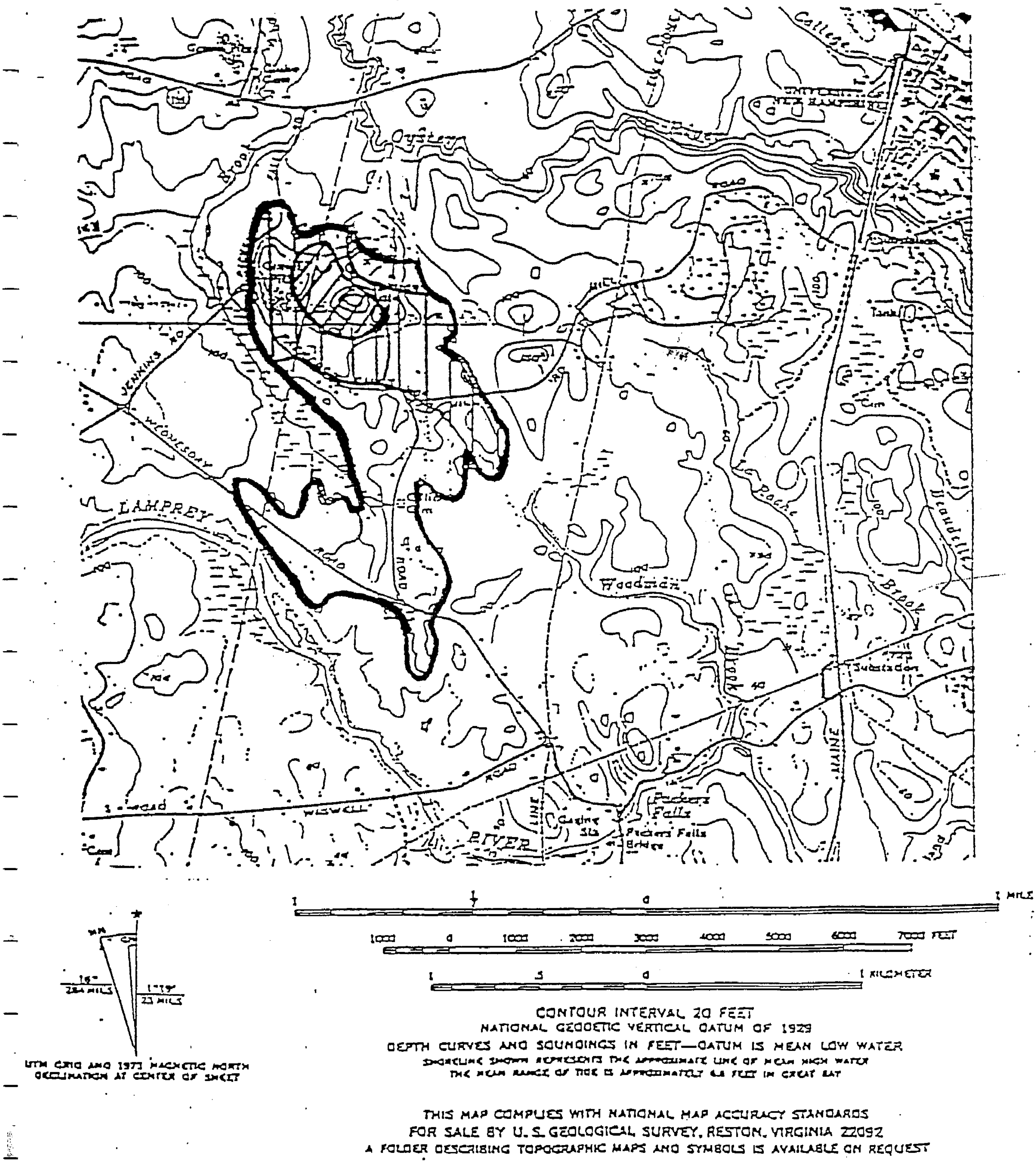


Figure 2. Spruce Hole primary aquifer zone (diagonal lines indicate a saturated thickness greater than 60 feet, vertical lines show saturated thickness greater than 20 feet).

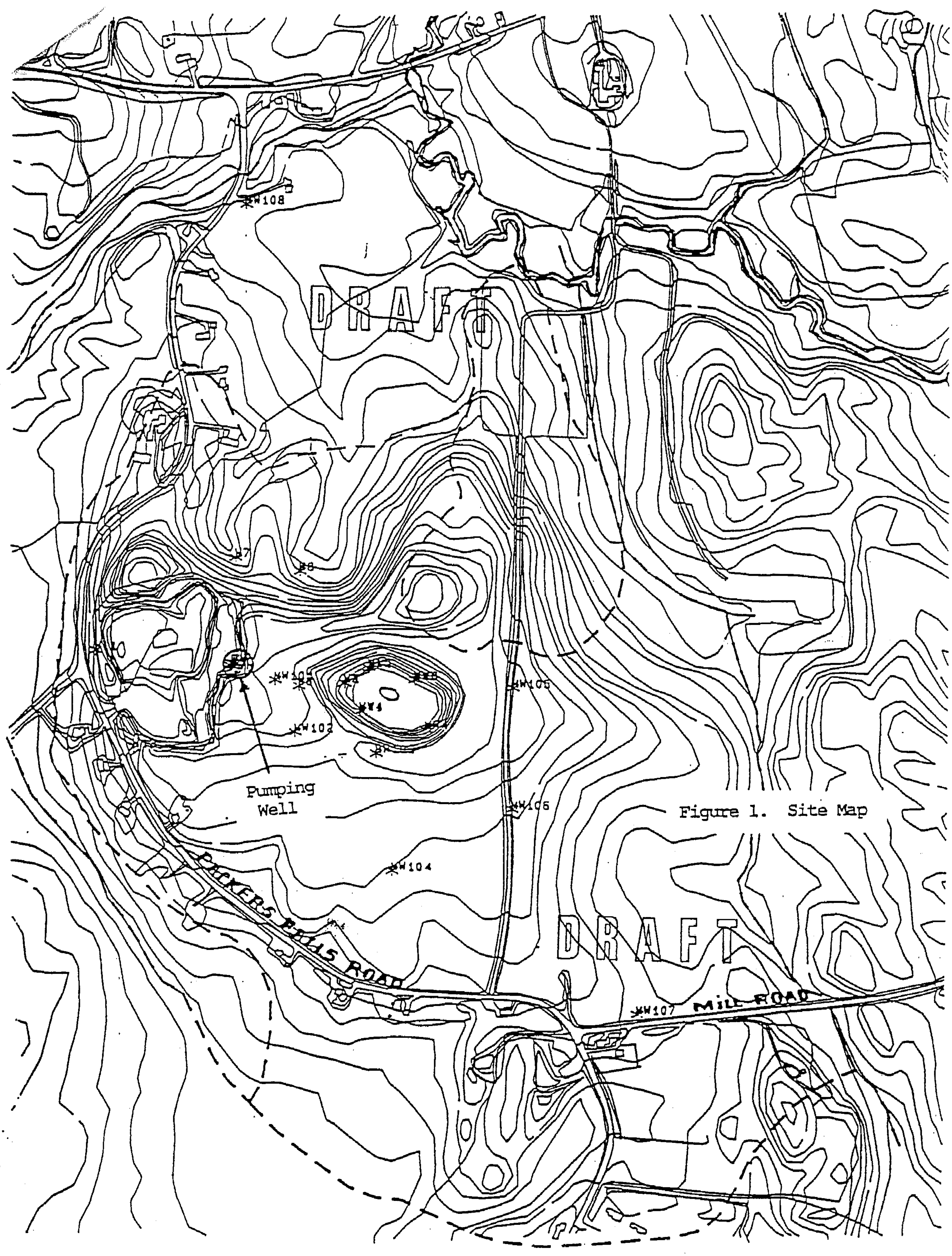


Figure 1. Site Map

APPENDIX C

NHDES

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
(603) 271-2457 FAX (603) 271-7894

April 3, 2001

Water Quality Certificate # 2001-001

RECEIVED
APR - 6 2001
PUBLIC WORKS DEPT.
TOWN OF DURHAM, N.H.

Robert Levesque
Town of Durham
15 Newmarket Road
Durham, NH 03824

RE: Section 401 Water Quality Certification for Town of Durham withdrawal at Lamprey River, Durham, New Hampshire, Water Quality Certificate File # 2001-001, Wetlands Bureau Permit #2000-00506.

A. INTRODUCTION

The above-referenced project (the Project) at Durham consists of modifications to an existing pump station and installation of new force main piping for transfer of water from the Lamprey River in the Wiswall Dam impoundment to the Durham public water system. The purpose of the Project is to improve the operation of the existing raw water supply system from the Lamprey River to the Durham Water Treatment Plant by adding a direct connection to the plant. The addition of a direct connection eliminates the current practice of discharging raw water from the Lamprey River to the Oyster River approximately eight thousand feet above the water treatment plant intake. This will allow more efficient use of the available water resources, especially during drought conditions. In addition to constructing the pipe connection between the Lamprey River and the water treatment plant, the recently prepared Water Resources Management Plan will be implemented to improve management of the available water sources for Durham public water supply. A significant component of the Plan will be the management of water supply demand during periods of limited surface water availability due to drought conditions. The Project is further described in the NHDES Wetlands Bureau file #2000-00506 and the Town of Durham/ University of New Hampshire Water Resources Management Plan dated March, 2000 - Revised July, 2000, on file with the NHDES Water Supply Engineering Bureau.

The Town of Durham (the Applicant) has applied for a Wetlands permit under State of New Hampshire Wetland Rule.

B. STATEMENT OF FACTS AND LAW

1. The Corps of Engineers has issued a State of New Hampshire Programmatic General Permit under under Section 404 of the federal Clean Water Act (The Act) (33 U.S.C. 1344) that allows permits issued under State of New Hampshire Wetland to serve as a federal permit under Section 404.

2. Section 401 of the Act requires state certification that construction and operation of the Project will comply with Water Quality Standards before a federal permit may be issued for all projects that may result in a discharge to waters of the United States. To implement this

provision of the Act, DES has adopted Section 401 water quality certification rules, at Env-Ws 451-455 under the authority of RSA 485-A:6, VII.

3. Env-Ws 1700, Surface Water Quality Regulations, effective December 3, 1999, fulfills the requirements of Section 401 of the Act that New Hampshire adopt water quality standards consistent with the provisions of the Act.

4. Env-Ws 452.02 defines a discharge as any addition of pollutants to the surface waters of the state, or release of water which alters the physical, chemical or biological condition of surface waters of the state.

5. Env-Ws 1702.18 defines discharge as:

(1) The addition, introduction, leaking, spilling, or emitting of a pollutant to surface waters, either directly or indirectly through the groundwater, whether done intentionally, unintentionally, negligently, or otherwise; or

(2) The placing of a pollutant in a location where the pollutant is likely to enter surface waters.

6. Env-Ws 1702.46 defines surface waters of the state as "perennial and seasonal streams, lakes, ponds and tidal waters within the jurisdiction of the state, including all streams, lakes, or ponds bordering on the state marshes, water courses and other bodies of water, natural or artificial." The term includes wetlands.

7. Env-Ws 1701.02 provides that the water quality standards "shall apply to any person who causes point or nonpoint source discharge(s) of pollutants to surface waters, or who undertakes hydrologic modifications, such as dam construction or water withdrawals, or who undertakes any other activity that affects the beneficial uses of the level of water quality of surface waters."

8. Env-Ws 1703.01, Water use Classifications, provides that:

(b) All surface waters shall be restored to meet the water quality criteria for their designated classification including existing and designated uses, and to maintain the chemical, physical, and biological integrity of surface waters

(c) All surface waters shall provide, wherever attainable, for the protection and propagation of fish, shellfish and wildlife, and for recreation in and on the surface waters.

(d) Unless the flows are caused by naturally occurring conditions, surface water quantity shall be maintained at levels adequate to protect existing and designated uses.

9. Env-Ws 1703.19, Biological and Aquatic Community Integrity, provides that:

"(a) The surface waters shall support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.

(b) Differences from naturally occurring conditions shall be limited to non-detrimental differences in community structure and function."

10. Env-Ws 455.02(c) provides that a water quality certificate may only be issued if construction or operation of the project will not violate surface water quality standards.

11. The wetlands adjacent to the Project, including the wetlands subject to dredge and fill, are surface waters of the state under Env-Ws 1702.46.

12. Construction activity in a wetland constitutes a discharge under the definitions of Env-Ws 1702.18(b) and Env-Ws 452.02.

13. Operation of the Project involves water withdrawal from the Lamprey River at the existing Lamprey River Pump Station intake in the impoundment upstream of the Wiswall Dam.

14. The Lamprey River or portions of the river may not meet the biological integrity standard of Env-Ws 1703.19 with respect to fish species. US Fish & Wildlife Service analysis of fish survey data collected by NH Fish & Game Department and DES indicates that fish species, composition, diversity, and functional organization may be different from that of similar natural habitats in the coastal region (reference: Memo from Vern Lang, US Fish & Wildlife Service to Paul Currier, DES, dated February 16,2001, titled "Draft Water Quality Certification, Town of Durham", on file at DES).

15. Published studies have established a possible link between alteration of stream flows and changes in fish species, composition, diversity, and functional organization. The contribution of future Project operations, if any, to detrimental differences from naturally occurring fish species, composition, diversity, and functional organization has not been determined. There is a need for further study to establish whether or not the biological integrity standard for fish is met and to understand reasons for any detrimental differences from naturally occurring conditions.

C. FINDINGS

1. Construction and operation of the Project requires Water Quality Certification under Section 401 of the act and Env-Ws 451.02.

2. Operation of the Project diverts natural flow from the Lamprey River, which may result in alteration of flows downstream of the dam.

3. When river flow during the summer season at the Packers Falls gaging station is less than 13 cubic feet per second (cfs), which is the estimated summer seasonal river flow equaled or exceeded ninety percent of the time, the maintenance of flow below the Wiswall Dam equal to inflow is not expected to have a significant effect on biological and aquatic community integrity.

4. When river flow during the summer season at the Packers Falls gaging station is between 21 cfs, which is the estimated summer seasonal river flow equaled or exceeded eighty percent of the time, and 13 cfs the maintenance of flow below the Wiswall Dam at approximately 98% of inflow, or inflow less .4 cfs, is not expected to have a significant effect on biological and aquatic community integrity.

5. When river flow during the summer season at the Packers Falls gaging station is between 45 cfs, which is the estimated summer seasonal river flow equaled or exceeded sixty percent of the time, and 21 cfs the maintenance of flow below the Wiswall Dam at approximately 96% of inflow, or inflow less 1.8 cfs, is not expected to have a significant effect on biological and community integrity.

6. Limiting drawdown of the Wiswall Dam impoundment to no more than six inches below the crest elevation of the dam will support the aquatic life designated use in the impoundment.

D. WATER QUALITY CERTIFICATION CONDITIONS

1. When river flow at the Packers Falls gaging station is between 45 and 21 cfs, outflow from the Wiswall dam shall be maintained at no less than inflow minus 1.8 cfs. When river flow at the Packers Falls gaging station is between 21 and 13 cfs, outflow from the Wiswall dam shall be maintained at no less than inflow minus .4 cfs. When river flow at the Packers Falls gaging station is less than 13 cfs, outflow from the Wiswall dam shall be maintained equal to inflow.

2. The pool elevation in the Wiswall Dam impoundment shall be drawn down no more than 0.5 inches in any 24-hour period. The maximum drawdown of the pool elevation in the impoundment shall be six inches below the crest elevation of the dam.

3. If an emergency exists which affects public health and safety and requires operation of the Project or the dam, adherence to conditions 1 and 2 is not required. The Applicant shall maintain records of Project operations during emergency conditions including times of beginning and end of emergency conditions, reasons for the emergency, and the name and office of the public official who declared the emergency. Within 60 days of the end of an emergency the Applicant shall file with DES a letter report describing the times and amounts of water withdrawal under the emergency, causes of the emergency, and, unless the emergency was caused by one-time, non-recurring circumstances such as fire or a contamination event, detailing specific steps that will be taken to avoid recurrence of emergency conditions."

4. Before the Project is operated when river flow at the Packers Falls gage is less than 45 cubic feet per second, the Applicant shall submit to DES for approval, receive approval, and implement a plan to measure or estimate outflow from the Wiswall dam and inflow to the

impoundment.

5. Before the Project is operated when river flow at the Packers Falls gage is less than 13 cfs the Applicant shall submit to DES for approval, receive approval, and implement a plan to maintain outflow equal to inflow during periods of operation when river flow is below 13 cfs. The plan shall include details of measurement methods for inflow, and a detailed plan of operation for the Wiswall Dam gates to maintain outflow equal to inflow.

6. The Applicant shall maintain records of the operation of the pump station, including dates and times of operation, and the pumping flow rate during Project operation.

7. The Applicant may operate the pump station for up to 1.5 hours each week to prevent stagnation of water in the force main, irrespective of river flow.

8. The Applicant shall maintain daily records of the pool elevation in the Wiswall Dam impoundment during Project operation, and daily records of inflow to the Wiswall Dam impoundment and outflow from the dam.

9. The Applicant shall make the records maintained in 3, 5, and 6 above available to DES upon request.

10. The terms and conditions of this Water Quality Certification may be amended and additional terms and conditions may be added by DES to ensure compliance with Water Quality Standards, after notice to the Applicant and opportunity for hearing.

E. WATER QUALITY CERTIFICATION APPROVAL

Based on the above determinations and conditions, construction and operation of the Project will not violate surface water quality standards, and DES hereby issues Water Quality Certification under Section 401 of the Act for the Project, subject to the above conditions.

F. APPEAL

If you are aggrieved by this decision, you may appeal the decision to the Water Council. Any appeal must be filed within 30 days of the date of this decision, and must conform to the requirements of Env-Wc 200. Inquires regarding appeal procedures should be directed to Jim Ballentine, DES Council Appeals Clerk, 6 Hazen Drive, PO Box 95, Concord, NH 03302-0095; telephone (603) 271-6072.

Paul M. Currier

Paul Currier, Administrator
DES Water Division, Watershed Management Bureau

cc: Harry Stewart, DES
Wayne Ives, DES
Bob Mann, DES
Jamie Fosberg, National Park Service
Bill Ingham, Fish & Game
Vernon Lang, US Fish and Wildlife Service
Ralph Abele, EPA
Judith Spang, Lamprey River Local Advisory Committee

APPENDIX D

TABLE OF CONTENTS

CHAPTER Env-Ws 1900 RULES FOR THE PROTECTION OF INSTREAM FLOW ON DESIGNATED RIVERS

Statutory Authority: RSA 483:9-c; RSA 483:11, IV; 2002, 278:2, II

PART Env-Ws 1901 PURPOSE AND APPLICABILITY

Env-Ws 1901.01 Purpose. The purpose of these rules is to specify standards, criteria, and procedures by which a protected instream flow shall be established and enforced for each designated river segment on the Lamprey River and the Souhegan River in order to maintain water for instream public uses and to protect the resources for which the river or river segment is designated.

Source. #7901, eff 5-29-03

Env-Ws 1901.02 Applicability. The requirements set forth in Env-Ws 1900 shall apply to:

(a) Designated segments, under RSA 483, on the Lamprey and Souhegan Rivers and their tributary drainage areas;

(b) Affected water users on the Lamprey and Souhegan Rivers; and

(c) Affected dam owners on the Lamprey and Souhegan Rivers.

Source. #7901, eff 5-29-03

PART Env-Ws 1902 DEFINITIONS

Env-Ws 1902.01 "7Q10" means the lowest average flow rate for a period of 7 consecutive days on an annual basis with an expected recurrence interval of once in every 10 years, determined at a fixed location on a river or stream, and expressed in terms of volume per time period.

Source. #7901, eff 5-29-03

Env-Ws 1902.02 "Affected dam owner" means an owner of a dam with an impoundment with a surface area greater than 10 acres in the watershed area of a designated river.

Source. #7901, eff 5-29-03

Env-Ws 1902.03 "Affected water user" means a water user required to be registered under Env-Wr 700, or successor rules, and having a withdrawal or return location within 500 feet of a designated river or within 500 feet of a river or stream in its tributary drainage area.

Source. #7901, eff 5-29-03

Env-Ws 1902.04 "Aggregate water use" means the total water use by all affected water users at, and upstream from, any location on a designated river, being the difference between the sum of water withdrawals and the sum of measured registered water returns.

Source. #7901, eff 5-29-03

Env-Ws 1902.05 "Commissioner" means the commissioner of the New Hampshire department of environmental services.

Source. #7901, eff 5-29-03

Env-Ws 1902.06 "cfsm" means cubic feet per second of flow per square mile of stream drainage area.

Source. #7901, eff 5-29-03

Env-Ws 1902.07 "De minimis amount" means an aggregate water use at any river location equal to 5 percent of 7Q10 at that location.

Source. #7901, eff 5-29-03

Env-Ws 1902.08 "Department" means the New Hampshire department of environmental services.

Source. #7901, eff 5-29-03

Env-Ws 1902.09 "Designated river" means a river or river segment that is designated under RSA 483.

Source. #7901, eff 5-29-03

Env-Ws 1902.10 "General standard" means a quantitative method for assessing aggregate water use at any river location relative to stream flow at that location.

Source. #7901, eff 5-29-03

Env-Ws 1902.11 "Governing body" means the board of selectmen in a town, the board of mayor and aldermen in a city or the council in a city or town with a council, or the county commissioners in unincorporated towns and unorganized places.

Source. #7901, eff 5-29-03

Env-Ws 1902.12 "Lakes management advisory committee (LMAC)" means the committee established under RSA 483-A:6.

Source. #7901, eff 5-29-03

Env-Ws 1902.13 "Local river management advisory committee (LRMAC)" means a committee established under RSA 483:8-a.

Source. #7901, eff 5-29-03

Env-Ws 1902.14 "Rivers management advisory committee (RMAC)" means the committee established under RSA 483:8.

Source. #7901, eff 5-29-03

Env-Ws 1902.15 "Segment" means a portion of a designated river assigned to one of the classifications identified in RSA 483:7-a.

Source. #7901, eff 5-29-03

Env-Ws 1902.16 "Water management planning area (WMPA)" means the tributary drainage area to a designated river for which a water management plan is required.

Source. #7901, eff 5-29-03

PART Env-Ws 1903 DE MINIMIS AMOUNT AND ESTIMATION OF AGGREGATE WATER USE

Env-Ws 1903.01 De Minimis Amount Available For Use. The de minimis amount shall be always available for use.

Source. #7901, eff 5-29-03

Env-Ws 1903.02 Estimation and Report of Aggregate Water Use and Streamflow.

(a) Each year the department shall:

(1) For each designated river, estimate average monthly aggregate water use and average monthly stream flow; and

(2) For each designated river without established protected instream flows under Env-Ws 1905, estimate the month(s) and identify the location(s) not in compliance with the general standard.

(b) For each designated river with protected instream flows established under Env-Ws 1905, the department shall keep a record of the date(s) and location(s) at which protected instream flows were not maintained.

(c) A designated river shall be not in compliance with the general standard if:

(1) The average monthly aggregate water use exceeds 5 percent of 7Q10 when average monthly stream flow is less than or equal to 0.5 cfsm;

(2) The average monthly aggregate water use exceeds 0.02 cfsm when average monthly stream flow is greater than 0.5 cfsm and less than or equal to 1.0 cfsm;

(3) The average monthly aggregate water use exceeds 0.04 cfsm when average monthly stream flow is greater than 1.0 cfsm and less than or equal to 4 cfsm; or

(4) The average monthly aggregate water use exceeds 0.16 cfsm when average monthly stream flow is greater than 4 cfsm.

(d) The general standard shall not apply to hydroelectric facilities for the river locations between their point of withdrawal and point of return.

(e) Each year the department shall publish a report on aggregate water use and streamflow for the previous year.

(f) The report shall be published no later than June first.

(g) The report shall include:

(1) An estimate of water use for each affected water user;

(2) An estimate of aggregate water use at each withdrawal or return location;

(3) An estimate of stream flow at each withdrawal or return location;

(4) A record of the month(s) and location(s) not in compliance with the general standard for designated rivers without established protected instream flows under Env-Ws 1905;

(5) A description of the WMPA for designated river(s) that are not in compliance with the general standard; and

(6) For each designated river with protected instream flows established under Env-Ws 1905, a record of the date(s) and location(s) at which protected instream flows were not maintained.

Source. #7901, eff 5-29-03

PART Env-Ws 1904 PROTECTED INSTREAM FLOWS AND WATER MANAGEMENT PLANS

Env-Ws 1904.01 Establishment of Protected Instream Flows and Adoption of Water Management Plans. The department shall establish protected instream flows and adopt water management plans for the WMPAs of the designated segments of the Lamprey and Souhegan Rivers, as defined by RSA 483:15, I and RSA 483:15, XIII, respectively.

Source. #7901, eff 5-29-03

Env-Ws 1904.02 Sequence. The department shall establish scientifically-supported protected instream flows prior to adoption of the water management plan for a WMPA.

Source. #7901, eff 5-29-03

PART Env-Ws 1905 PROCEDURE FOR ESTABLISHMENT OF PROTECTED INSTREAM FLOWS

Env-Ws 1905.01 Elements. To establish protected instream flows:

(a) The department shall:

(1) Conduct a protected instream flow study and propose protected instream flows based on scientifically-accepted ecological methods as provided in Env-Ws 1905.02;

(2) Make the study available for public review; and

(3) Hold a public hearing and receive comments on the study and the recommended protected instream flows as provided in Env-Ws 1905.03;

(b) The commissioner shall issue a decision establishing protected instream flows for the designated river, as provided in Env-Ws 1905.04.

Source. #7901, eff 5-29-03

Env-Ws 1905.02 Protected Instream Flow Study. The protected instream flow study shall:

(a) For each river segment designated under RSA 483:15, identify and catalog all outstanding characteristics listed under RSA 483:1;

(b) For each river segment designated under RSA 483:15, identify and catalog all instream public uses on the designated river listed under RSA 483:9-c,I, and all designated uses under the federal Clean Water Act;

(c) For each river segment designated under RSA 483:15, identify and catalog all resources listed under RSA 483:6,IV,(a) for which the river or segment is designated;

(d) Identify and catalog all documents and reports relative to a segment's outstanding characteristics, the resources for which the river is designated, and instream public uses, including:

(1) Designated river nomination reports;

(2) River corridor management plans;

(3) Water quality studies;

(4) Natural heritage inventory;

(5) Fishery and aquatic resource studies;

(6) Environmental assessments;

(7) Environmental impact statements; and

(8) Other applicable reports and documents;

(e) Include an on-the-water stream survey of all resources that identifies and catalogs from direct observation:

(1) Fish;

(2) Wildlife;

(3) Macroinvertebrates;

(4) Plants;

(5) Recreational uses;

(6) Characteristics identified in (a) above;

(7) Instream public uses identified in (b) above; and

(8) Resources identified in (c) above;

(f) Identify and document method(s) that are consistent with applicable designated uses and water quality standards, for establishing a protected instream flow that conserve and protect the outstanding characteristics, instream public uses and resources identified in (a), (b), (c), and (e) above;

(g) For each segment, determine and document a recommended, scientifically-based protected instream flow based on application of the method(s) identified in (f) above, and applicable water quality standards; and

(h) For each segment classified natural under RSA 483:7-a, assess the effect on recommended protected instream flows of inclusion as an outstanding resource water under the provisions of RSA 483:9,V.

Source. #7901, eff 5-29-03

Env-Ws 1905.03 Publication, Hearing, and Opportunity for Public Comment on Protected Instream Flows.

(a) After the protected instream flow study has been prepared, and prior to establishment of protected instream flows for a designated river or segment, the department shall make the study available for public review and hold a public hearing, in accordance with Env-C 205, to receive comments.

(b) The department shall use the comments received during the public hearing and comment period to review the proposed protected instream flow relative to the following factors:

(1) The outstanding characteristics identified in RSA 483:1;

(2) The factors identified in RSA 483:6, IV(a);

(3) The instream public uses identified in RSA 483:9-c;

(4) Water quality standards;

(5) Flows established pursuant to existing Federal Energy Regulatory Commission licensing processes or state contracts;

(6) Whether there are wastewater discharges that require a certain instream flow for permit compliance or maintaining water quality standards;

(7) Whether the river contains flow-regulating structures such as dams, and if so, how such structures are used to manage flow;

(8) Information relevant to flow conditions that will conserve, protect, maintain, or restore aquatic life or habitat, or both;

(9) Information relevant to flow conditions that will conserve, protect, maintain, or restore recreational uses;

(10) Information relevant to flow conditions that will conserve, protect, maintain, or restore resources for which the river is designated;

(11) Data from stream gages;

(12) Watershed characteristics;

(13) Pertinent resource management plans including, but not limited to, fisheries management plans, watershed management plans, and recreation management plans; and

(14) Other information relevant to the proposed protected instream flows.

(c) The hearing shall be held in a community through or past which the designated river flows.

(d) At least 30 days before the hearing, the department shall issue a notice of hearing, including locations where a copy of the study may be obtained, in a newspaper of local circulation and on the department's website.

(e) At least 30 days before the hearing, the department shall send written notice of the hearing and study availability to, and solicit comment from, the following:

(1) Affected water users in the WMPA;

(2) Affected dam owners in the WMPA;

(3) Federal Energy Regulatory Commission, for each WMPA with a licensed or exempted hydropower site;

(4) LMAC members;

(5) LRMAC members for the designated river;

(6) The governing body of each municipality through or past which the designated river flows;

(7) The National Park Service;

(8) The New Hampshire department of justice;

(9) The New Hampshire public utilities commission;

(10) RMAC members;

(11) The governor of any state which shares a designated river;

(12) The United States Environmental Protection Agency;

(13) The United States Fish And Wildlife Service;

(14) The United States Forest Service, for each designated river inside the White Mountain National Forest;

(15) The United States Geological Survey; and

(16) Persons who have requested in writing to be notified of the hearing.

(f) At the public hearing, the department shall specify a comment period which shall close at least 30 days after the hearing date, during which time the department shall accept written comments on the factors pertaining to the proposed protected instream flows.

Source. #7901, eff 5-29-03

Env-Ws 1905.04 Establishment of Protected Instream Flows.

(a) Within 60 days of the close of the public comment period, the department shall issue a decision establishing protected instream flows for the designated river that meet the criteria in RSA 483:1 and 483:2.

(b) The decision shall:

(1) Be in writing;

(2) State the scientific basis for the established flow(s);

(3) Include an assessment of how the established flows will meet applicable water quality standards;

(4) Include the assessment required by RSA 483:9-c, III;

(5) Summarize the comments received; and

(6) Explain how the comments affected the decision.

(c) The department shall provide copies of the decision to:

(1) Persons identified in Env-Ws 1905.03(e);

(2) Persons who submitted written comments on the proposed flows; and

(3) Persons who requested to receive a copy of the notice of the established flows.

Source. #7901, eff 5-29-03

Env-Ws 1905.05 Petition for Change of an Established Protected Instream Flow.

(a) A person may file a petition with the department for change of an established protected instream flow.

(b) The petition shall be in writing.

(c) The petition shall include:

(1) The name, address, and daytime telephone number of the person requesting change;

(2) If the person requesting change is not an individual, the name of an individual who can be contacted on behalf of the organization requesting the change;

(3) A clear and concise statement of the specific change of an established protected instream flow requested;

(4) A list of the outstanding characteristics identified in RSA 483:1, the resources identified in RSA 483:6, IV (a), and the instream public uses identified in RSA 483:9-c applicable to the river segment for which change of a protected instream flow is being requested;

(5) An explanation of how change of protected instream flows would conserve and protect the factors identified under (4) above;

(6) An explanation of how a change of protected instream flows would meet water quality standards;

(7) A full explanation of why protected instream flows should be changed on the designated river; and

(8) Any factors identified in (4) above, that the petitioner believes the department should re-evaluate;

(9) Data not available or not considered at the time the protected instream flow was established; and

(10) Other reasons for requesting change of the protected instream flow.

(d) Within 30 days of receiving a petition for change of the protected instream flow, the department shall:

(1) Deny the petition and affirm the established protected instream flow; or

(2) Grant the petition and begin reconsideration of the protected instream flow.

(e) The department shall grant the petition if the information in the petition or other information reviewed by the department indicates that the established protected instream flows are not correct and if the petition is complete as described in (c) above.

(f) The department's decision shall:

(1) Be in writing;

(2) Be sent to the person who petitioned for the change of the instream flow and to any other person who has asked to be notified of the decision in writing;

(3) Be made available electronically to the general public; and

(4) State the reason(s) for the decision, whether the decision is to deny the petition or to reconsider established protected instream flows.

(g) If the department grants the petition, the department shall establish revised protected instream flows by the process set forth in Env-Ws 1905.01.

(h) As specified in RSA 483:9-c, VI, the commissioner's decision on the petition may be appealed in accordance with RSA 541.

(i) The department shall initiate action to reconsider a protected instream flow by the processes set forth in Env-Ws 1905.01 if there are changed conditions in the watershed that warrant re-evaluation of the flows.

Source. #7901, eff 5-29-03

PART Env-Ws 1906 PROCEDURE FOR ADOPTION OF WATER MANAGEMENT PLANS

Env-Ws 1906.01 Elements of a Water Management Plan.

(a) The department shall prepare a water management plan that sets forth how the protected instream flows established under Part Env-Ws 1905 for a designated river or segment shall be maintained.

(b) The water management plan shall include:

(1) A conservation plan, as provided in Env-Ws 1906.02;

(2) A water use plan, as provided in Env-Ws 1906.03; and

(3) A dam management plan, as provided in Env-Ws 1906.04.

(c) The department shall:

(1) Notify each affected water user and affected dam owner in the WMPA by certified mail that:

a. A water management plan is being prepared; and

b. The plan will be enforceable.

(2) Notify each affected water user in the WMPA by certified mail that the water user is strongly encouraged to participate in the process by providing information that will help the department understand that user's water use;

(3) Notify each affected dam owner in the WMPA by certified mail that the dam owner is strongly encouraged to participate in the process by providing information that will help the department understand their impoundment's operation and uses;

(4) Meet with each affected water user and affected dam owner in the WMPA and discuss protected instream flow requirements;

(5) Make the water management plan available for public review;

(6) Conduct a public hearing and receive comments as provided in Env-Ws 1906.06; and

(7) Issue a written decision as provided in Env-Ws 1906.07.

Source. #7901, eff 5-29-03

Env-Ws 1906.02 Conservation Plan.

(a) The department shall prepare a conservation plan.

(b) The conservation plan shall:

(1) Identify all affected water users in the WMPA;

(2) Determine affected water user types within the WMPA, and identify conservation measures and best management practices applicable to each type of affected water user;

(3) For each affected water user in the WMPA, include a report of water use patterns, needs, and the potential for conservation based on specific water-use data and information from department records, site visits, and meetings, which includes the following information:

a. A complete description of all water use including:

1. Water source(s) and destination(s);

2. Anticipated demand for water that describes maximum, minimum, and average water withdrawal rates, schedules, and durations;

3. Factors that control water demand such as consumer choice, delivery contracts, availability, crop needs, manufacturing runs, seasonal occupancy, and precipitation;

4. Projected growth or decline in the demand for water and a description of the factors that control the growth or decline in demand for water; and

5. A description of how the water is used including a description and a percent estimate of the total volume of water used for each applicable process or need;

b. An evaluation of all water conservation opportunities employed, including:

1. An assessment of changes to historic water demand;

2. Leak detection and repair activities;

3. Water audits and preventative maintenance programs;

4. Employee education pertaining to water conservation practices; and

5. Other water conservation opportunities;

c. A detailed description of past and present water conservation efforts, effectiveness, and cost;

d. A description of water conservation best management practices and technologies applicable to the types of water-using processes;

e. A detailed summary of water conservation measures that might be implemented during the next 5 years including a quantitative estimate of the water savings associated with these measures;

f. An economic assessment of the cost to implement the water conservation plan; and

g. A detailed summary of any efforts to implement or develop new processes or technologies that may result in additional water conservation opportunities;

(4) For each affected water user in the WMPA, include a conservation implementation schedule with quantitative water use reduction targets, which includes:

a. A description of water conservation measures to be implemented;

b. Target dates for the implementation of water conservation measures; and

c. A description of a process to monitor and evaluate the results of, and compliance with, the water conservation plan.

(c) The conservation implementation schedule shall be based on the results of meetings and discussions with the affected water user.

(d) If, based on meetings and discussions with the affected water user, the department determines that no conservation measures will be implemented, then the conservation plan shall:

(1) Contain the statement, "No conservation measures are to be implemented," and no target dates or process descriptions as described in (4)b and (4)c above, respectively, shall be required;

(2) Not include target dates for implementation of water conservation measures; and

(3) Not include a description of a process to monitor and document results of water conservation measures.

(e) If the department develops a conservation implementation schedule that is not agreed to by the affected water user, the schedule in (4) above shall include the sentence "This conservation measure has not been agreed to by the affected water user."

(f) The economic assessment identified in (b)(3)f above shall:

(1) Include an estimate of implementation costs of the conservation plan for each affected water user;

(2) Incorporate the conservation implementation schedules in (b)(4) above; and

(3) Include any other identified economic factors not attributable to affected water users.

Source. #7901, eff 5-29-03

Env-Ws 1906.03 Water Use Plan.

(a) The department shall prepare a water use plan.

(b) The water use plan shall:

(1) Include the water use data and information collected under Env-Ws 1906.02(b)(3) to define water use patterns and needs of each affected water user within the WMPA;

(2) For each affected water user in the WMPA, include a report describing the potential for water use modification, sharing, or both, to meet protected instream flow requirements, including water use patterns and needs as determined in (1) above;

(3) With the assistance of the public utilities commission, assess the effect of the protected instream flow on each existing hydroelectric power facility within or upstream from the designated river or segment;

(4) For each affected water user in the WMPA, include an individual water use plan so that the net effect of implementation of all individual plans, in coordination with implementation of the dam management plan, is maintenance of the protected instream flows; and

(5) For each affected water user in the WMPA, include an implementation schedule for the individual water use plan.

(c) The department shall:

(1) Coordinate negotiations among affected dam owners, affected water users and other applicable interests towards water use and dam management that will meet protected instream flow requirements and the existing uses of reservoirs; and

(2) Prepare an economic assessment of the cost to implement the water use plan.

(d) The economic assessment shall:

(1) Include an estimate of implementation costs of the plan for each affected water user;

(2) Incorporate the implementation schedules in (b)(5) above; and

(3) Include any other identified economic factors not attributable to affected water users.

Source. #7901, eff 5-29-03

Env-Ws 1906.04 Dam Management Plan.

(a) The department shall prepare a dam management plan.

(b) The dam management plan shall:

(1) Include data and information from department sources, site visits, and interviews with each affected dam owner or their operator on characteristics and operational procedures of affected dams within the WMPA including:

a. The name of the dam;

b. The name of the town where the dam is located;

c. The name, address, and telephone number of owner, operator or both;

d. The emergency contact person and phone number;

e. The dam state ID number;

f. The dam status as either active or inactive;

g. The name of the water body impounded by dam and the downstream river;

h. The designated use(s) of the impoundment;

i. The elevation, in feet, of the recreational pool or height relative to the lowest spillway;

j. The elevation, in feet, of additional spillway crest(s) or height relative to the lowest spillway;

k. The elevation, in feet, of streambed at the dam centerline or the height relative to the lowest spillway;

l. The elevation, in feet, of the top of the dam or dam height relative to the lowest spillway;

m. The height of the dam, in feet, from toe to the highest point on the dam;

n. The freeboard, as defined in Env-Wr 101.16, in feet;

o. The type and dimensions of spillway control(s) or outlet works;

p. The surface area, in acres of impoundment at maximum impoundment;

q. The drainage area, in square miles;

r. The maximum storage, in acre-feet, which is the volume of water which could be impounded above the natural pond or stream elevation, with the water level at the top of dam, or with the water level at the highest elevation which could be hydrologically attained, if this elevation is below the top of dam;

s. The normal storage, in acre-feet, which is the volume of water impounded above the natural pond or stream elevation when the water level is at the spillway crest;

t. Descriptions of the type, dimensions, invert elevation, and when available, discharge capacity at the water surface elevation of normal storage, or rating curves, or both, of each outlet structure of the dam;

u. The maximum unoperated discharge, in cubic feet per second (cfs);

v. The design storm discharge, in cfs;

w. The estimated 50-year flood flow, in cfs;

x. The estimated 100-year flood flow, in cfs;

y. Any contractual obligations, minimum flow requirements and flowage rights;

z. An operation and maintenance plan summary;

aa. A description of any interests of riparian property owners to the impoundment; and

ab. A description of any water quality standards factors related to the impoundment;

(2) For each affected dam in the WMPA, include a report describing:

a. The potential water available for release to maintain protected instream flows;

b. The ecological and other impacts to the impoundment and downstream river reaches which might restrict the use of such waters for augmentation flows; and

c. The potential for dam management to meet instream flow requirements, including dam operation patterns, physical structure, and needs as determined in (b)(1) above;

(3) For each affected dam in the WMPA, include an individual dam management plan so that the net effect of implementation of all individual plans, in coordination with implementation of the water use plan, is maintenance of the protected instream flows; and

(4) For each affected dam in the WMPA, include an implementation schedule for the individual dam management plan.

(c) The department shall:

(1) Meet with each affected dam owner to explain protected instream flow requirements;

(2) Coordinate negotiations among affected dam owners, affected water users, and other applicable interests toward water use and dam management that will meet protected instream flow requirements and the existing uses of the reservoirs; and

(3) Prepare an economic assessment of the cost to implement the dam management plan.

(d) The economic assessment shall:

(1) Include an estimate of implementation costs of the plan for each affected dam owner;

(2) Incorporate the implementation schedules in (b)(4) above; and

(3) Include any other identified economic factors not attributable to affected dam owners.

Source. #7901, eff 5-29-03

Env-Ws 1906.05 Water Management Plan Document.

(a) The department shall prepare a water management plan document specifying the conservation measures and operational measures that will be implemented by each affected water user and affected dam operator in the WMPA to meet the protected instream flow requirements.

(b) The plan shall include an implementation schedule for each measure identified in (a) above.

(c) For affected water users engaged in agriculture or public water supply, the plan shall:

(1) Identify any local, state, or federal financial assistance programs that could provide funding for plan implementation;

(2) Estimate the amount of financial assistance available; and

(3) Estimate the schedule for receiving assistance.

(d) For affected water users engaged in agriculture or public water supply, the implementation schedule shall:

(1) Incorporate the availability and estimated schedule of financial assistance;

(2) Allow flexibility to account for unforeseen changes in availability and timetable of financial assistance if the affected water user is engaged in a good faith effort to procure such assistance.

(e) The department shall make the draft water management plan available for public review at least 30 days before the hearing and opportunity for public comment as specified in Env-Ws 1906.06.

Source. #7901, eff 5-29-03

Env-Ws 1906.06 Hearing and Opportunity for Public Comment on Water Management Plans.

(a) Prior to adoption of a water management plan for a designated river or segment, the department shall hold a public hearing, in accordance with Env-C 205, to receive public comment.

(b) The department shall use the comments received during the public hearing and comment period to review the proposed water management plan relative to the following factors:

(1) The outstanding characteristics identified in RSA 483:1;

(2) The resources identified in RSA 483:6, IV(a);

(3) Instream public uses identified in RSA 483:9-c;

(4) Water quality standards;

(5) The extent to which implementation of the water management plan will maintain the established protected instream flows;

(6) Whether there are affected water users or affected dam owners in the WMPA that have failed to provide information or participate in good faith in negotiations for development of the plan;

(7) The reasons affected water users or affected dam owners object to provisions of the proposed plan;

(8) Information relevant to conservation, water use, or dam operation which has not been considered in preparation of the proposed plan;

(9) Information relevant to implementation of the proposed plan; and

(10) Other information relevant to the proposed plan.

(c) The hearing shall be held in a community through or past which the designated river flows.

(d) At least 30 days before the hearing, the department shall issue a notice of the hearing in a newspaper of local circulation and send written notice of the public hearing to and solicit comment from the following:

(1) Affected water users in the WMPA;

(2) Affected dam owners in the WMPA;

(3) The Federal Energy Regulatory Commission, for each designated river with a licensed or exempted hydropower site;

(4) LMAC members;

(5) LRMAC members for the designated river;

(6) The governing body of each municipality through or past which the designated river flows;

(7) The National Park Service;

(8) The New Hampshire department of justice;

(9) The New Hampshire public utilities commission;

(10) RMAC members;

(11) The governor of any state which shares a designated river;

(12) The United States Environmental Protection Agency;

(13) The United States Fish And Wildlife Service;

(14) The United States Forest Service, for each designated river inside the White Mountain National Forest;

(15) The United States Geological Survey; and

(16) Persons who have requested in writing to be notified of the hearing.

(e) At the public hearing, the department shall specify a comment period which shall close at least 30 days after the hearing date, during which time the department shall accept written comments on the factors pertaining to the proposed water management plan.

Source. #7901, eff 5-29-03

Env-Ws 1906.07 Adoption of Water Management Plans.

(a) Within 60 days of the close of the public comment period, the department shall:

(1) Review all comments received; and

(2) Revise the plan if testimony received shows that the plan does not meet the criteria in (b) below.

(b) The commissioner shall adopt the plan if:

(1) The plan contains the 3 major elements described in Env-Ws 1906.01(b);

(2) The conservation plan contains goals and timelines for each affected water user;

(3) Implementation of the water management plan will result in maintenance of the established protected instream flows; and

(4) Implementation of the water management plan will enhance or not diminish the enjoyment of outstanding river characteristics including recreational, fisheries, wildlife, environmental, cultural, historical, archaeological, scientific, ecological, aesthetic, community significance, agriculture and public water supply as outstanding characteristics of the river or segment.

(c) The adopted water management plan shall:

(1) Be in writing;

(2) Summarize comments received by the department; and

(3) Explain how the comments affected the adopted plan.

(d) The department shall provide copies of the adopted plan to:

(1) Persons identified in Env-Ws 1906.06(d);

(2) Persons who submitted written comments on the draft plan; and

(3) Persons who requested to receive a copy of the plan.

Source. #7901, eff 5-29-03

Env-Ws 1906.08 Petition for Changes to an Adopted Water Management Plan.

(a) A person may file a petition with the department for change of an adopted plan when:

(1) There is a new affected water user in the WMPA;

(2) An existing affected water user desires to increase water use;

(3) An existing affected water user has changes in timing of water use;

(4) An existing affected water user has decreased water use; or

(5) There are changes in water use or operating conditions for an affected water user or affected dam owner.

(b) The petition shall be in writing.

(c) The petition shall include:

(1) The name, address, and daytime telephone number of the person petitioning for change;

(2) If the person petitioning for change is not an individual, the name of an individual who can be contacted on behalf of the organization petitioning for change;

(3) A clear and concise statement of the specific change being sought to the plan;

(4) An explanation of how the change to the adopted plan is consistent with maintenance of established protected instream flows and water quality standards;

(5) Documentation that all affected water users and affected dam owners to whom the change applies have agreed to the change, or if all have not agreed, an explanation of the reasons for failure to agree;

(6) If applicable, any factors the petitioner believes the department should reevaluate; and

(7) Data not available or considered at the time the plan was adopted.

(d) The department shall grant the petition if the information in the petition indicates that criteria in (a) above for changes to a water management plan are met, and if the petition is complete as described in (c) above.

(e) The department shall deny a petition for change that is based on information available to the requesting party when the water management plan was prepared, but not submitted to the department in a timely fashion.

(f) Within 30 days of receiving a petition for change, the department shall:

(1) Deny the petition and affirm the adopted plan; or

(2) Grant the petition and begin reconsideration of the provisions of the plan requested in the petition.

(g) The department's decision shall:

(1) Be in writing;

(2) Be sent to the person who requested the change of the water management plan and to any other person who has asked to be notified of the decision in writing;

(3) Be made available electronically to the general public; and

(4) State the reason(s) for the decision, whether the decision is to deny the petition or to grant the petition and reconsider the specified provisions of the water management plan.

(h) If the department grants the petition, the department shall within 30 days of the decision, initiate action to reconsider a water management plan by the processes described in Env-Ws 1906.01.

(i) The department shall initiate action to reconsider a water management plan by the processes described in Env-Ws 1906.01 if there are changed conditions in the watershed that warrant re-evaluation of the plan.

Source. #7901, eff 5-29-03

PART Env-Ws 1907 ADMINISTRATION OF WATER MANAGEMENT PLANS

Env-Ws 1907.01 Compliance with Adopted Water Management Plan. Affected water users and affected dam owners shall comply with the provisions of an adopted water management plan.

Source. #7901, eff 5-29-03

Env-Ws 1907.02 Protected Instream Flows and Water Quality Criteria. Protected instream flows established by the commissioner shall serve as water quality criteria for the purpose of administration of water quality standards by the department under the federal Clean Water Act.

Source. #7901, eff 5-29-03

PART Env-Ws 1908 WAIVERS

Env-Ws 1908.01 Waivers

(a) The rules contained in this part are intended to apply to a variety of conditions and circumstances. It is recognized that strict compliance with all rules prescribed herein might not fit every conceivable situation. Affected persons may request a waiver of specific rules outlined in this part in accordance with paragraph (b) below.

(b) All requests for waivers shall:

(1) Be submitted in writing to the department; and

(2) Include the following information:

a. A description of the designated river and water use, instream public use or resource to which the waiver request relates;

b. A specific reference to the section of the rule for which a waiver is being sought;

c. A full explanation of why a waiver is necessary and demonstration of the effect caused if the rule is adhered to;

d. A full explanation of the alternatives for which a waiver is sought with supporting data; and

e. A full explanation of how the alternatives for which a waiver is sought are consistent with the intent of RSA 483:9-c, would have a just result, and would adequately protect human health and the environment.

(c) The department shall grant a waiver if the department finds that the alternatives proposed are at least equivalent to the requirements contained in this chapter, meet water quality standards, and are adequate to ensure that the provisions of RSA 483:9-c are met.

(d) The department shall not grant any waiver that contravenes the intent of any rule, or conflicts with any statute.

(e) The department shall issue a written response to a request for a waiver.

(f) If the waiver is denied, the department shall specifically set forth the reason(s) for the denial.

(g) The department shall grant a waiver for a specific time period not to exceed 10 years.

Source. #7901, eff 5-29-03

APPENDIX

New Hampshire Rule	NH State Statute
Env-Ws 1901.01 - Env-Ws 1901.02(a)	RSA 483:9-c, I; RSA 483:11, IV; and Law of 2002, Chapter 278:2, I
Env-Ws 1901.02(b) and (c)	RSA 483:9-a, V and RSA 483:9aa, V
Part Env-Ws 1902	RSA 541-A:7
Part Env-Ws 1903	RSA 483:9-c, I
Part Env-Ws 1904	Laws of 2002, Chapter 278:2, I+II
Env-Ws 1905.01 – 1905.02	RSA 483:9-c, I
Env-Ws 1905.03 (a)	RSA 483:9-c, II
Env-Ws 1905.03 (b) - (f) and 1905.04 [except 1905.04(b)(4)]	RSA 483:9-c, I
Env-Ws 1905.04(b)(4)	RSA 483:9-c, III
Env-Ws 1905.05 (a)	RSA 483:9-c, I
Env-Ws 1905.05 (b)	RSA 483:9-c, VI
Env-Ws 1905.05(c) - (k)	RSA 483:9-c, I
Env-Ws 1906.01(a)	Laws of 2002, Chapter 278:2, I and RSA 483:9-c, I
Env-Ws 1906.01(b) and (c), and Env-Ws 1906.02 – 1906.08	RSA 483:9-c, I
Env-Ws 1907.01	RSA 483:9-c, IV
Env-Ws 1907.02	RSA 485-A:8
Part Env-Ws 1908	RSA 541-A:22, IV

APPENDIX E

AGREEMENT
BETWEEN TOWN OF DURHAM, NEW HAMPSHIRE
AND
THE TOWN OF LEE, NEW HAMPSHIRE
FOR
THE DEVELOPMENT OF A WELL AND TRANSMISSION LINE
BY THE TOWN OF DURHAM LOCATED WITHIN THE TOWN OF LEE

THIS AGREEMENT, made as of June 27, 1984, between the Town of Durham and the Town of Lee, New Hampshire, both municipal corporations within the County of Strafford, and the State of New Hampshire.

The Town of Durham intends to investigate, test and evaluate a certain potential groundwater well site on property owned by the Town of Durham within the bounds of the Town of Lee. Said well site in the Town of Lee is identified on Town of Lee tax map parcel #5-6-1 and referenced on attached plan.

The Town of Durham agrees to convey to the Town of Lee upon successful development of a permanent and operational well on the property described above the following rights.

1. The Town of Lee will be granted by the Town of Durham specified daily water reserves as follows.

Once the well is developed, it will have a specified design capacity of X amount of gallons per day. Both parties understand that the actual well capacity can change as time passes. The Town of Durham agrees to set a yearly daily capacity level of the well from which the Town of Lee may purchase a portion under the following terms and conditions:

A. On August 1st of each year, it will be determined by the Town of Durham and its Engineer, the projected daily safe output of the well for the following year.

B. The Town of Lee shall be granted on a yearly basis no later than September 1st of each year a reserve of 10 percent per day of the daily maximum safe yield of the well and this formula holds true up to a safe daily yield of the well of 700,000 gallons per day resulting in a maximum reserve of 70,000 gallons per day.

C. If it is determined on a yearly basis that the well has a safe daily capacity of greater than 700,000 gallons per day, the Town of Lee will be granted up to 15 percent of reserve based on a maximum safe daily output of one million gallons per day or a maximum reserve of 150,000 gallons per day.

D. Durham agrees that upon the Town of Lee consuming 75 percent of its maximum reserve of 70,000 gallons per day, the Town of Durham is obligated to re-negotiate with the Town of Lee an increase in reserve up to 15 percent of each 100,000 gallons produced on a daily basis up to a daily safe yield of one million gallons per day of the well or a maximum of 150,000 gallons per day.

E. The Town of Durham agrees that upon successful development of this well and incorporation of said source into the Durham Water system, it will install and maintain hydrants at 500 foot intervals along said transmission line to connect the well to the Durham water system. Use of these hydrants by the Town of Lee shall be for the sole Purpose of fire fighting. Any other use must be approved by the Town of Durham.

F. The Town of Durham agrees that while tying said water source into the Durham water system, it will install corporations in its transmission line at 250 foot intervals to provide service to abutters providing they meet the same terms and conditions of any water customer within the Town of Durham. The Town of Lee acknowledges that all water consumed by these abutters becomes part of the reserve.

2. In consideration of the above covenants, the Town of Lee agrees to the following conditions with the Town of Durham:

A. The Town of Durham has an obligation to provide the Town of Lee a prescribed amount of water on a daily basis at the well site. The Town of Lee recognizes its responsibility that in order to utilize this water, it must provide the easements, booster stations, transmission lines, standpipes, and other facilities to convey this water reserve from the Town of Durham well site. The Town of Lee shall be responsible for all development costs. In addition, it must purchase the water used consistent with what it cost the Town of Durham to produce a million gallons of water from the well. Costs shall include energy, treatment, depreciation, monitoring, testing, capital improvements to the well, and labor. Other costs both capital and operating costs in the Durham water system may not be chargeable to the Town of Lee for water purchased from the well. Costs for water sold to Lee will be determined on a yearly basis for the coming year. The Town of Durham is obligated to the Town of Lee to provide an official audit of all costs to operate the well on a yearly basis.

B. The Town of Lee recognizes that Durham is only responsible to its pre-determined reserve as defined in this agreement on a daily basis, based on the well design and safe consumption parimeters which would not have an adverse impact on the capacity of the well field at any time. The Town of Durham is not responsible for holding reserves if the Town of Lee does not consume its proportionate share on a daily basis, said share is forever lost to the Town of Lee.

C. The Town of Lee agrees upon successful completion of the well, it will allow the Town of Durham the right to construct and maintain a transmission water line along said town roads as shown on attached plan. The Town of Durham agrees to construct this line in conformance with accepted engineering practices.

D. It is understood by both parties, that the protection of the aquifer in the location of the above described well is in the best interest of both parties. The Lee Board of Selectmen agree to support and enact legislation or other restrictions upon development or uses that could have an adverse impact on the aquifer.

E. Any extensions of service from the well by the Town of Lee must be designed by a professional engineer and approved by the Town of Durham and the State of New Hampshire Water Supply Pollution Control Commission.

F. The Town of Lee shall require a meter to be placed to record daily consumption of the well, and records and inspection logs must be provided by the Town of Durham to insure accurate daily consumption.

G. The Town of Lee agrees to meter all water which is taken from the Durham well. The metering and recordkeeping procedures shall be approved by the Town of Durham.

3. Both Towns in signing this Agreement, realize that a water resource must be managed. The Town of Durham recognizes that although they have the right to take water from its well under the Doctrine of reasonable use, it has an obligation to cooperate with the Town of Lee and abutters to insure protection of the aquifer. Both parties agree that before the start up of this well, a reasonable plan will be in place to protect abutters; existing water supplies against being adversely affected by the Town of Durham well. This plan will become an addendum to this Agreement. The Town of Lee recognizes the right of the Town of Durham to take water from the well site, and releases its right for further claim on reserves from this well field unless specifically agreed to by both parties.

4. Both Boards of Selectmen will meet at least once per year, to discuss operation of these facilities.

5. The Town of Lee and Durham recognize the need to plan for the use of water resources on a regional basis. Both communities agree to appoint a joint committee to discuss and recommend to the joint Board of Selectmen from the Towns of Lee and Durham, the feasibility and recommendations on a comprehensive water district plan by October 1, 1986. It is agreed, the Town of Madbury will be invited to join and become part of this process.

6. This Agreement may be modified at anytime, providing both Boards of Selectmen agree to reopen discussions, and both boards vote in the majority to modify this contract.

7. The Town of Durham understands that if the proposed well is not developed and in service by September 1, 1986, this Agreement becomes null and void, unless both Boards of Selectmen agree to an extension of time.

This Agreement remains in effect for the life of the proposed well unless modified or abolished with the mutual Agreement of both parties.

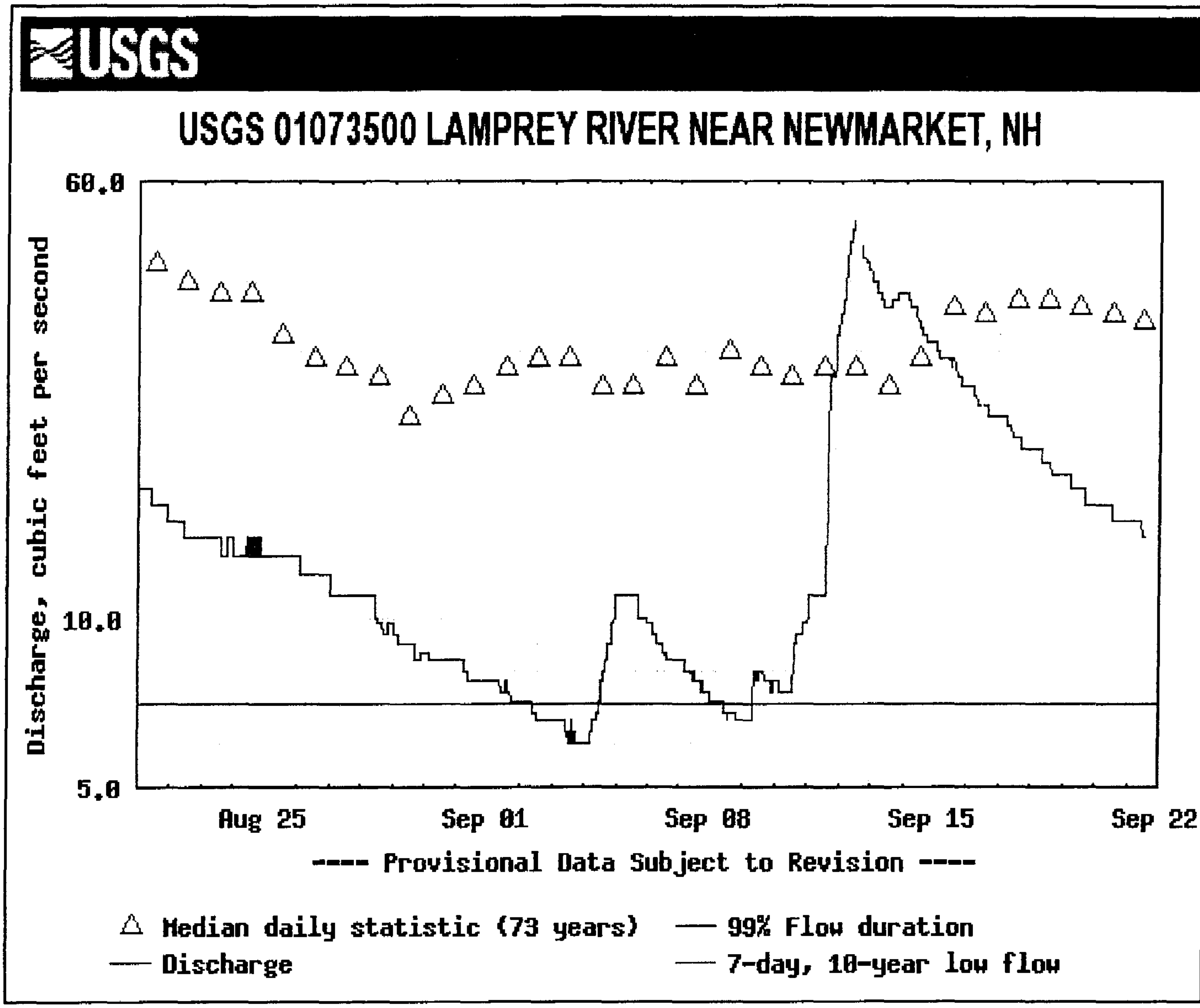
In the event that any Article, section or portion of this Agreement be in violation of State law or be found to be unlawful and unenforceable by any court of competent jurisdiction, or have the effect of loss to the Town of funds made available through Federal Law, rule or regulation, then such specific Article, Section or portion shall be amended to the extent necessary to conform with such law, rule or regulation, but the remainder of this Agreement shall continue in full force and effect.

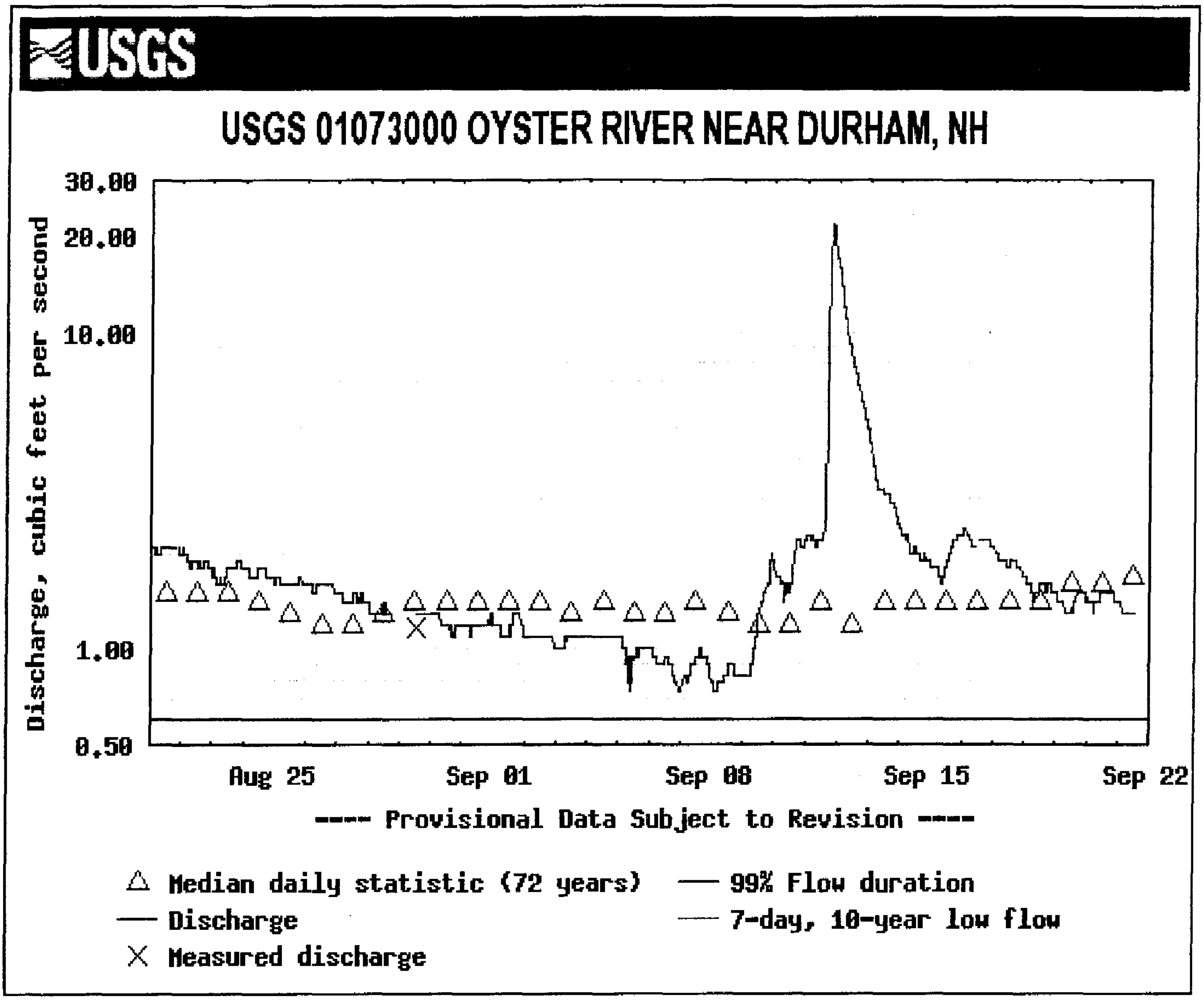
However, it is expressly understood by the parties hereto that this Agreement is not intended for the benefit of any third party. It is solely to protect the Towns from any legal or equitable claim and all costs and expenses arising from the failure of the Towns to perform its obligations hereunder.

DATED AT Durham, New Hampshire, this 27th day of June, 1984.

Witness:	TOWN OF LEE
	Board of Selectmen
George Crombie	Shirley Clark
George Crombie	Wallace E. Dennis
George Crombie	Joseph P. Ford
	TOWN OF DURHAM
	Board of Selectmen
George Crombie	Norman W. Stiles, Chm
George Crombie	Anne E. Goodman
George Crombie	James Chamberlin
George Crombie	Guy Hodgin
George Crombie	Patricia L. Fisk

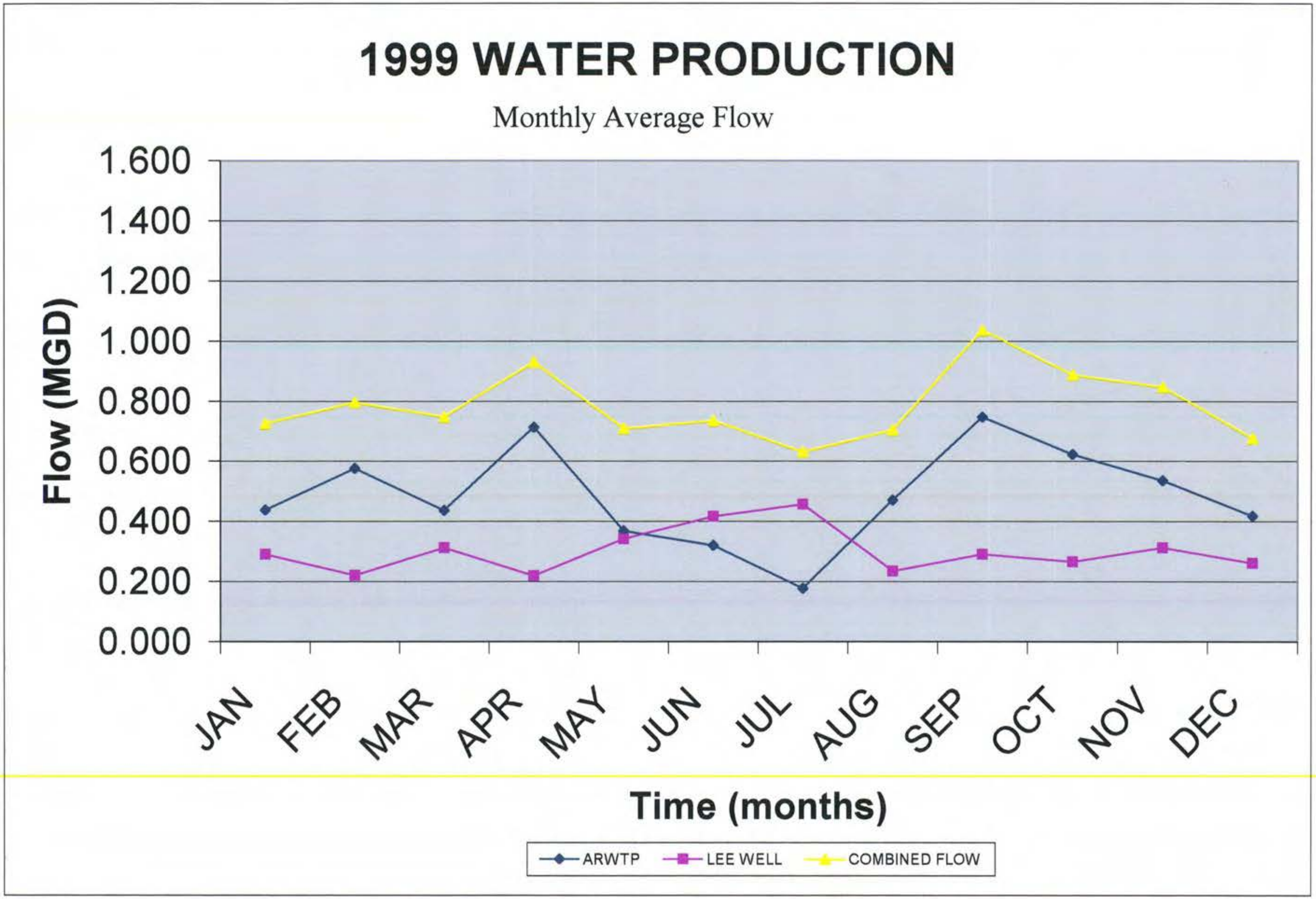
APPENDIX F

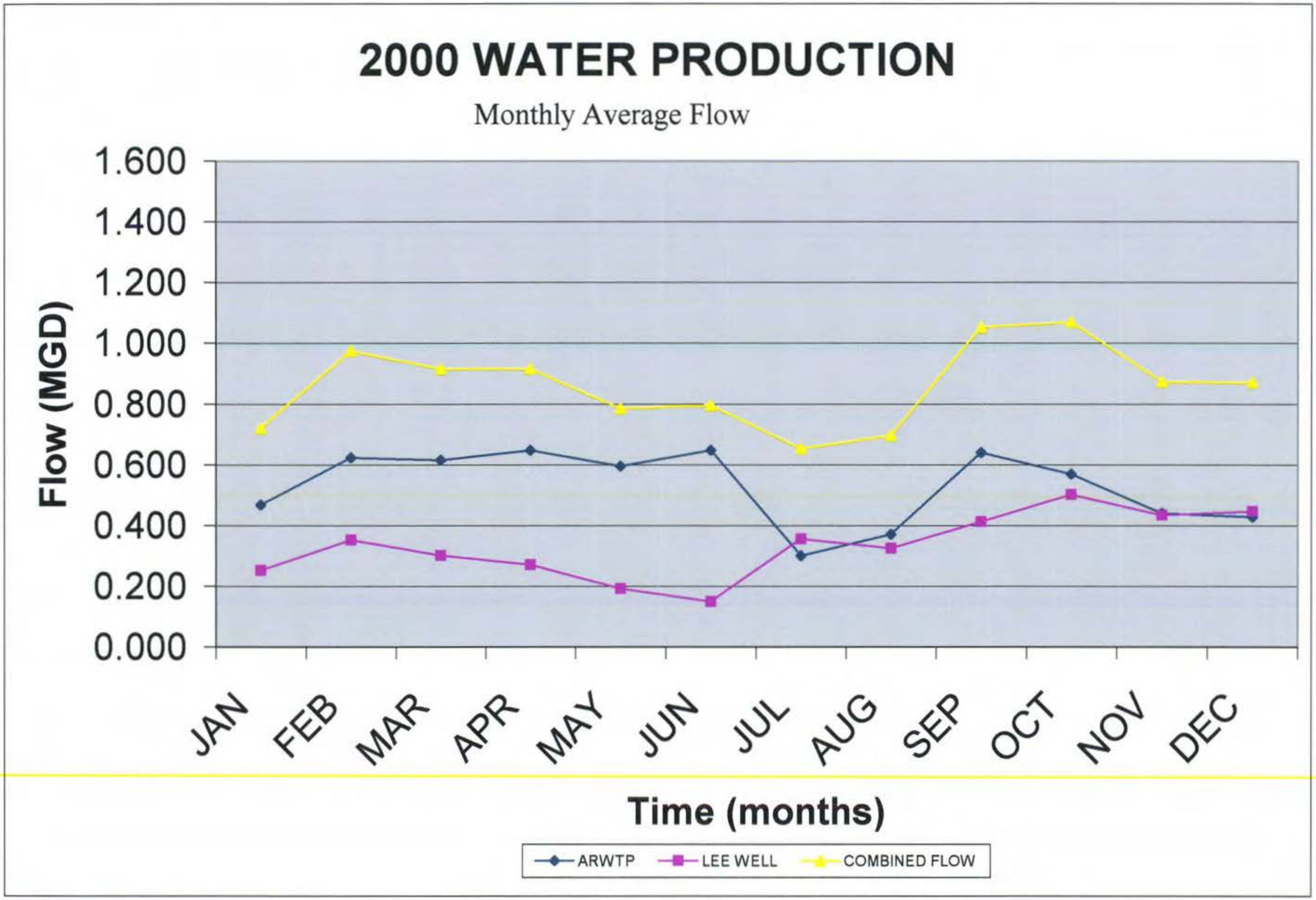

USGS
USGS 01073500 LAMPREY RIVER NEAR NEWMARKET, NH
60.0
10.0
5.0
Discharge, cubic feet per second
Aug 25
Sep 01
Sep 08
Sep 15
Sep 22
---- Provisional Data Subject to Revision ----
Median daily statistic (73 years)
99% Flow duration
Discharge
7-day, 10-year low flow

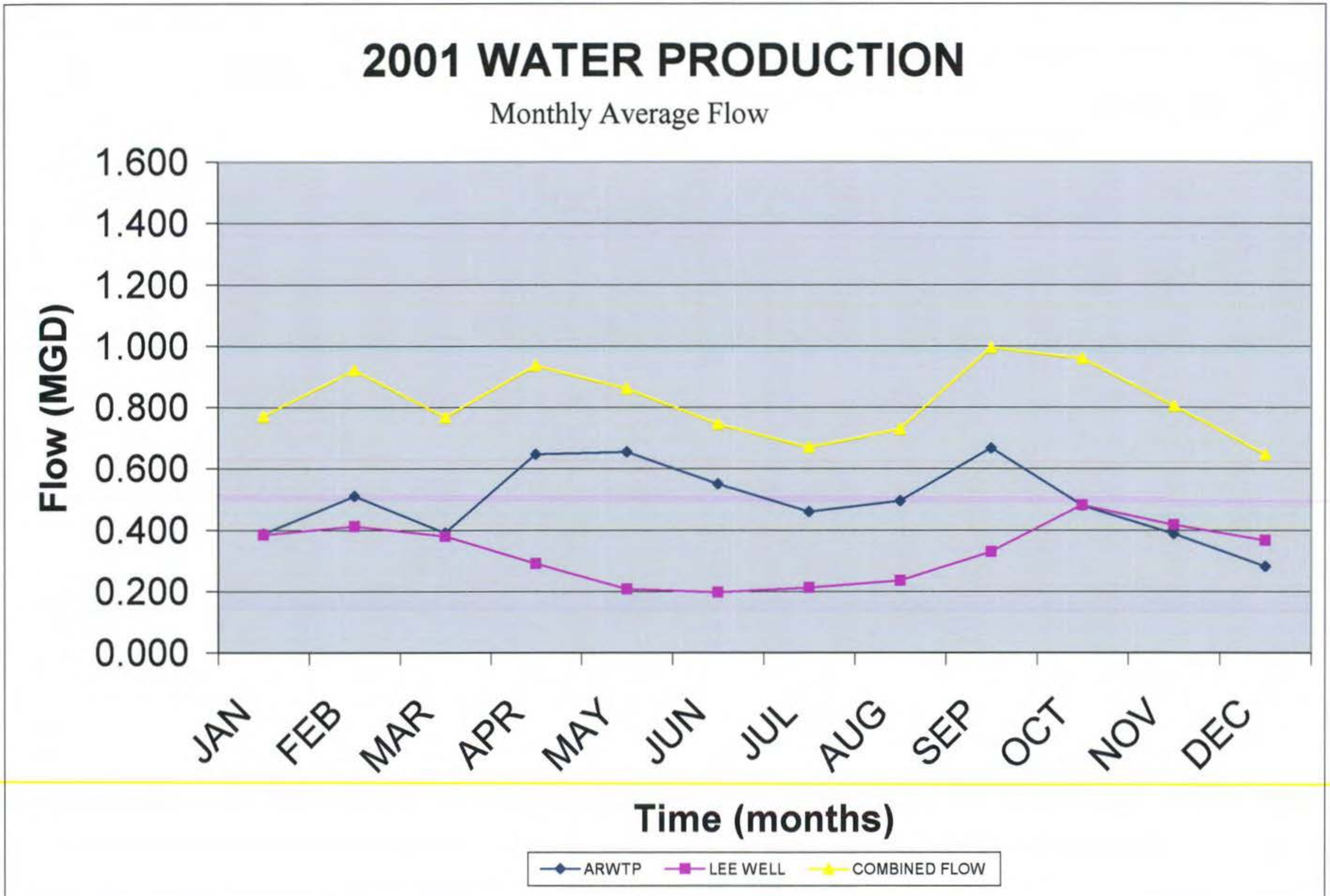

USGS
USGS 01073000 OYSTER RIVER NEAR DURHAM, NH
30.00
20.00
10.00
1.00
0.50
Discharge, cubic feet per second
Aug 25
Sep 01
Sep 08
Sep 15
Sep 22
---- Provisional Data Subject to Revision ----
Median daily statistic (72 years)
Discharge
Measured discharge
99% Flow duration
7-day, 10-year low flow

Comparison of Lamprey and Oyster River Flows with WTP Production August - September 2007					
Date	Lamprey River Flow	Oyster River Flow	Oyster River Flow	WTP Production	OR Flow - WTP Prod.
	cfs	cfs	gpd	gpd	gpd
8/20/2007	18.92	2.44	1,574,633	464,000	1,110,633
8/21/2007	16.32	2.07	1,339,044	795,000	544,044
8/22/2007	14.45	1.88	1,217,819	261,000	956,819
8/23/2007	13.76	1.75	1,130,303	616,000	514,303
8/24/2007	13.23	1.74	1,123,571	499,000	624,571
8/25/2007	13.00	1.62	1,048,846	579,000	469,846
8/26/2007	12.03	1.58	1,018,552	518,000	500,552
8/27/2007	11.03	1.44	927,911	525,000	402,911
8/28/2007	10.29	1.32	853,079	583,000	270,079
8/29/2007	8.93	1.31	848,149	705,000	143,149
8/30/2007	8.44	1.22	788,990	772,000	16,990
8/31/2007	7.91	1.21	779,566	791,000	-11,434
9/1/2007	7.44	1.19	772,160	887,000	-114,840
9/2/2007	6.81	1.09	705,514	896,000	-190,486
9/3/2007	6.33	1.07	692,050	853,000	-160,950
9/4/2007	7.67	1.10	710,899	1,000,000	-289,101
9/5/2007	10.70	0.98	631,462	924,000	-292,538
9/6/2007	8.86	0.88	571,816	537,000	34,816
9/7/2007	7.80	0.87	565,151	997,000	-431,849
9/8/2007	6.87	0.81	524,423	566,000	-41,577
9/9/2007	7.41	1.26	815,986	378,000	437,986
9/10/2007	8.29	1.82	1,176,754	523,000	653,754
9/11/2007	17.18	7.07	4,569,682	496,000	4,073,682
9/12/2007	42.30	8.83	5,708,736	494,000	5,214,736
9/13/2007	37.44	3.22	2,081,534	569,000	1,512,534
9/14/2007	33.72	2.06	1,333,609	464,000	869,609
9/15/2007	28.06	1.95	1,258,884	0	1,258,884
9/16/2007	24.08	2.21	1,427,184	562,000	865,184

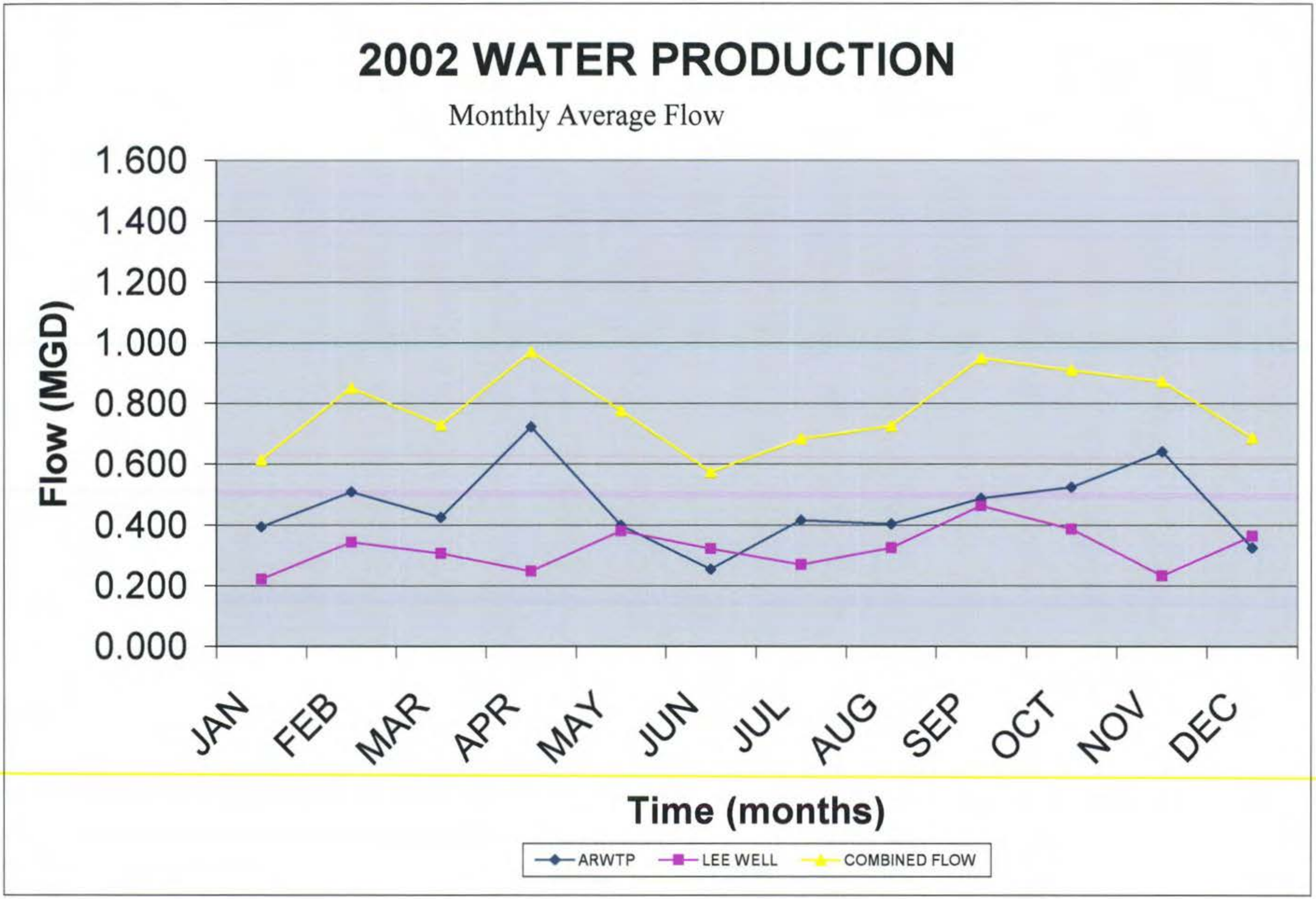
APPENDIX G

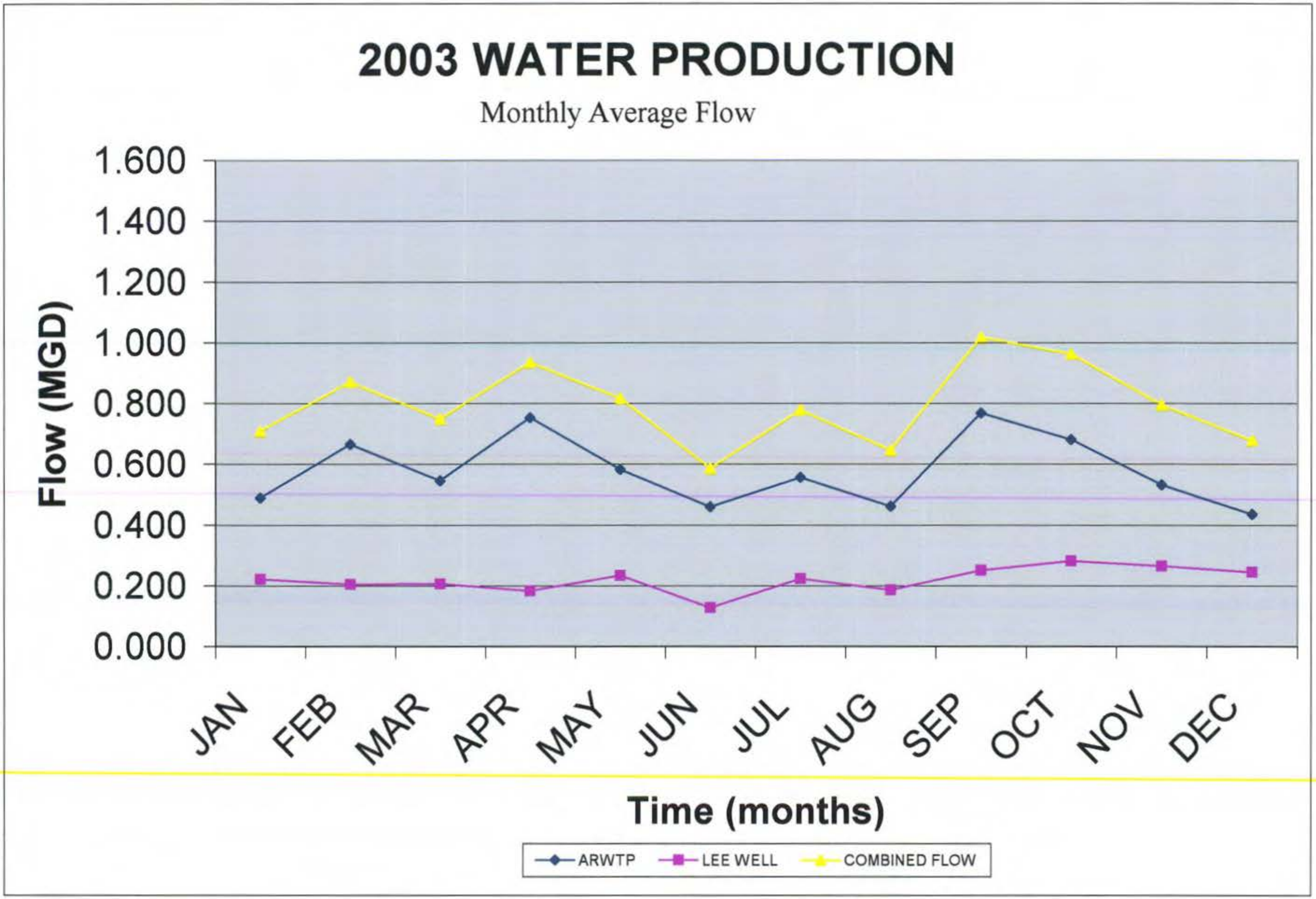

1999 WATER PRODUCTION
Monthly Average Flow
Flow (MGD)
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)
ARWTP
LEE WELL
COMBINED FLOW


2000 WATER PRODUCTION
Monthly Average Flow
Flow (MGD)
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)
ARWTP
LEE WELL
COMBINED FLOW

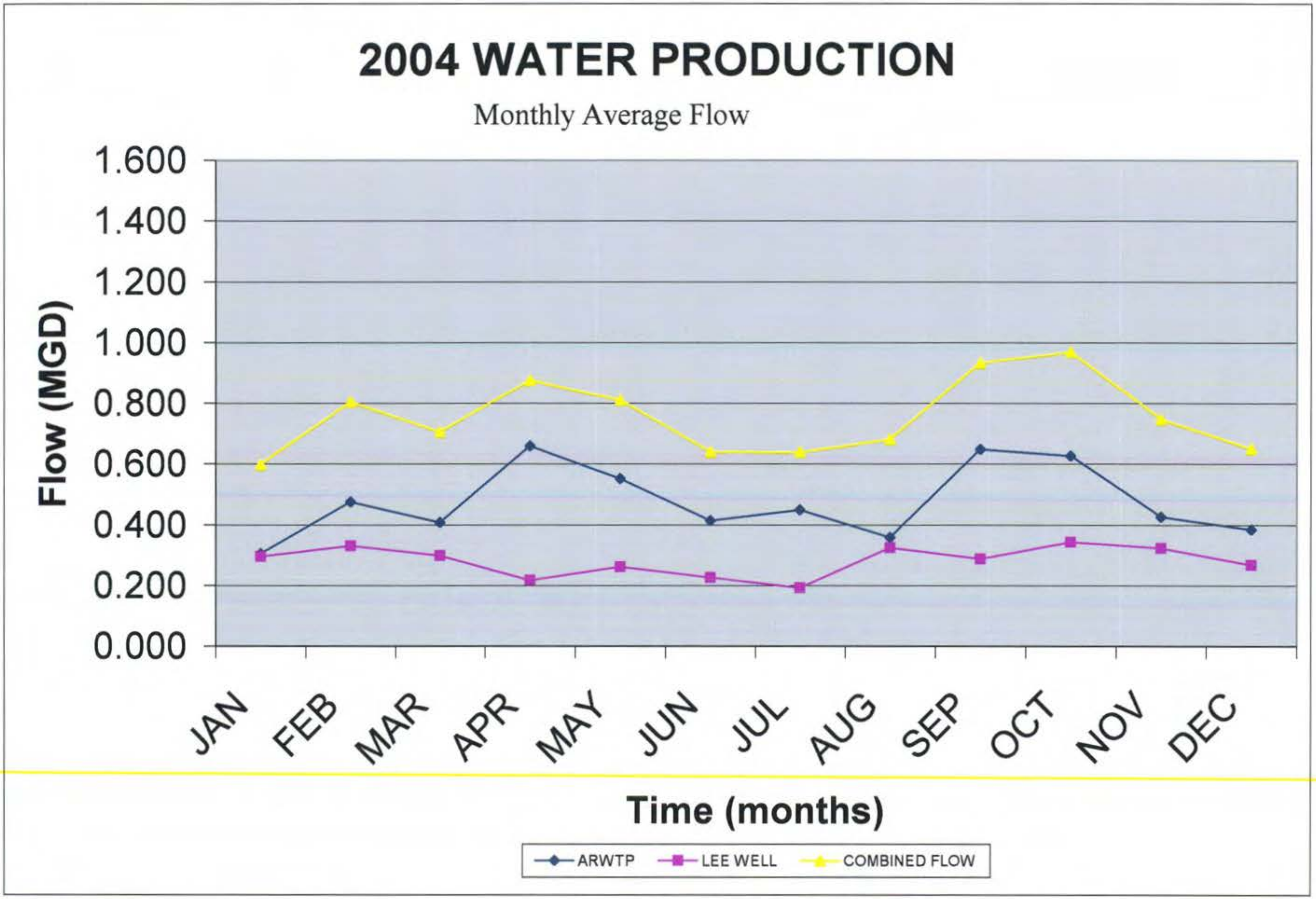


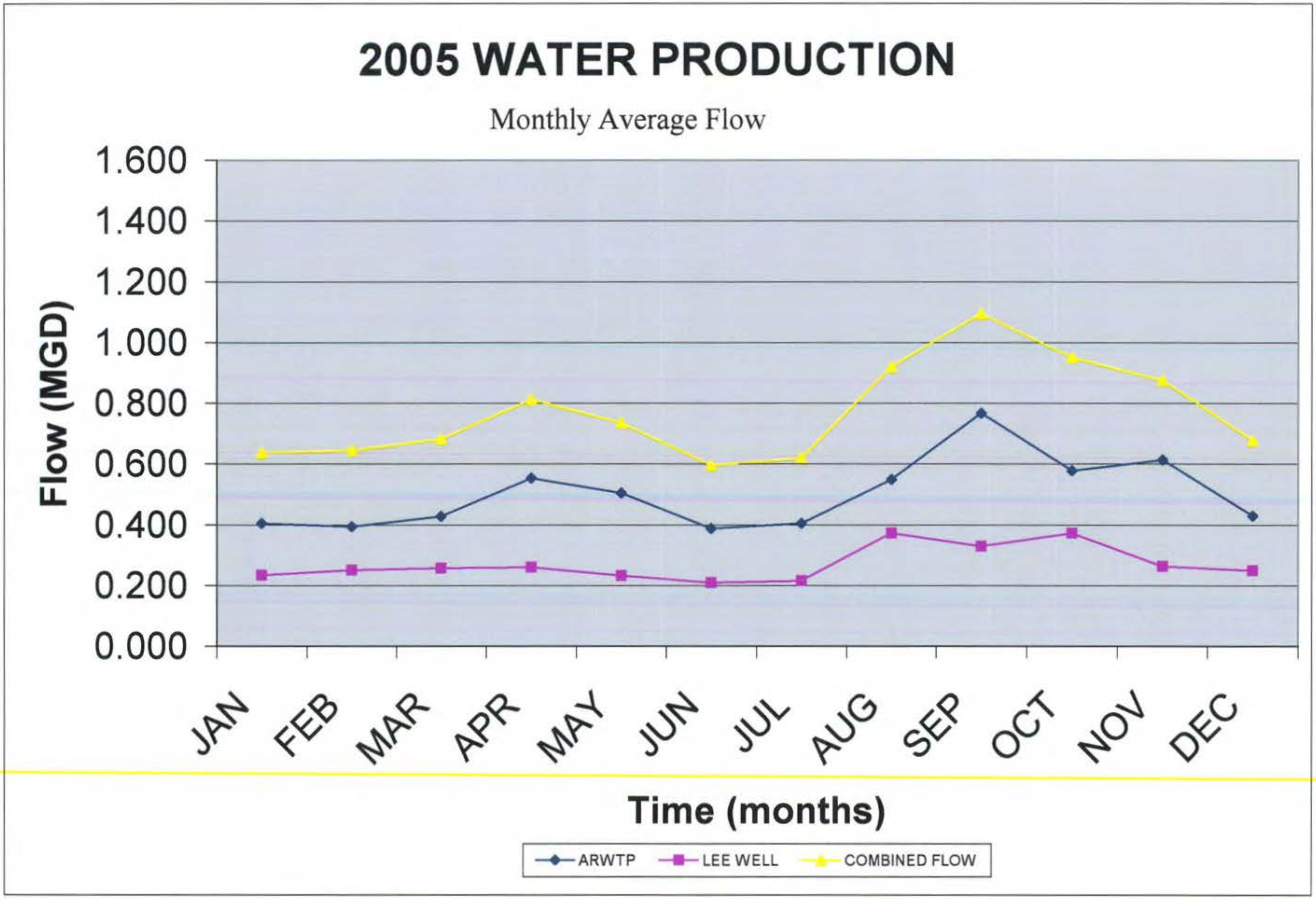
2001 WATER PRODUCTION
Monthly Average Flow
Flow (MGD)
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)
ARWTP
LEE WELL
COMBINED FLOW

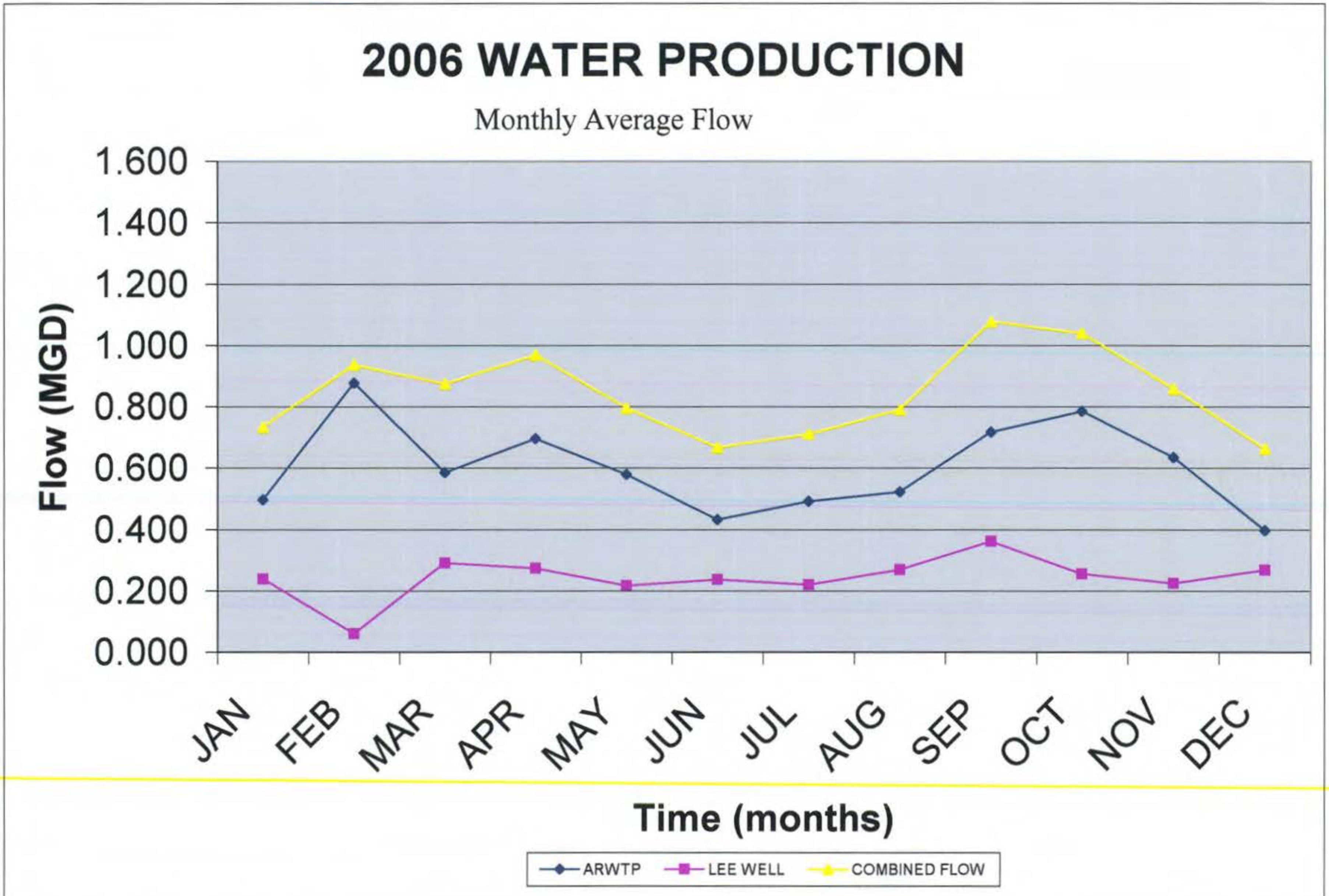

2002 WATER PRODUCTION
Monthly Average Flow
Flow (MGD)
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)
ARWTP
LEE WELL
COMBINED FLOW



2003 WATER PRODUCTION
Monthly Average Flow
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Flow (MGD)
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)
ARWTP
LEE WELL
COMBINED FLOW

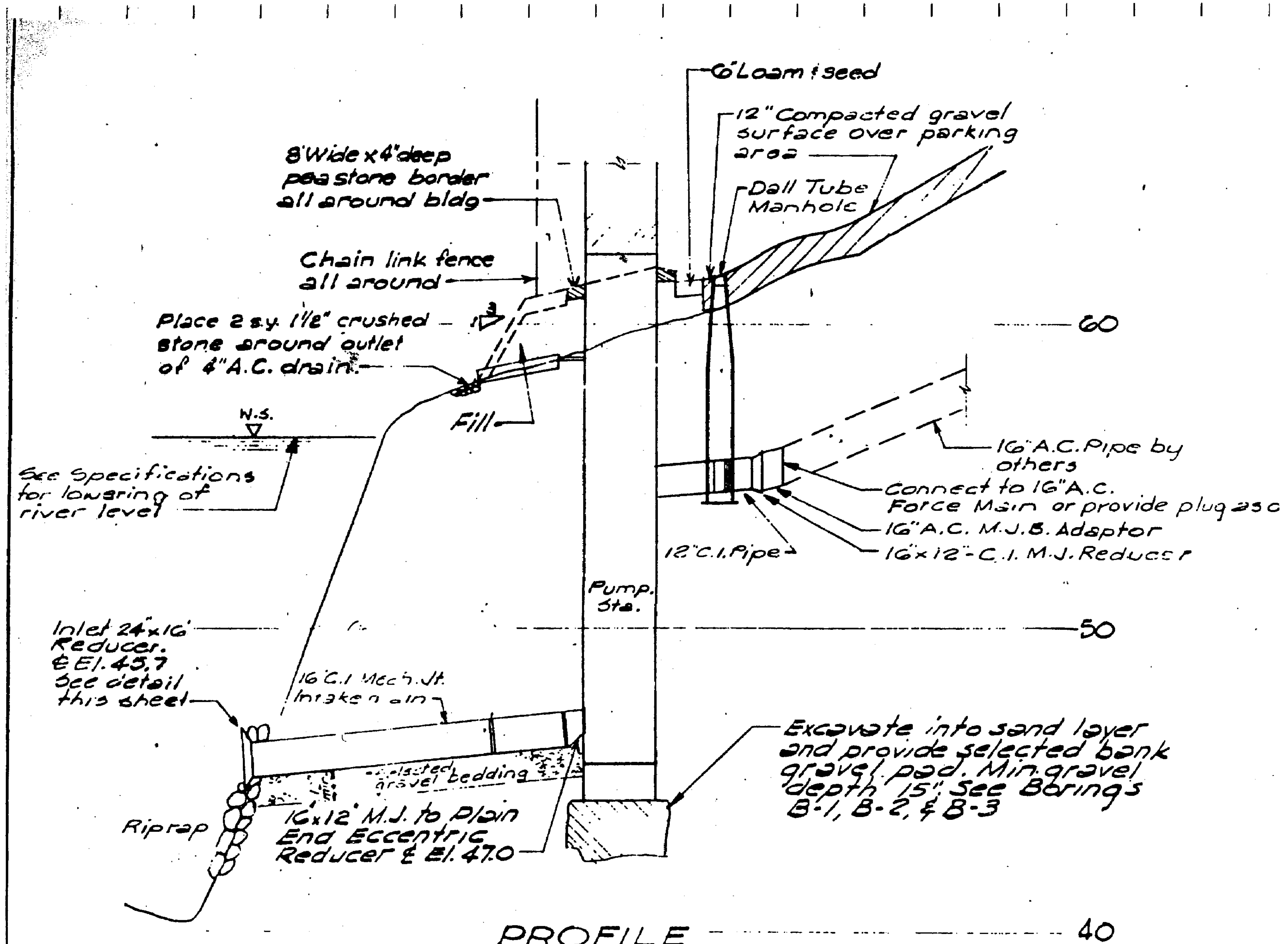

2004 WATER PRODUCTION
Monthly Average Flow
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Flow (MGD)
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)
ARWTP
LEE WELL
COMBINED FLOW


2005 WATER PRODUCTION
Monthly Average Flow
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Flow (MGD)
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)
ARWTP
LEE WELL
COMBINED FLOW



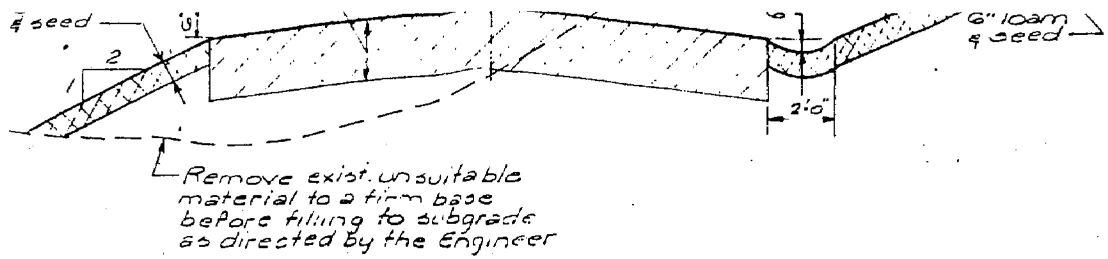
2006 WATER PRODUCTION
Monthly Average Flow
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Flow (MGD)
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Time (months)
ARWTP
LEE WELL
COMBINED FLOW

APPENDIX H



PROFILE

Scales: Hor. 1" = 20'
Vert. 1" = 4'



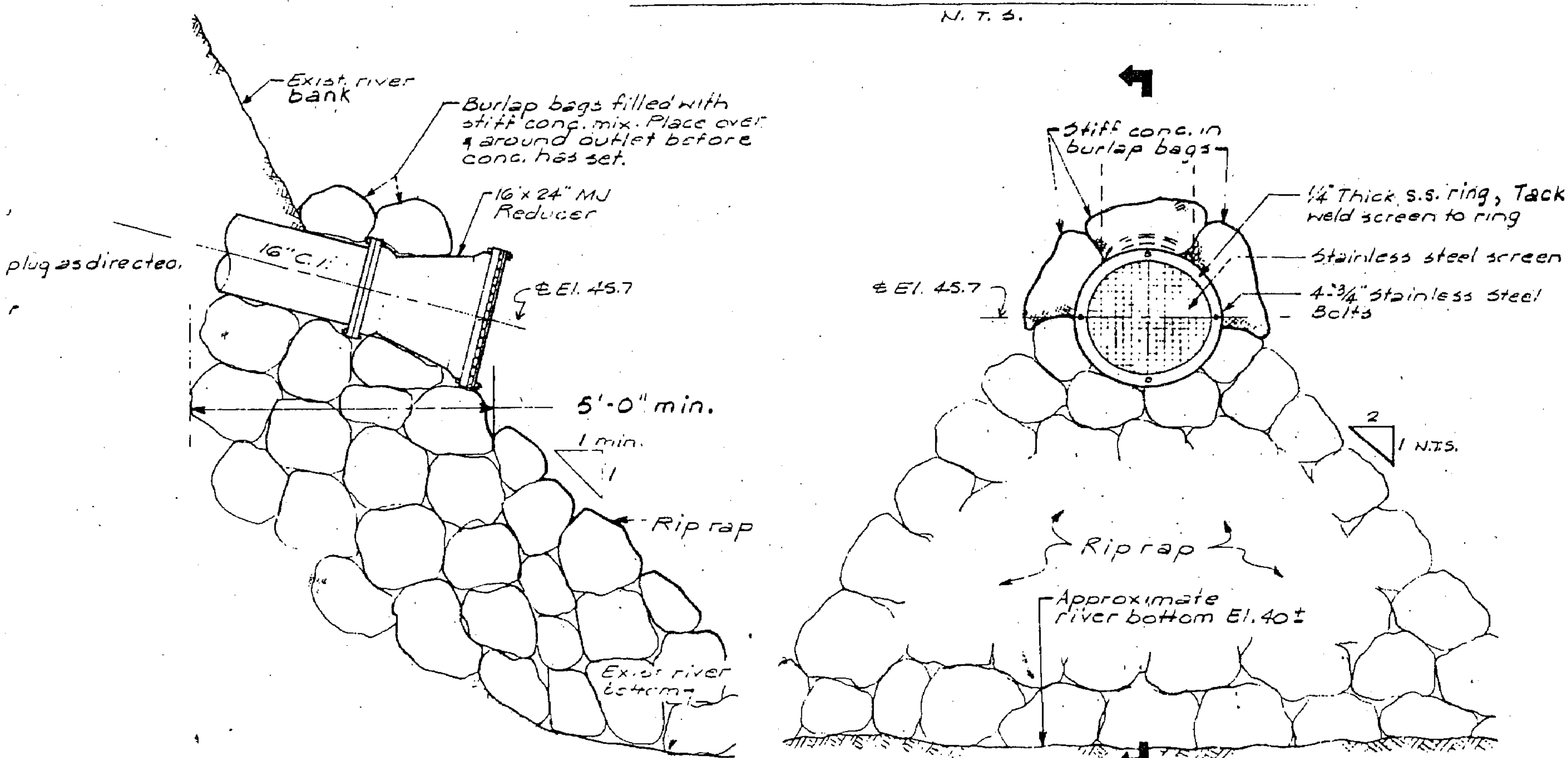
TYPICAL PARKING AREA SECTION

N. T. S.

1. All

2. Pla.
Dre

3. Not



SECTION

ELEVATION

INLET DETAILS

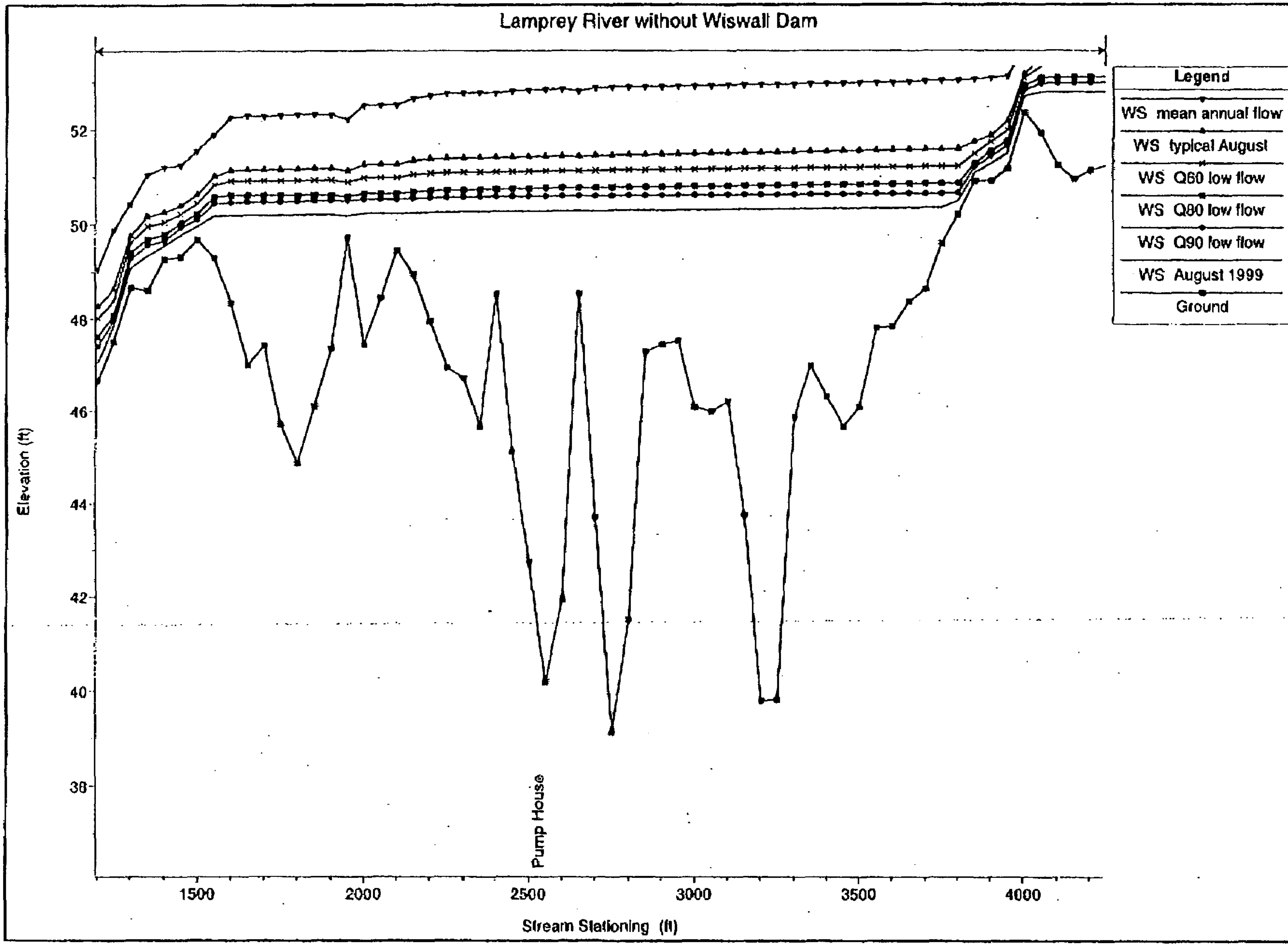
Scale 3/8" = 1'-0"

5/4/72	RT	REVIS.
Date	Ch'k'd.	

Drawn by: G.O

Checked by: WEM

Approved by: PAB



Lamprey River without Wiswall Dam
Legend
WS mean annual flow
WS typical August
WS Q60 low flow
WS Q80 low flow
WS Q90 low flow
WS August 1999
Ground
Elevation (ft)
52
50
48
46
44
42
40
38
Pump House
1500
2000
2500
3000
3500
4000
Stream Stationing (ft)

Lamprey River Flow Measurements Upstream of Wiswall Dam Impoundment

Location: 700 Ft Downstream of Lee Hook Road Bridge
Note: Small Tributary is Just Downstream of Gaging Section

Measurement Method: Velocity-Area Discharge Method

Equipment: Marsh McBirney Electronic Velocity Meter
Wading Rod
Tape

Date (mo-dd-yr)	Staff Gage Reading (in)	Staff Gage Reading (cm)	Lamprey Flow (cfs)	Tributary Flow (cfs)	Total Flow (cfs)
9/10/2002	30-5/8	78.1	3.72	0.26	3.98
9/12/2002	31-3/16	79.7	2.34	0.23	2.57
9/16/2002	31	79.2	---	---	---
9/17/2002	31-1/8	79.5	2.76	0.25	3.01
9/20/2002	31	79.0	3.02	0.20	3.22
9/23/2002	28.8??	73.2	10.01	0.00	10.01
9/29/2002	29	74.0	9.08	0.09	9.17
10/3/2002	29-13/16	76.3	5.81	0.27	6.08
10/6/2002	30-3/8	77.6	---	---	---
10/9/2002	30-7/16	77.8	---	---	---

APPENDIX I

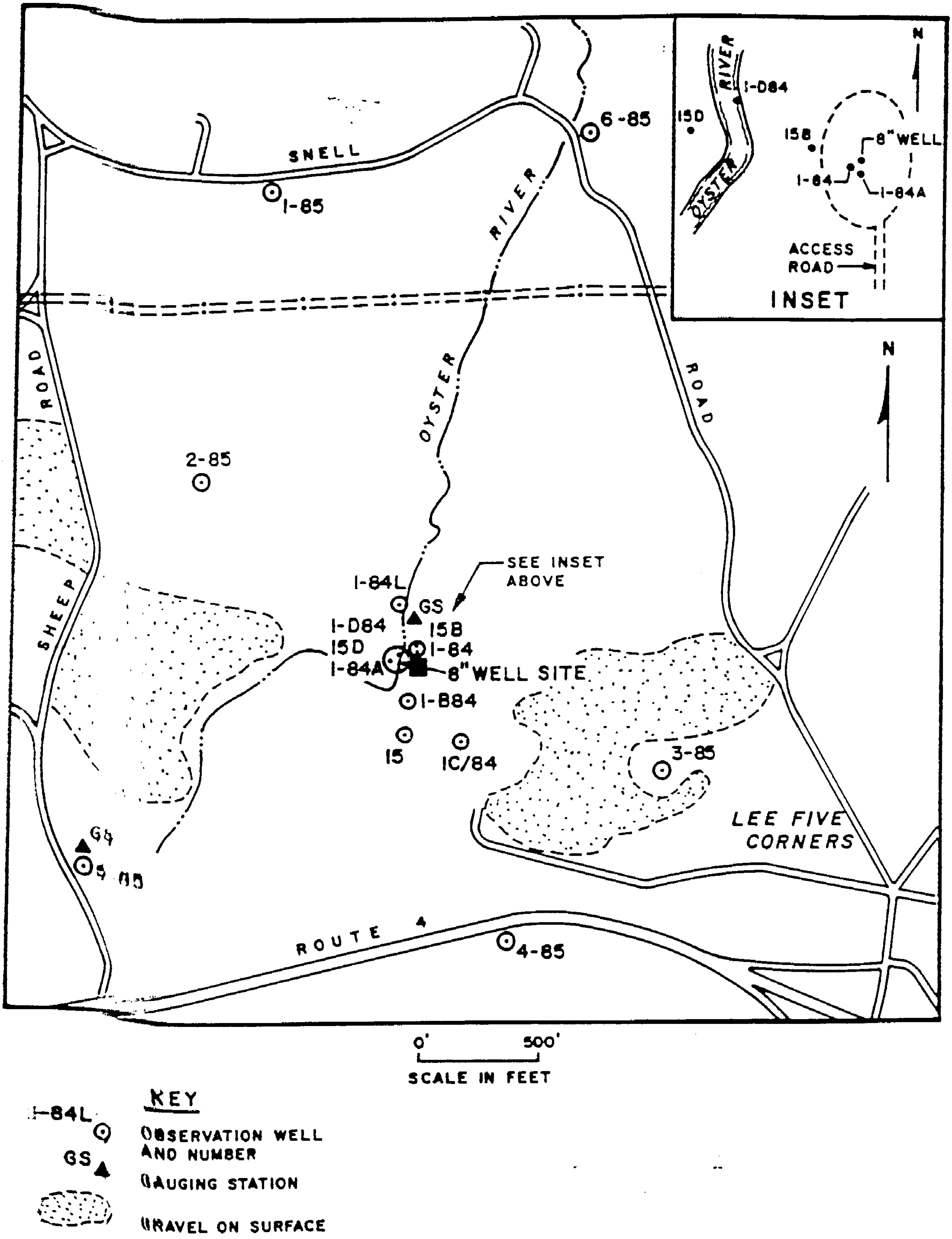


Figure 2

SITE MAP

TOWN OF DURHAM - MONITORING WELL READINGS FOR THE LEE WELL

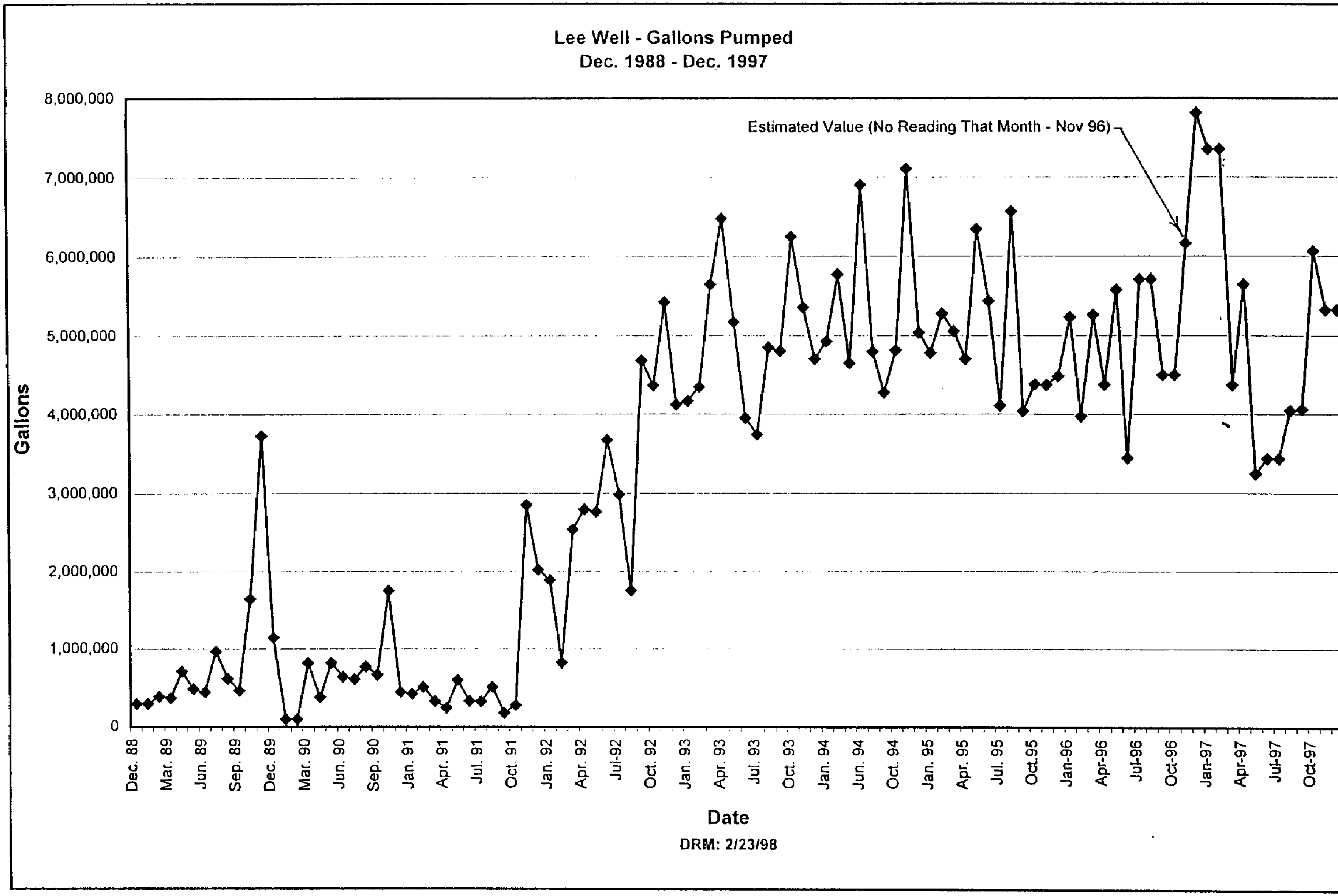
1999

(All readings shown are in feet. The MAIN reading relates to the water level over the probe)

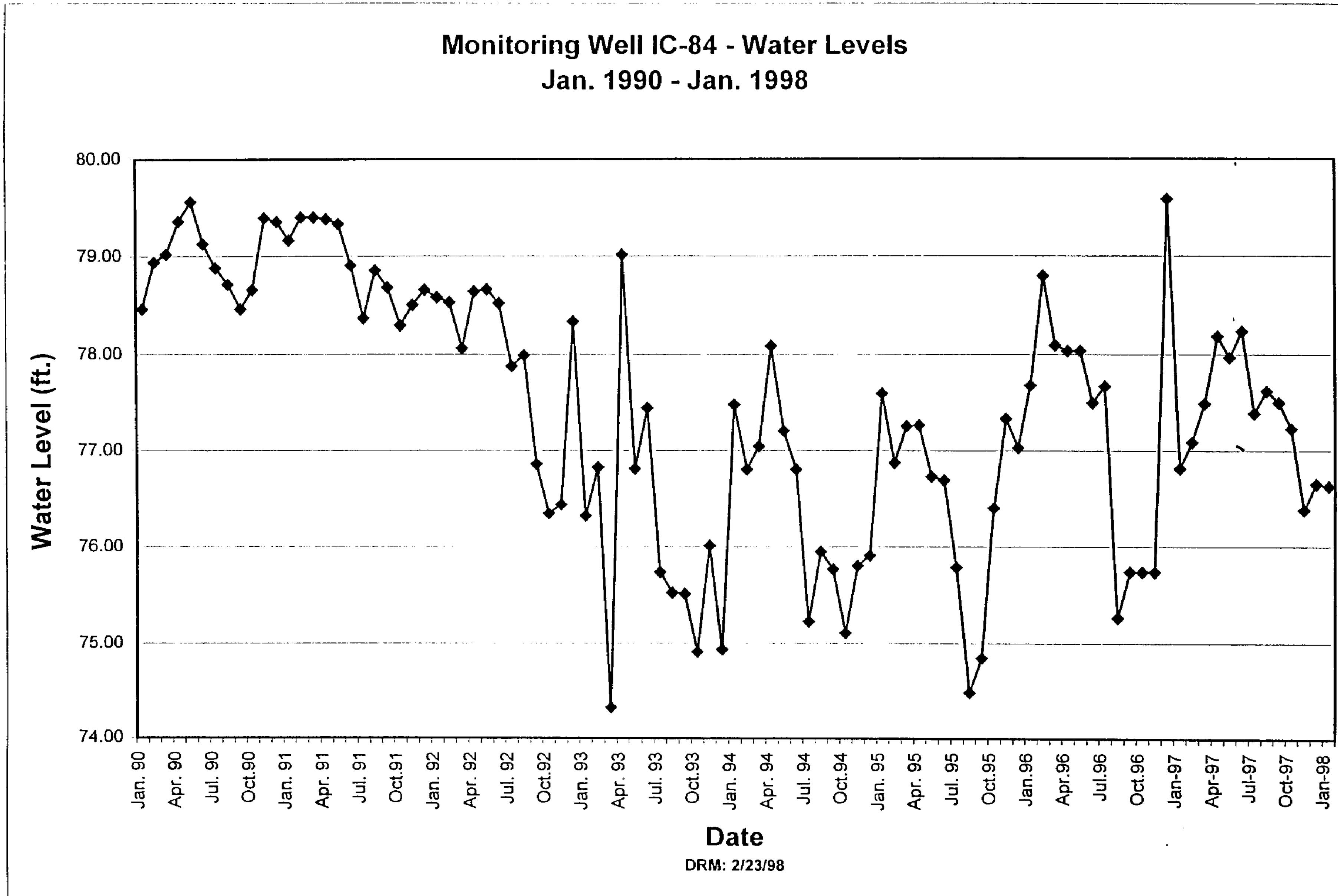
(All other readings relate to the level of water in the monitoring well pipe from the top downward)

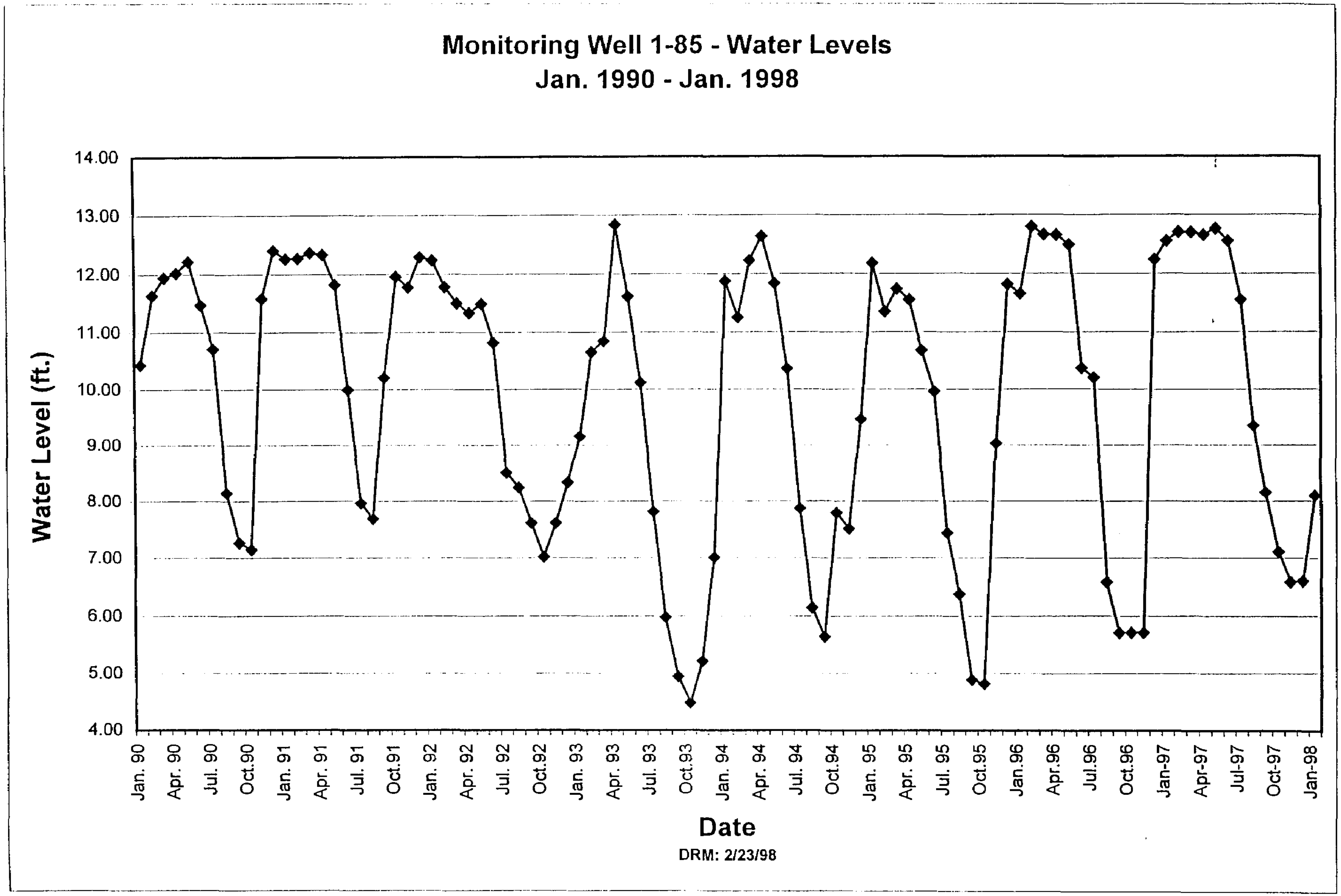
(For various reasons it is not always possible to get all readings)

Date	Time of Reading	Date Pump Stopped	Time Pump Stopped	6-85	1-85	4-85	3-85	IC-84	15	1-B84	15-B	1-D84	1-84 L	1-84	1-84 A	Main	Height of Beech Hill Tank
Distance from bottom of well to TOP of pipe =				10.65'	18.86'	42.67'	13.08'	84.84'	56.86'	41.89'	50.26'	9.00'	17.05'	49.60'	49.83'		
03-Aug	07:00	Pumping		8.75	12.25	22.12	10.90	13.43	14.03	11.60	13.53	9.00	-	12.50	14.25	28.60	24.50
10-Aug	07:00	08/10/1999	03:00	8.80	12.74	22.75	11.00	12.12	12.13	10.25	11.30	9.00	-	11.25	12.50	35.40	27.25
17-Aug	07:00	08/16/1999	15:30	8.78	13.15	22.90	11.10	10.60	10.60	8.64	8.75	8.80	-	9.70	10.70	36.90	29.50
24-Aug	06:30	08/23/1999	22:15	8.85	14.48	23.00	11.30	10.90	10.90	9.10	9.20	8.90	-	10.00	11.40	36.60	27.00
31-Aug	07:00	08/30/1999	23:30	9.00	14.75	23.18	11.40	10.90	10.90	9.24	9.23	9.00	-	10.18	11.34	36.50	26.00
07-Sep	07:30	Pumping		9.12	14.85	23.30	11.35	12.95	13.98	11.65	13.35	9.00	-	13.00	14.25	28.10	27.00
14-Sep	07:00	Pumping		8.50	14.95	23.43	11.45	11.75	12.80	9.80	12.13	7.95	-	10.55	12.30	29.40	26.00
21-Sep	07:00	09/21/1999	00:15	7.10	14.63	23.45	11.05	9.30	9.10	7.30	8.25	6.90	-	8.30	9.88	38.20	25.75
28-Sep	07:00	09/27/1999	21:45	7.45	14.03	23.55	11.05	8.95	8.90	6.98	7.53	-	-	8.20	9.35	38.40	25.50
05-Oct	07:30	10/05/1999	02:30	7.35	13.70	23.60	11.25	9.30	9.10	7.43	7.40	-	-	8.65	9.85	38.10	27.00
12-Oct	07:30	10/12/1999	02:00	7.40	13.30	23.65	11.34	9.21	9.03	7.43	7.75	-	-	8.58	9.90	38.30	27.00
19-Oct	07:30	10/18/1999	22:30	7.10	12.98	23.75	11.40	8.50	8.30	6.53	7.30	-	-	7.90	8.88	38.90	25.00
26-Oct	07:30	Pumping		5.95	12.50	23.70	11.25	9.40	10.70	7.30	11.90	-	-	8.00	9.24	31.40	26.50
02-Nov	07:30	11/02/1999	03:00	6.20	11.08	23.60	11.05	9.55	9.18	7.40	7.30	-	-	8.50	9.84	38.40	25.00
09-Nov	07:30	11/08/1999	22:30	6.20	10.50	23.60	11.05	8.40	8.35	6.84	6.70	-	-	7.75	8.95	38.80	25.00
16-Nov	07:30	11/15/1999	22:30	6.00	10.25	23.60	10.95	8.25	8.35	6.50	6.60	-	-	7.70	8.95	38.80	25.25
23-Nov	08:00	11/22/1999	21:30	6.10	10.75	23.65	11.23	8.90	8.40	6.45	6.85	-	-	7.80	8.90	39.00	24.25
30-Nov	08:00	Pumping		5.75	9.30	23.70	11.10	8.70	8.70	7.05	7.10	-	-	8.20	9.65	38.70	26.00

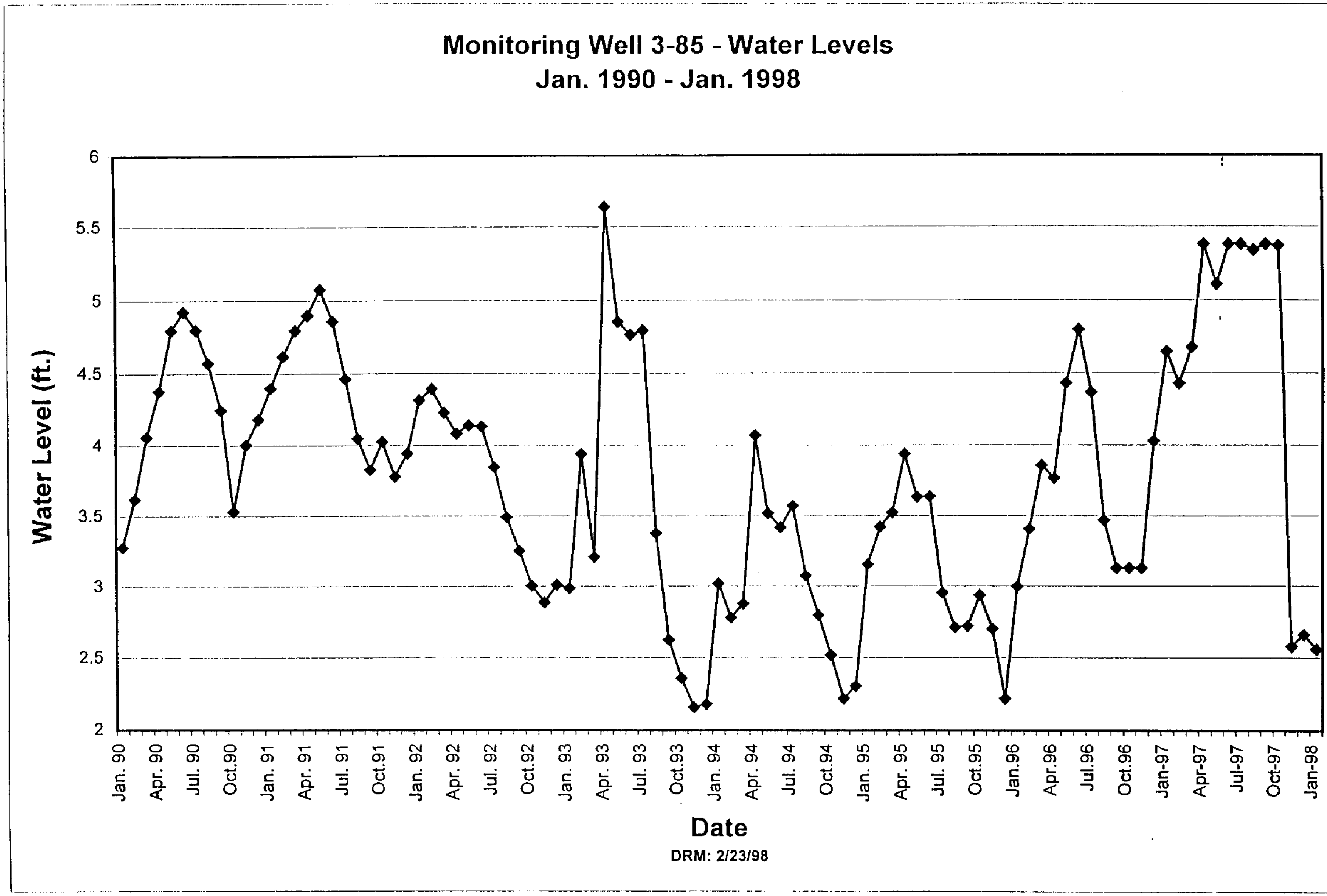


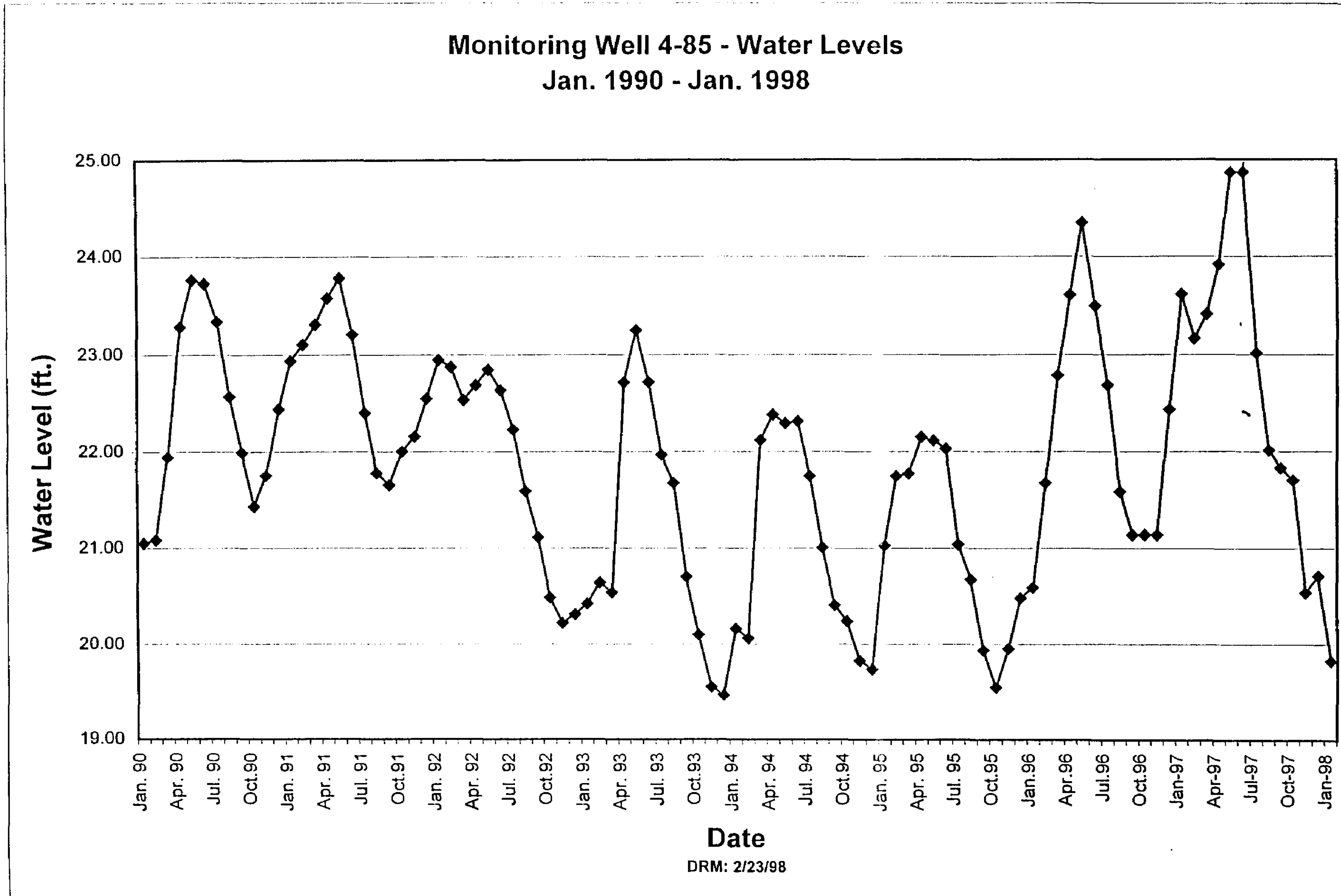
Lee Well - Gallons Pumped
Dec. 1988 - Dec. 1997
Gallons
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Estimated Value (No Reading That Month - Nov 96)
Dec. 88
Mar. 89
Jun. 89
Sep. 89
Dec. 89
Mar. 90
Jun. 90
Sep. 90
Jan. 91
Apr. 91
Jul. 91
Oct. 91
Jan. 92
Apr. 92
Jul-92
Oct. 92
Jan. 93
Apr. 93
Jul. 93
Oct. 93
Jan. 94
Jun. 94
Oct. 94
Jan. 95
Apr. 95
Jul. 95
Oct.95
Jan-96
Apr-96
Jul-96
Oct-96
Jan-97
Apr-97
Jul-97
Oct-97
Date
DRM: 2/23/98

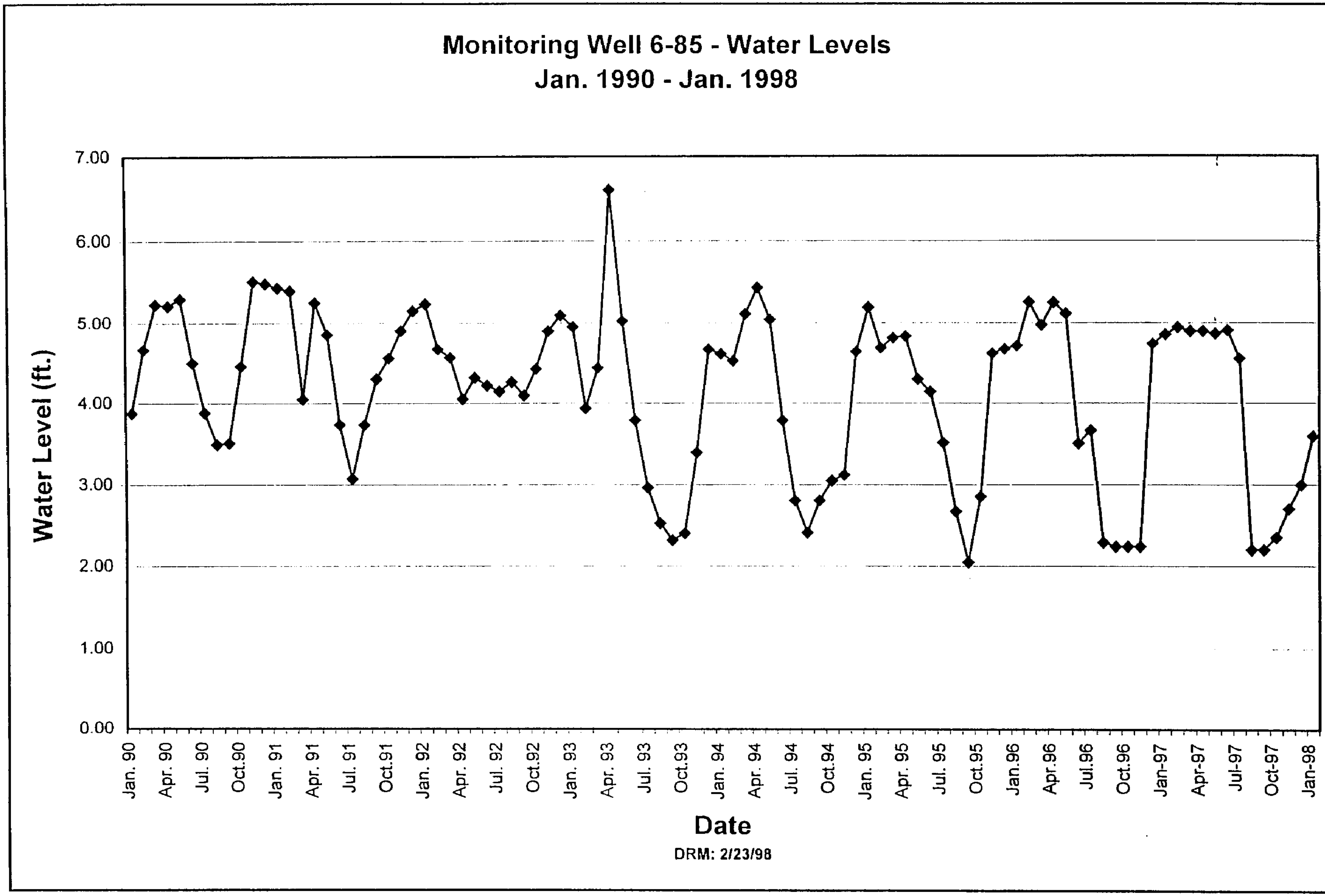

Monitoring Well IC-84 - Water Levels
Jan. 1990 - Jan. 1998
Water Level (ft.)
80.00
79.00
78.00
77.00
76.00
75.00
74.00
Jan. 90
Apr. 90
Jul. 90
Oct.90
Jan. 91
Apr. 91
Jul. 91
Oct.91
Jan. 92
Apr. 92
Jul. 92
Oct.92
Jan. 93
Apr. 93
Jul. 93
Oct.93
Jan. 94
Apr. 94
Jul. 94
Oct.94
Jan. 95
Apr. 95
Jul. 95
Oct.95
Jan.96
Apr.96
Jul.96
Oct.96
Jan-97
Apr-97
Jul-97
Oct-97
Jan-98
Date
DRM: 2/23/98



Monitoring Well 1-85 - Water Levels
Jan. 1990 - Jan. 1998
Water Level (ft.)
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
Jan. 90
Apr. 90
Jul. 90
Oct.90
Jan. 91
Apr. 91
Jul. 91
Oct.91
Jan. 92
Apr. 92
Jul. 92
Oct.92
Jan. 93
Apr. 93
Jul. 93
Oct.93
Jan. 94
Apr. 94
Jul. 94
Oct.94
Jan. 95
Apr. 95
Jul. 95
Oct.95
Jan.96
Apr.96
Jul.96
Oct.96
Jan-97
Apr-97
Jul-97
Oct-97
Jan-98
Date
DRM: 2/23/98


Monitoring Well 3-85 - Water Levels
Jan. 1990 - Jan. 1998
Water Level (ft.)
6
5.5
5
4.5
4
3.5
3
2.5
2
Jan. 90
Apr. 90
Jul. 90
Oct.90
Jan. 91
Apr. 91
Jul. 91
Oct.91
Jan. 92
Apr. 92
Jul. 92
Oct.92
Jan. 93
Apr. 93
Jul. 93
Oct.93
Jan. 94
Apr. 94
Jul. 94
Oct.94
Jan. 95
Apr. 95
Jul. 95
Oct.95
Jan.96
Apr.96
Jul.96
Oct.96
Jan-97
Apr-97
Jul-97
Oct-97
Jan-98
Date
DRM: 2/23/98


Monitoring Well 4-85 - Water Levels
Jan. 1990 - Jan. 1998
Water Level (ft.)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
Jan. 90
Apr. 90
Jul. 90
Oct.90
Jan. 91
Apr. 91
Jul. 91
Oct.91
Jan. 92
Apr. 92
Jul. 92
Oct.92
Jan. 93
Apr. 93
Jul. 93
Oct.93
Jan. 94
Apr. 94
Jul. 94
Oct.94
Jan. 95
Apr. 95
Jul. 95
Oct.95
Jan.96
Apr.96
Jul.96
Oct.96
Jan-97
Apr-97
Jul-97
Oct-97
Jan-98
Date
DRM: 2/23/98


Monitoring Well 6-85 - Water Levels
Jan. 1990 - Jan. 1998
Water Level (ft.)
7.00
6.00
5.00
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Jan. 90
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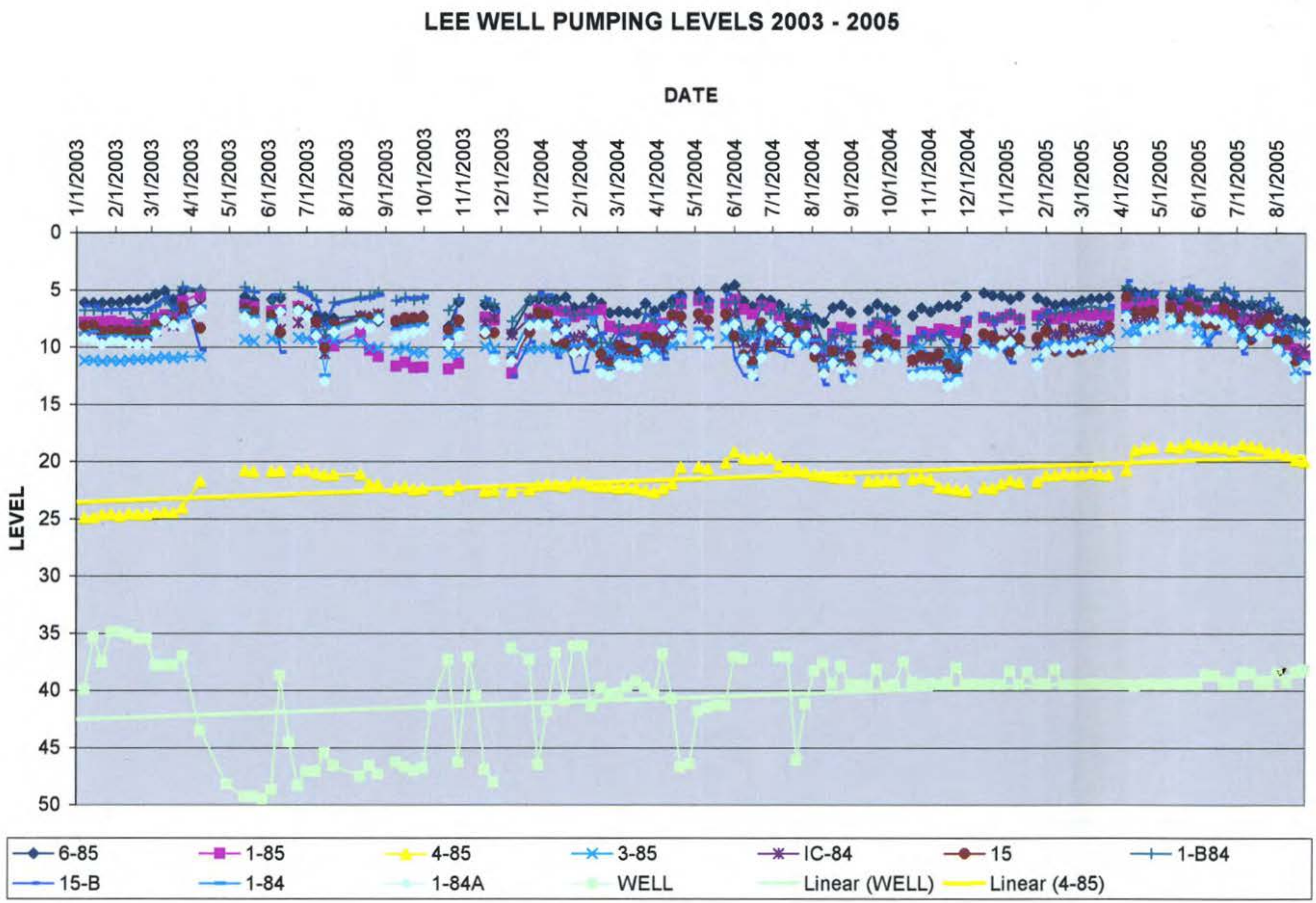
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1-85
4-85
3-85
IC-84
15
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1-84A
WELL
Linear (WELL)
Linear (4-85)

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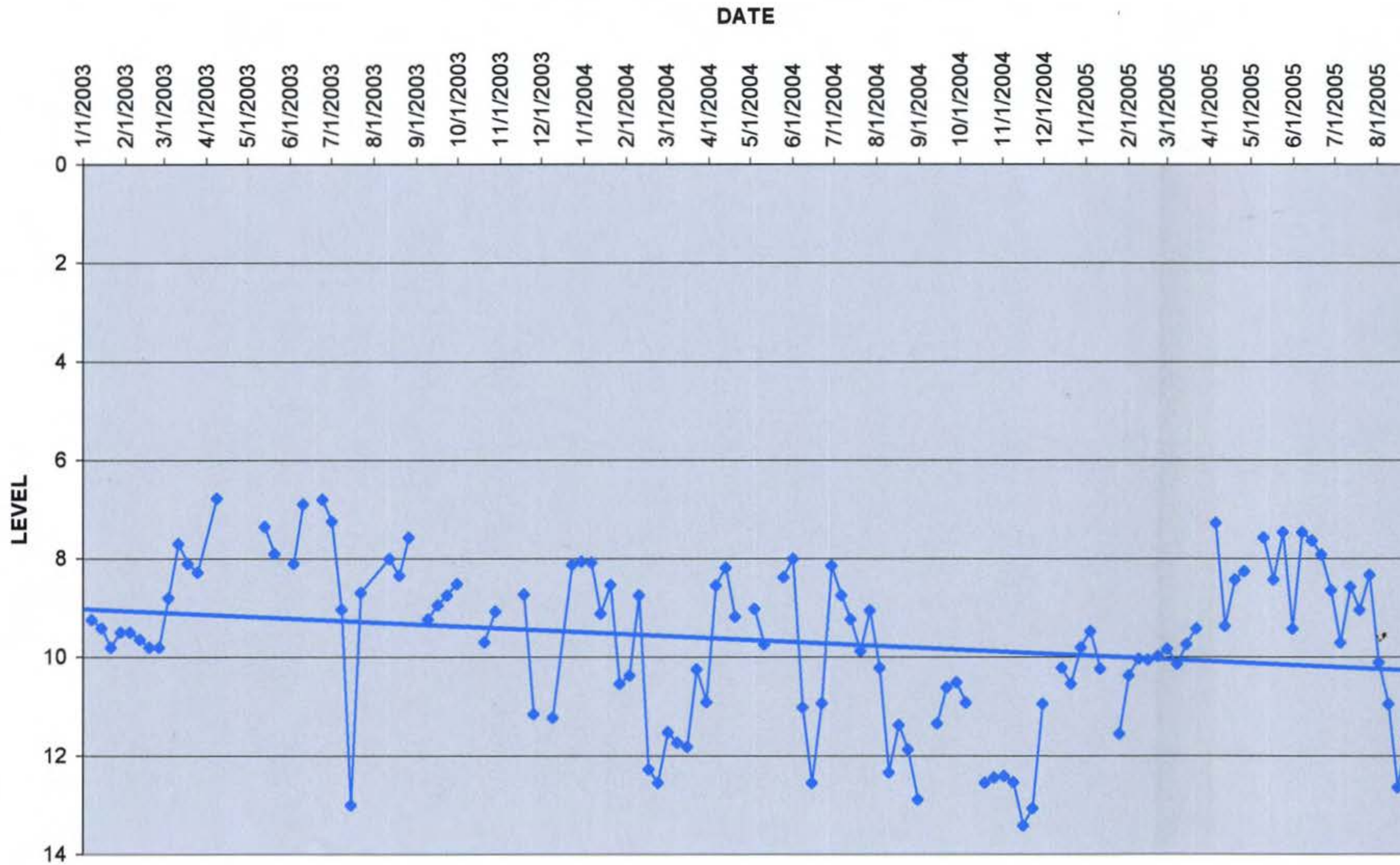

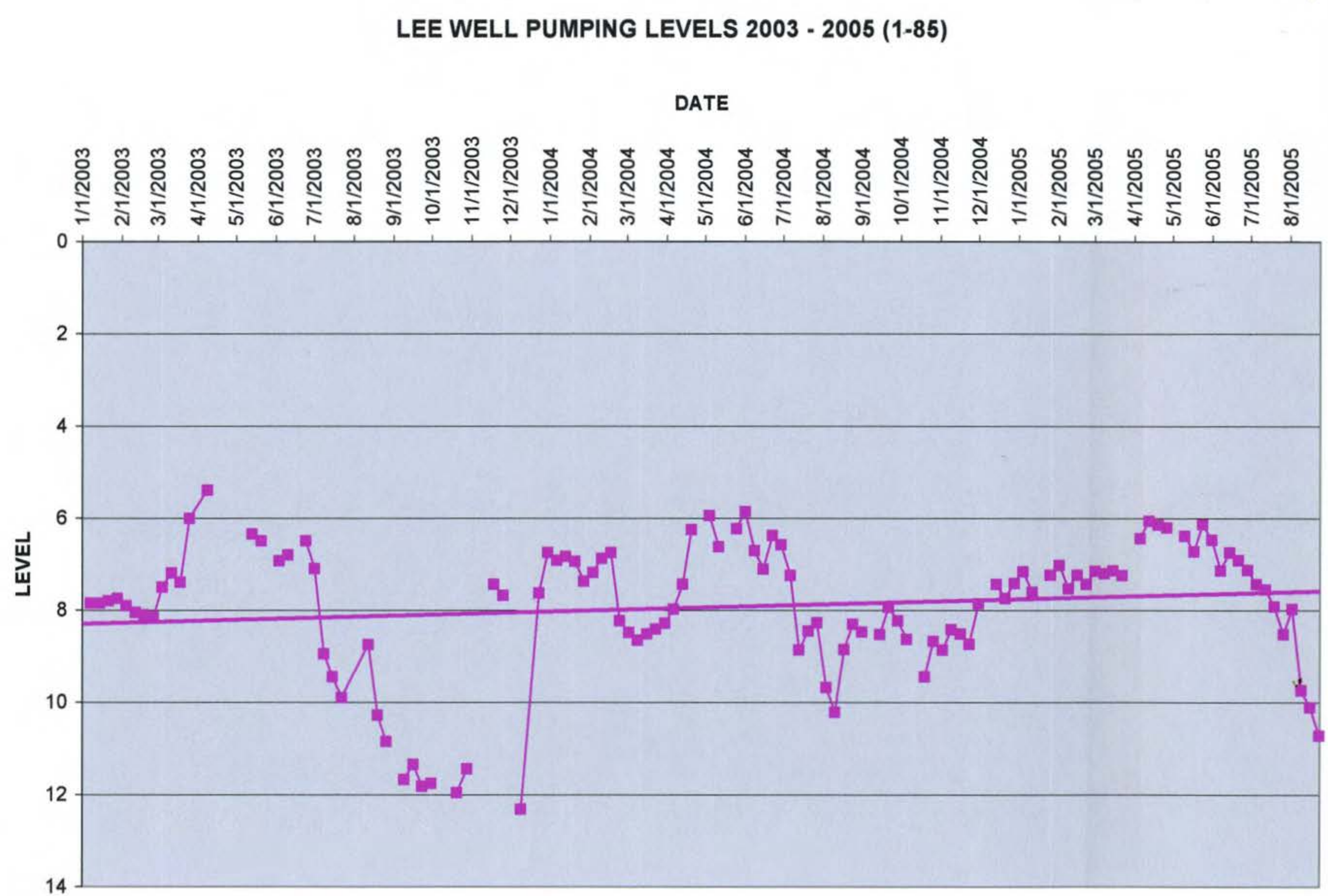
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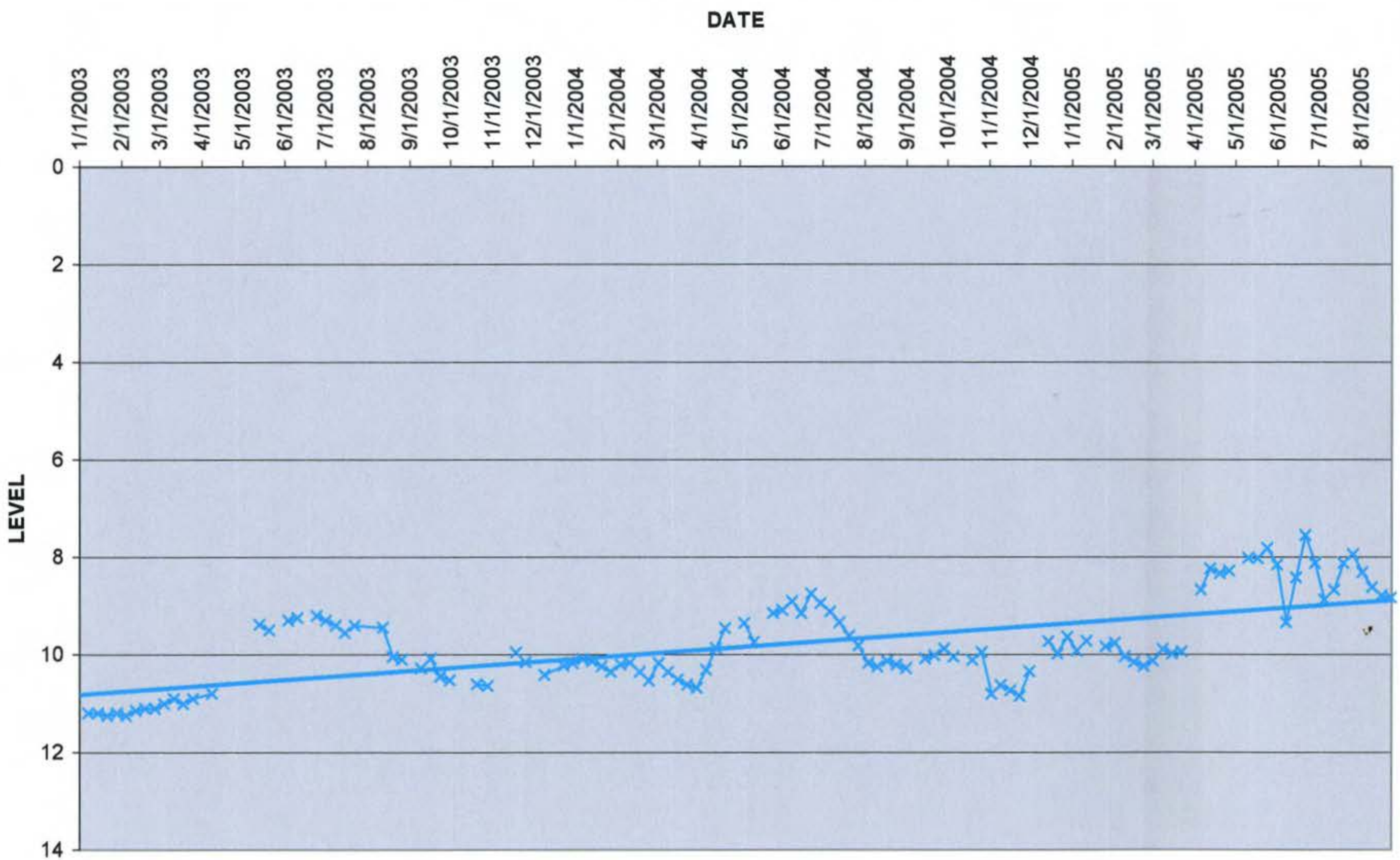

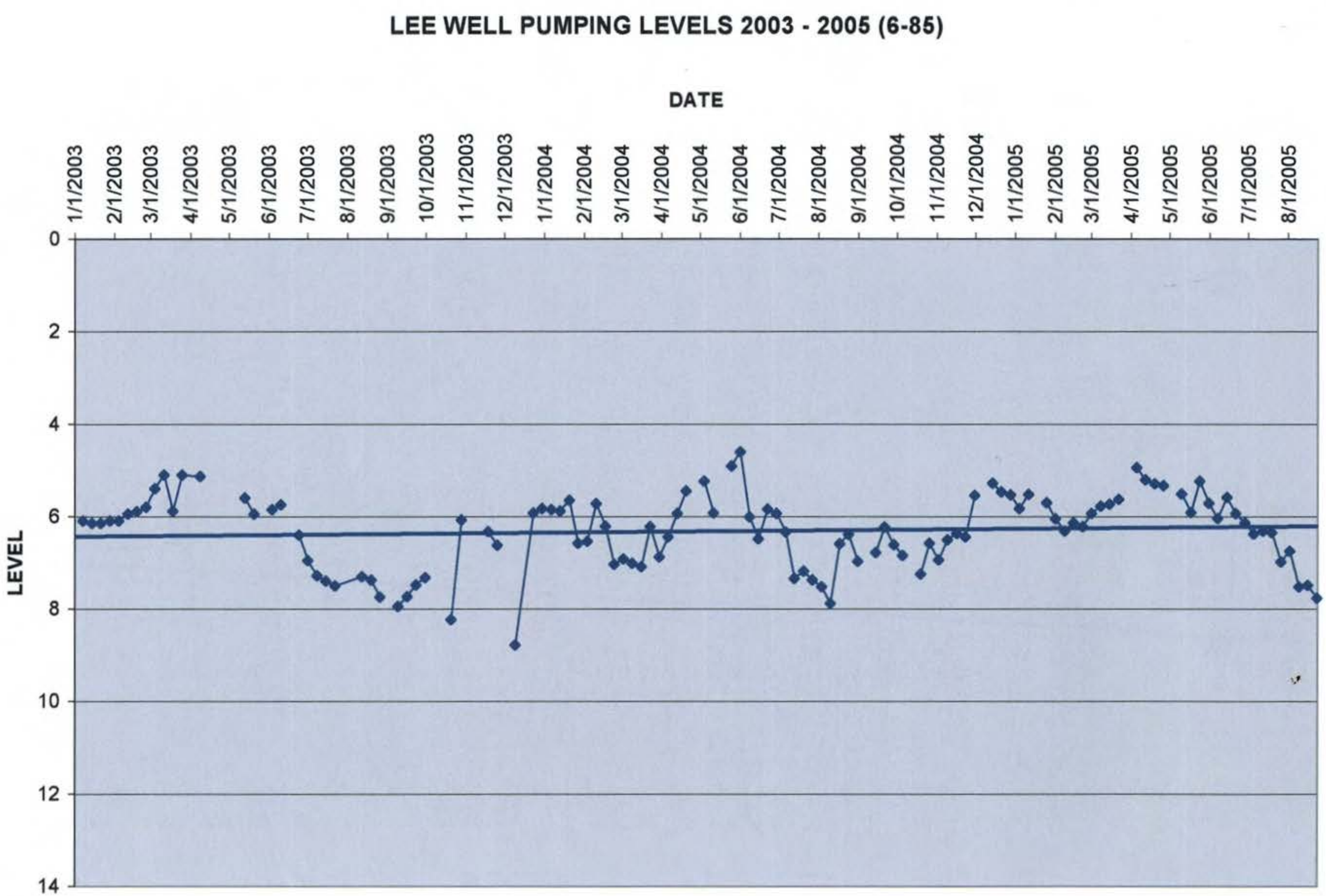
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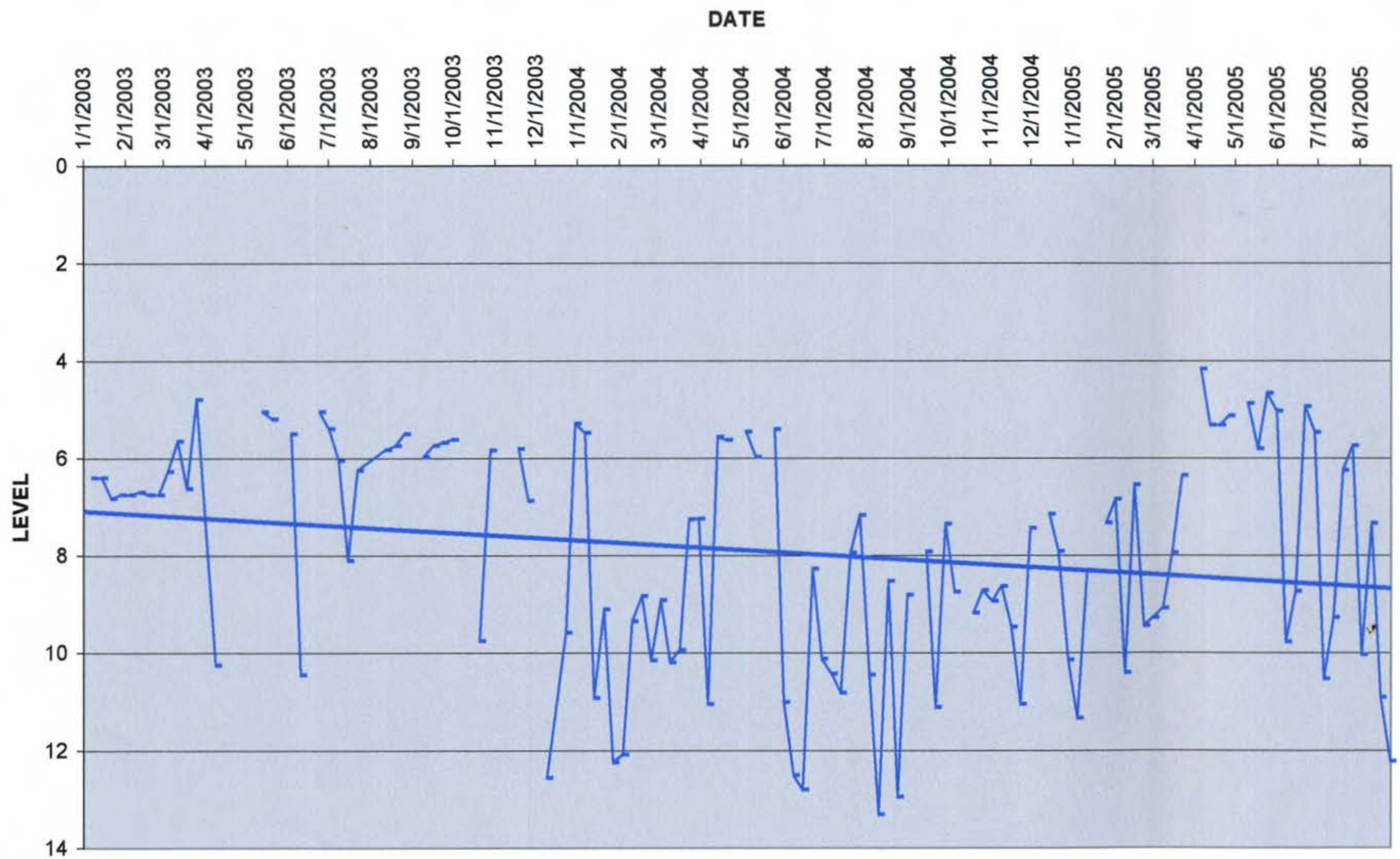


APPENDIX J

Laws of 1965

CHAPTER 332.

AN ACT RELATIVE TO FUTURE USE OF PORTIONS OF THE WATERS OF THE LAMPREY RIVER AND/OR ITS TRIBUTARIES FOR PUBLIC WATER SUPPLIES, AND TO NAME THE DAM AT AYERS LAKE IN BARRINGTON.

WHEREAS, the General Court has established by general legislation a policy to provide on a state-wide basis for long-range planning for the water supply requirements of the people of this state; and

WHEREAS, a study has been completed on behalf of the town of Durham and the university of New Hampshire which shows that the Lamprey river is the best source for a needed addition to the public water supply for the town of Durham and the university of New Hampshire, therefore

Be it Enacted by the Senate and House of Representatives in General Court convened:

332:1 Use of Waters. The towns of Durham, Epping, Lee, Newmarket and Raymond shall have the use of the waters of the Lamprey river and its tributaries within said towns for the purpose of public water supplies to the exclusion of all other ıicipalities. Except as provided in sections 2 and 3, this act shall not affect e respective rights and powers of said towns or any other towns in which are :ated portions of the Lamprey river and/or tributaries thereto under RSA 38 to use such waters flowing within their respective borders for the purpose of public water supplies. In the event that the towns within which flow the waters of the Lamprey river and/or its tributaries, or any combination thereof shall use such waters flowing within their respective borders for the purpose of public water supplies and there shall prove to be an insufficient amount of water to meet their respective requirements, the allocation of said waters among the towns which use said waters for public water supply purposes shall be determined by the general court upon application of any of said towns under and in pursuance of the provisions of RSA 148-A, provided that the town of Durham shall be liable for and pay to the owners of any of the rights enumerated above all loss, cost, damage and expense incurred by any of such owners on or with reference to the Lamprey river or its tributaries in any town including losses to business or other commercial or similar activities owned by any of such owners; provided further that, subject to the obligation of downstream riparian owners to take reasonable action to store waters of the Lamprey river to meet their respective requirements, the town of Durham shall not take or refrain from or permit, any course of conduct, action or inaction, through itself or any other person, firm or corporation which shall decrease the amount or type of water currently required or used or reasonably required for use by any municipality, person, firm or corporation having rights to use, (for manufacturing, fire control or other proper purposes) impound, divert, flow or other riparian or water rights in said Lamprey river or any of its tributaries in any town; provided further that, in addition to payment of compensation and damages as set forth above, the town of Durham shall be liable to any of the foregoing towns for property and other similar xes on property or rights taken or acquired or used in connection with the purposes this act to the same extent as a private individual; and provided further that any e of water by the town of Durham shall not lower the water level upstream from the so-called Hook Island Falls in Lee nor shall the town of Durham take, permit or refrain from any course of conduct, action or inaction, through itself or any person, firm or corporation, the direct or indirect result of which may be the breaching of the Hook Island Falls.

332:2 Durham Rights. Without limiting its powers under RSA 38, the town of Durham shall have the right to acquire by purchase or by eminent domain in accordance with the procedures of RSA 38:13 and 14 (a) the right to divert waters from the Lamprey river by means of any dam that it may build or acquire at or "near" the location of the dam at Wiswell Falls on the Lamprey river now owned by Carl F. Spang as against private owners of lands bordering the Lamprey river in the town of Newmarket, and (b) flowage rights in the town of Lee to the extent necessary to maintain a dam at Wiswell Falls at or near the location of the dam now owned by Carl F. Spang on the Lamprey river to the height of the said dam with two feet of flashboards thereon; both upon the payment of such damages as the owners of lands affected may be legally entitled to receive, as set forth above.

332:3 Newmarket Rights. Without limiting its powers under RSA 38, the town of Newmarket shall have the right to acquire by purchase or by eminent domain in accordance with the procedures of RSA 38:13 and 14(a) the right to divert waters from the Lamprey river by means of any dam that it may build or acquire at or near the location of the dam at the tidal headwaters on the Lamprey river now owned by the Macallen Company, Inc. as against private owners of lands bordering the Lamprey river in the town of Durham, and (b) flowage rights in the town of Durham to the extent necessary to maintain a dam that it may build or acquire at or near the location of the dam in Newmarket now owned by the Macallen Company, Inc. on the Lamprey river to the height of said dam with forty-four inches of flashboards thereon, either upon the payment of such damages as the owners of lands affected may be legally entitled to receive, as set forth above.

332:4 Protection of Water Supply. The town of Durham shall have the right and authority to protect the purity of the water from the Lamprey river as granted under RSA 38:21 provided that there shall be no curtailment of present or future recreational uses, namely, swimming, boating and fishing.

332:5 Water Supply of Other Towns. The towns of Lee, Epping, Raymond and Newmarket shall have the same correlative rights and be subject to the same correlative restrictions, limitations and liabilities as those granted to and imposed on the town of Durham under this act.

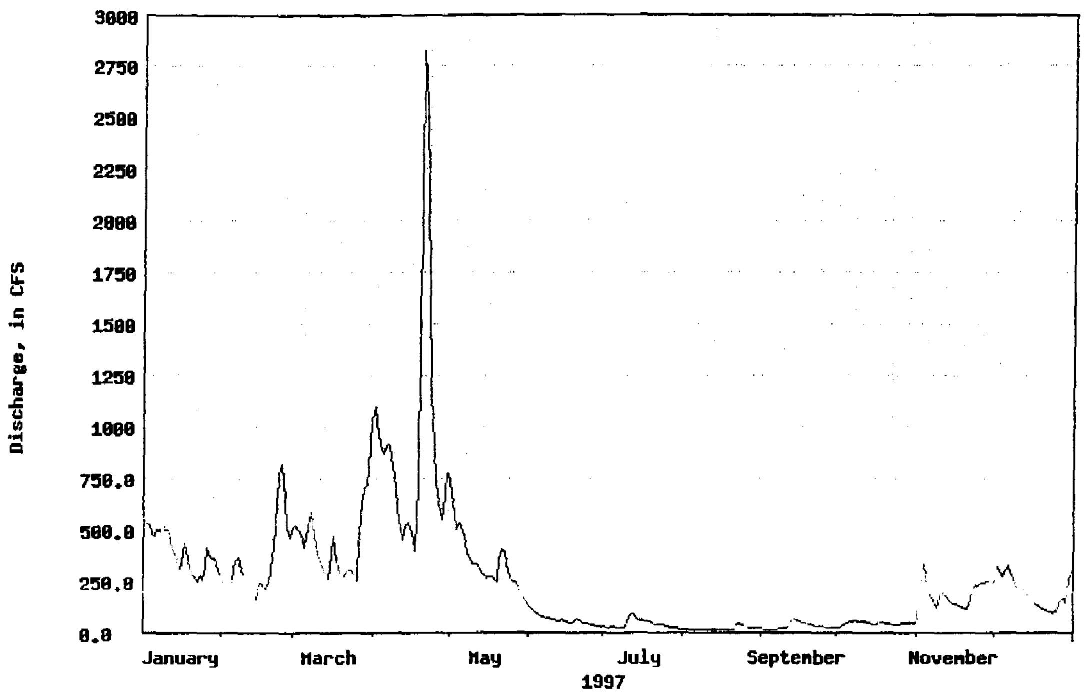
332:6 Jurisdiction. The water resources board shall have the jurisdiction and duty to enforce the provisions of this act, provided that nothing herein shall impair the right of any person, firm or corporation whose rights, as enumerated herein, are affected by the act or any portion thereof, to maintain injunction or other proceedings to enforce compliance with said act or damages for failure to do so.

332:7 Ayers Lake in Barrington. The dam at Ayers lake in the town of Barrington is named and shall be called Dustin Dam.

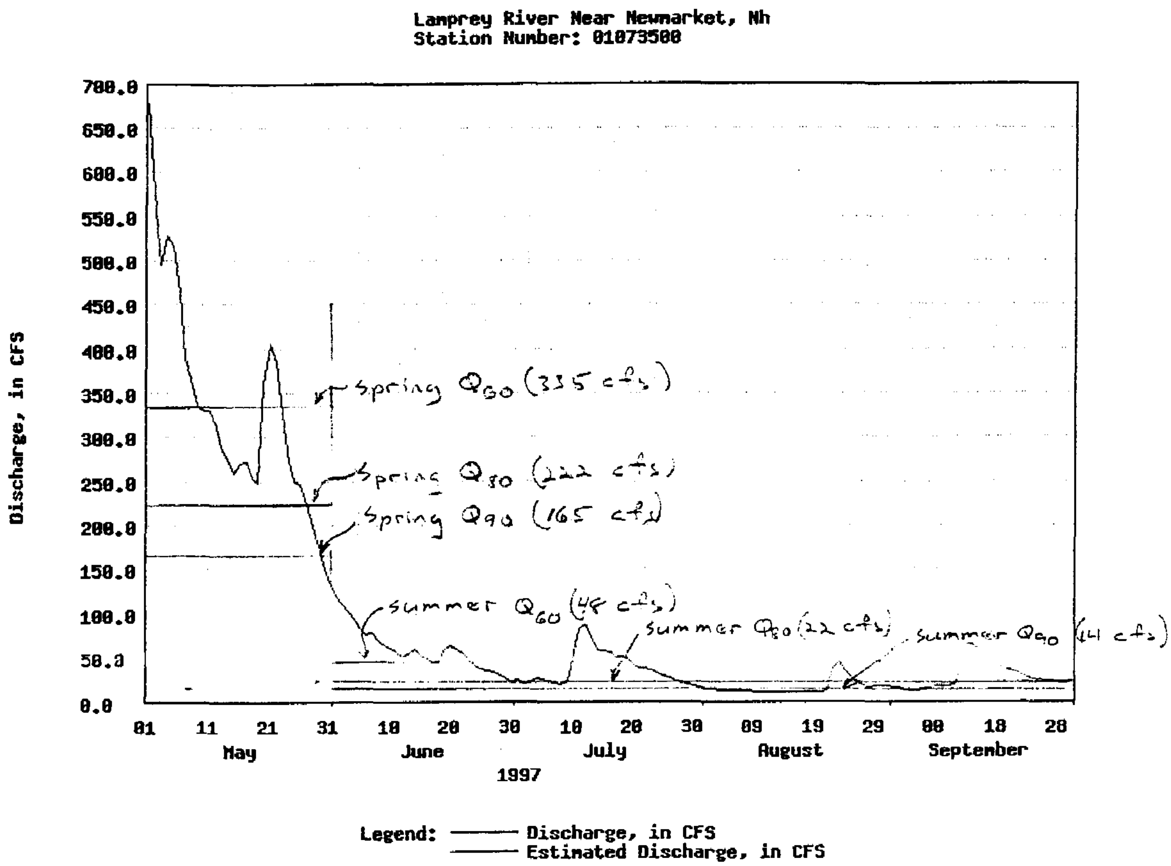
Source: 1965, 332, eff. July 8, 1965.

APPENDIX K

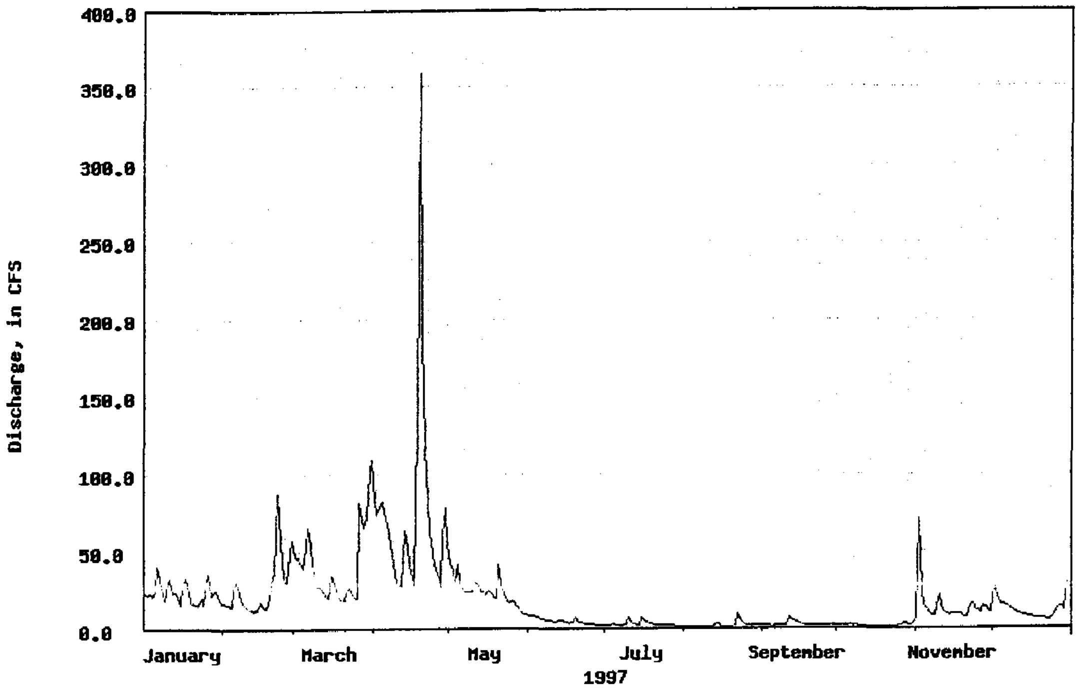
Lamprey River Near Newmarket, Nh
Station Number: 01073500



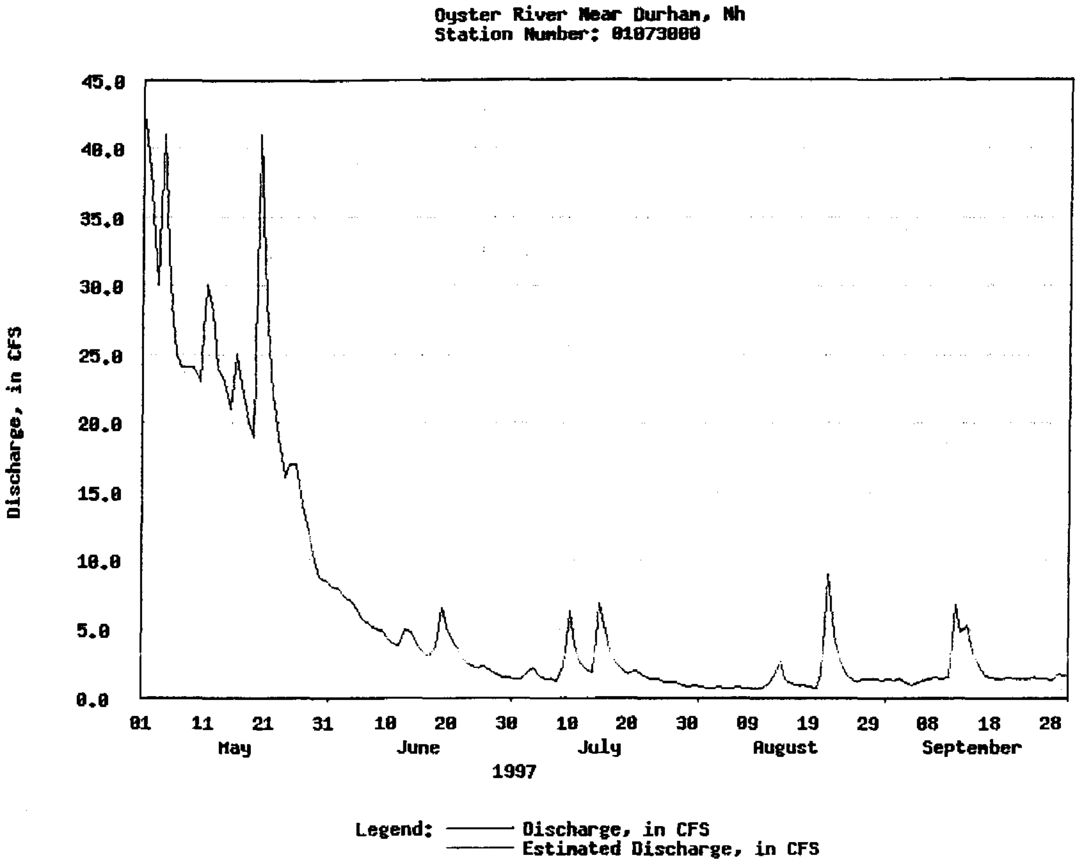
Legend: —— Discharge, in CFS
—— Estimated Discharge, in CFS


Lamprey River Near Newmarket, Nh
Station Number: 01073500
Discharge, in CFS
700.0
650.0
600.0
550.0
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
01 11 21 31 10 20 30 10 20 30 09 19 29 08 18 28
May June July August September
1997
Spring Q_{60} (335 cfs)
Spring Q_{80} (222 cfs)
Spring Q_{90} (165 cfs)
summer Q_{60} (48 cfs)
summer Q_{80} (22 cfs)
summer Q_{90} (14 cfs)
Legend: Discharge, in CFS
Estimated Discharge, in CFS

Oyster River Near Durham, Nh
Station Number: 01073000



Legend: Discharge, in CFS
Estimated Discharge, in CFS


Oyster River Near Durham, Nh
Station Number: 01073000
Discharge, in CFS
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
01 11 21 31 10 20 30 10 20 30 09 19 29 08 18 28
May June July August September
1997
Legend: Discharge, in CFS
Estimated Discharge, in CFS

DAM MANAGEMENT PLAN

Wiswall Dam (State Dam ID #071.04)

Figure 1 – Wiswall Dam, photo taken May 3, 2013.

Introduction

Wiswall Dam (lat. 43^o 06' 14", long. -70^o 57' 48") is located on the Lamprey River, immediately downstream of the Wiswall Road bridge crossing in Durham, New Hampshire. The dam is located on the Lamprey Designated River and is approximately three miles upstream of the end of the Designated River. This dam is owned by the Town of Durham (see contact information), is active, and its purpose is to impound water in the Wiswall Reservoir for water supply storage and recreation. The Wiswall Reservoir is one of the principal water sources for the University of New Hampshire/Town of Durham Water System (UDWS). The UDWS maintains a pump station upstream of the dam which was constructed in 1970 for the purpose of withdrawing drinking water.

Dam Design

The dam was constructed in 1911. The dam consists of a concrete structure, and has a gated spillway, which can be manually used to regulate water levels in the Wiswall Reservoir (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 describing the characteristics of the dam is summarized in Table 1. A final decision to install a fish ladder and flow structure for outlet migration at the dam was made in 2008. Construction began during the summer of 2011 and completed in late 2011. The construction and repairs on Wiswall Dam adds several functioning mechanisms for managing stream flow.

The fish ladder has an operable weir gate and an outlet structure with stoplogs on the opposite side of the dam for downstream fish migration. The repairs include replacement of the two low level gate structures.

Minimum Flow, Flowage Rights or Contractual Obligations

The conditions of 401 Water Quality Certification #2001-001 apply to management of this dam in concert with operation of UDWS's Lamprey River water withdrawal (Water User ID #20066-S02.) A specific right to the use of waters from the Lamprey River was granted to the Town of Durham by the New Hampshire legislature in Chapter 332 of the Laws of 1965. Under this law Durham was granted the right to divert waters from the Lamprey River and it has flowage rights in the Town of Lee to the extent necessary to maintain the dam at Wiswall Falls. The Town of Durham has identified Wiswall Reservoir as one of UDWS's primary drinking water sources. The installation of manual staff gages near the Wiswall Dam and an instrumented water level transducer near the UDWS's pump station was completed in 2011 to record real-time stage elevation and transmit real-time data to the UDWS Water Treatment Plant operator.

Riparian Property Obligations or Agreements

Chapter 332 of the Laws of 1965 dictates that the use of water by the Town of Durham cannot lower the water level upstream from the so-called Hook Island Falls in Lee or result in the breaching of the Hook Island Falls.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Wiswall Dam is 500 acre-feet (ac-ft), while its permanent storage volume is 360 ac-ft. Durham Public Works estimated the volume in gallons in the top 18 inches of the Wiswall Reservoir as:

0 to 6" -	7,137,266 gallons	= 954,052 cubic feet	= 21.9 acre-ft
0 to 12" -	12,142,211 gallons	= 1,623,290 cubic feet	= 37.3 acre-ft
0 to 18" -	17,037,153 gallons	= 2,277,390 cubic feet	= 52.3 acre-ft

The drainage area upstream of the dam is 183 square miles, which provides considerable runoff potential for refilling the Wiswall Reservoir following a rain event.

Potential Impacts of Storage and Relief Flows

Use of Wiswall Reservoir for providing relief flows was evaluated with respect to other existing uses. The Wiswall Dam and Reservoir provide for recreation in addition to water supply storage for UDWS. Boating, fishing and swimming are commonly observed recreational activities in the Wiswall Reservoir. If Wiswall were used as a source of water for a downstream flow relief pulse, lowering of the water level should have little impact on the recreational activities unless the water level is lowered by several feet. However, if the relief pulse occurred during a period of UDWS's typical late summer peak water demand (August 15 to October 15) it could create a management challenge with respect to the water storage available to UDWS.

There are mapped wetlands within the Wiswall Reservoir and they could be impacted by either rapid declines in water levels or by prolonged or recurrent periods of below normal water levels.

As previously mentioned, the Wiswall Reservoir is used as a water supply by UDWS. Releasing water from this dam would affect the storage available to the UDWS. As a result, this Dam Management Plan must be coordinated with the Water Use Plan developed for the UDWS withdrawal from the Wiswall Reservoir (#20066-S02).

Potential for Dam Management to Meet Instream Flow Requirements

The overall potential for this dam for flow management of the Lamprey Designated River is considered to be low due to its location, which affects only the last three miles of the Designated River. A relief pulse release from the Wiswall Reservoir would also result in loss of storage affecting its use as a water supply source for UDWS. Releases from the dam for the protection of instream flows would reduce the water available for use as source of water for UDWS without improving flow conditions in the upper parts of the Designated River.

Wiswall Dam has a potential to impact protected flows needed to maintain stream flow downstream. The volume of the impoundment creates a potential for attenuation of a relief flow release such that the target flow may not be met. Depending on the magnitude of the required relief flow and the reservoir stage elevation relative to the dam's spillway crest at a given time, the dam may need to be operated under this Dam Management Plan to attain the desired downstream relief flow.

Dam Management Activity

Dam management activities are expected to occur on a frequency from as little as none per year to one or more events per bioperiod in five of the six bioperiods. The Spring Flood bioperiod will not be managed under the Lamprey Dam Management Plan.

Because the dam impounds Wiswall Reservoir, this Dam Management Plan is integrally tied to the use of Wiswall Reservoir by UDWS as a water supply. This water supply (Water User ID 20066-S02) has conditions described under the UDWS Water Use Plan for the Lamprey River withdrawal. The Dam Management Plan activities in this sub-plan must be implemented in concert with the UDWS Water Use Plan. The general components of the dam management activities include:

1. At all times, when the flow at the USGS Lamprey near Newmarket gage is less than 16 cfs, the Town of Durham will operate the dam to ensure that downstream flow is maintained at a discharge rate effectively equal to inflow to the greatest extent practicable. Operation of outflow using stoplogs may include use of modified stoplogs calibrated to release of partial flows as alternatives to removing/replacing whole stoplog increments. Modifying stoplogs may be accomplished by means of notching or boring the stoplogs. Coordination with the UNH/Durham Water System may be required to meet this objective.

2. The Town of Durham will monitor and record flow and dam operational conditions and any other information necessary to determine relative outflow and inflow measurements whenever daily stream flow is equal or less than 16 cfs at the USGS gage Lamprey River Near Newmarket, NH, to the highest practicable accuracy. Flow measurements or height of the stage elevation relative to the spillway crest or other outlet structures will be measured on a frequency of at least once every hour until daily average stream flow exceeds 18 cfs from a natural storm event for two consecutive days. The Town's existing water level data recorder in Wiswall Reservoir has been identified as a means to make hourly measurements to calculate inflow. The logger records hourly water levels in Wiswall Reservoir. If the data logger fails, then Town of Durham will make manual measurements of water level at a minimum of once every four hours. The Town of Durham will also record the dam's current outflow structure conditions and any changes made to the gate position or other criteria defining the outflow. Measurements and results of calculations will be provided to DES upon request.

3. When protected flow conditions are not met resulting in catastrophic conditions, DES may release periodic relief flows from impoundments upstream of the Wiswall Reservoir. A relief flow release may start the day before flow conditions are expected to exceed the catastrophic conditions. When a relief flow release event is scheduled, DES will notify the Town of Durham contact identified in this document. The Town of Durham will provide an alternate or emergency contact person to the DES Instream Flow Program upon adoption of this plan. DES's notification will be by phone or email, or both, at least 72 hours in advance of the intended relief flow release. The Town of Durham will confirm receipt of this notification by phone or email within 24 hours unless the notification is received on a Friday or a weekend in which case the acknowledgment will be provide on the following Monday.

4. During a relief flow release conducted under the Lamprey Water Management Plan, the Town of Durham will operate the Wiswall Dam to maintain outflow from the Wiswall Reservoir effectively equal to inflow. During the effective period of the relief pulse, the Town of Durham will operate the dam (i.e., open gates or remove stop logs in the Wiswall Dam, or other) to pass the relief flow.

5. The Town of Durham will maintain the dam's water release mechanism(s) to allow controlled releases of water in the flow ranges of the proposed relief pulses and of inflow rates. Operation of one or more of the dam's outlet structures will be necessary to pass a relief flow pulse if the Wiswall Reservoir stage elevation has been drawn down below the spillway crest. Operation may also be necessary to maintain flow if water withdrawals from storage are or have been occurring. Variability in daily stream flow discharge is expected. If during the relief flow release the Wiswall Reservoir stage elevation is below the spillway crest, operation of the dam outlet to affect the rate of discharge may be required. Consequently, operability of some mechanism for flow release must be assured during all but the Spring Flood bioperiod. If Wiswall Dam is passing outflow effectively equal to inflow then no operational changes are necessary.

6. The Town of Durham will not at any time except relating to maintenance operations or in the case of a water supply emergency[1] cause the reservoir water level to fall below 18 inches below the spillway crest, nor to cause the water level to drop more than one inch per day. Coordination with the UNH/Durham Water System may be required to meet this objective.

7. Refilling of storage in the Wiswall Reservoir will meet the following conditions for downstream flow. No refilling will occur during a relief pulse or when flows are less than 18 cfs at the Lamprey Near Newmarket gage. Once daily average flows from natural recharge events are greater than 18 cfs for two days at the USGS Lamprey near Newmarket gage, storage equivalent to UDWS's withdrawal rate of 2.8 cfs may be used to refill the Wiswall Reservoir, or for water withdrawal, or a combination of the two.

Schedule for Dam Management Plan Implementation

This Dam Management Plan will be put into practice upon adoption of the Lamprey Water Management Plan.

Estimated Cost of the Implementation of the Dam Management Plan

As discussed and included in the UDWS Lamprey River withdrawal's Water Use Plan, the estimated cost of the installation of the gages for water level and flow monitoring range from $10,000 to $30,000 depending upon the equipment used and the type of installation.

The actions associated with the implementation of the Dam Management Plan for Wiswall Dam include operation of the dam's outlet structures; and monitoring, recording and reporting of water levels, dam release configuration, and flow measurements. Management will be required during relief flow pulse releases and when flows fall below 16 cfs. These latter management activities will be reduced or eliminated by operation of UDWS's other water sources when flows are low as has been UDWS's practice. However, management operations as described above may be required when low flows persist and water withdrawals are made from Wiswall Reservoir's storage to maintain outflow at effectively equal to inflow.

These actions are expected to be performed by Town personnel, however the town may choose to subcontract the work to consultants or contractors. The estimated annual costs associated with this work will be dependent upon the number of personnel involved; and either the degree of automation of the system or the number of site visits required to perform the necessary flow management actions; plus travel time and mileage. The estimated cost for monitoring, recording and reporting of water levels, dam release configuration and flow measurements for one relief flow event is $2,000 to $5,000 depending on labor rate and hours expended. The total cost involved will be dependent upon the number of relief flow events. Most years will require no management. During the 1960s drought, six management events would have been conducted during the worst year. The majority of durations below 18 cfs lasted less than 10 days.

[1] RSA 4:45, RSA 483:9-c, IV, and as defined in the UDWS Water Use Plan (#20066)

Dam Owner and Contact Information

Owner: Town of Durham
Address: Public Works Department, 100 Stone Quarry Drive, Durham, NH 03824
Contact: Mr. David Cedarholm, P.E.
Phone: 603-868-5578
Email: dcedarholm@ci.durham.nh.us

Conversion Factors for Volume and Flow Units

1	cubic foot =	7.481	Gallons
1	gallon =	0.1337	cubic feet
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	Gallons
1	cfs =	448.86	Gpm
1	cfs =	646,358.4	Gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	Cfs
1	gpd =	0.00000154713	Cfs
1	MGD =	1.5471	Cfs

References:

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/29/03.

Email from David Cedarholm, Town Engineer, Durham to Wayne Ives, NH Instream Flow Specialist, June 29, 2010.

Preliminary Dam Engineering Report, Wiswall Dam, Durham, New Hampshire. Prepared for Department of Public Works, Town of Durham. Prepared by Stephens Associates Consulting Engineers, LLC. Dated December 1, 2006.

Table 1 – Wiswall Dam Characteristics

Elevation (ft) of recreation pool or height relative to lowest spillway	**56.5***
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**56***
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**41***
Height of the dam (ft) from toe to the highest point on the dam	**18**
Freeboard (ft)	**5**
Type of spillway controls or outlet works	**2 Gates Stoplog bay**, Fish ladder weir gate****
Dimensions of spillway controls or outlet works	**Gates = 5 ft x 6 ft* Stoplog Bay = 5 ft x 5 ft Fish ladder weir gate = 4 ft x 4 ft**
Surface area (ac) of impoundment at maximum impoundment	**30**
Drainage area (sq. miles)	**183**
Maximum storage (ac-ft)	**500**
Normal or permanent storage (ac-ft)	**360**
Total discharge capacity (cfs)	**6238**
Maximum unoperated discharge (cfs)	**5216**
Design storm discharge (cfs)	**8210**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**8210**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #071.04.
*- Information from Stephens and Associates (2006)
**-Added in 2011

Note: NA – not available from NH Dams Data Sheet.

WATER USE PLAN

University of New Hampshire/Durham Water System (#20066)

Introduction

The following individual Water Use Plan (WUP) has been prepared for the University of New Hampshire/Durham Water System (UDWS), which supplies water for the University of New Hampshire and for the Town of Durham, New Hampshire. The WUP was prepared using information provided by the UDWS and from their water use records reported to the Department of Environmental Services (DES). The UDWS has three registered water sources: the Lee Well, the Oyster River and the direct withdrawal from the Lamprey Designated River in Durham.

Because one of its registered water sources is located on the Lamprey Designated River; UDWS is considered to be an Affected Water User (AWU) under the Instream Flow Rules (Chapter Env-Wq 1900). Under Chapter Env-Wq 1900, individual WUPs are to be prepared for each AWU located within the Lamprey River Water Management Planning Area (WMPA). Each individual WUP is to include:

- Water use data and information to define water use patterns and needs for each AWU,
- A description of the potential for water use modification, sharing or both to meet the protected instream flow requirements, including water use patterns and needs,
- An estimate of implementation costs of the plan for each AWU, and
- An implementation schedule for the individual WUP.

Water Source and Uses

The UDWS withdrawal from the Lamprey River is registered with DES as Water User ID #20066-S02. The pumping station and intake, which were constructed in 1970, are located in the reservoir approximately 2,700 feet upstream of Wiswall Dam. The original underground raw water main, also constructed in 1970, transferred water withdrawn at the pump station and discharged directly to the Oyster River at a location approximately 1 mile upstream from UNH’s Arthur Rollins Water Treatment Plant (ARWTP) in Durham. To improve the efficiency of the withdrawal, another raw water main was constructed in 2002, which was connected to the original pipe at an intermediary location and run directly to the ARWTP. This withdrawal improvement project, which also included upgrades at the pump station, allowed water withdrawn from the reservoir to be pumped directly to the ARWTP thereby avoiding losses of the transferred water within the Oyster River and riparian wetlands. The Wiswall Dam, the Wiswall Reservoir and the intake are all located on the Lamprey Designated River.

From 1970 to 2002, withdrawals from the Lamprey River were directly transferred to the Oyster River supply source in times of drought. Water was not withdrawn from the Lamprey River on a regular basis because it was inefficient and increased the turbidity in the Oyster River making it difficult to treat. As a result, infrequent withdrawals were made when demand was high and the available supply from the Oyster River was limited. After 2002, with the direct connection between the Lamprey River and the ARWTP completed, more frequent water usage for trials and experimentation with the new system configuration occurred from 2002 until 2004. From 2004 through 2008 the use of the Lamprey River withdrawal was infrequent and sporadic while a variety of operational complications were resolved. In late 2008, the Lamprey River became the principal source of water for the UDWS. The water from both the Lamprey and Oyster Rivers is treated at the ARWTP and then distributed to the water system, while the Lee Well, which represents 25-50 percent of the total supply.

Water Use Patterns

Lamprey River withdrawals are metered and withdrawal volumes are recorded daily and totaled monthly with reports provided to DES on a quarterly basis. Water use data for the UDWS Lamprey River withdrawals for the years of 1988 through 2008 were obtained from DES. From January 1988 through December 1992, there is no record of any Lamprey River water use. From January 1993 through December 2008, the monthly water use records are complete. The water use data are presented in Figures 1 and 2 and summarized in Tables 1 and 2.

From 1970 to 2008, withdrawals from the Lamprey River were sporadic due to the complexities described above. During this time supply needs were usually met with withdrawals from the Oyster River and the Lee Well. Withdrawals from the Lamprey River typically occurred during August and September, when demand increases in response to the return of UNH students to Durham and decreased at the end of May with the conclusion of the UNH spring semester and decline in student population. Starting late in 2008, the Lamprey River became the principal source of water for the UDWS when flow on the Lamprey River exceeds 45 cfs.

Annual water use from the Lamprey River from 1993 through 2008 has ranged from a high of 121.0 million gallons (2003) to a low of 0 gallons (multiple years) (Figure 1) with an average annual use of 21.9 million gallons (Figure 2 and Table 1). Withdrawals from the Lamprey River were greater from 2002 through 2004 than during all other years. As described above, this was a result of trials and experimentation as the Lamprey River withdrawal was transitioned from a direct discharge to the Oyster River Reservoir to a direct connection with the ARWTP. This period also coincided with several summers of below normal discharge on the Lamprey and Oyster Rivers due to regional drought conditions. Between 1993 and 2008 water withdrawals from the Lamprey River were sporadic and have little correlation to UDWS overall water use patterns.

Figure 1. UDWS Lamprey River Diversion Total Annual Water Use (1993 through 2008).

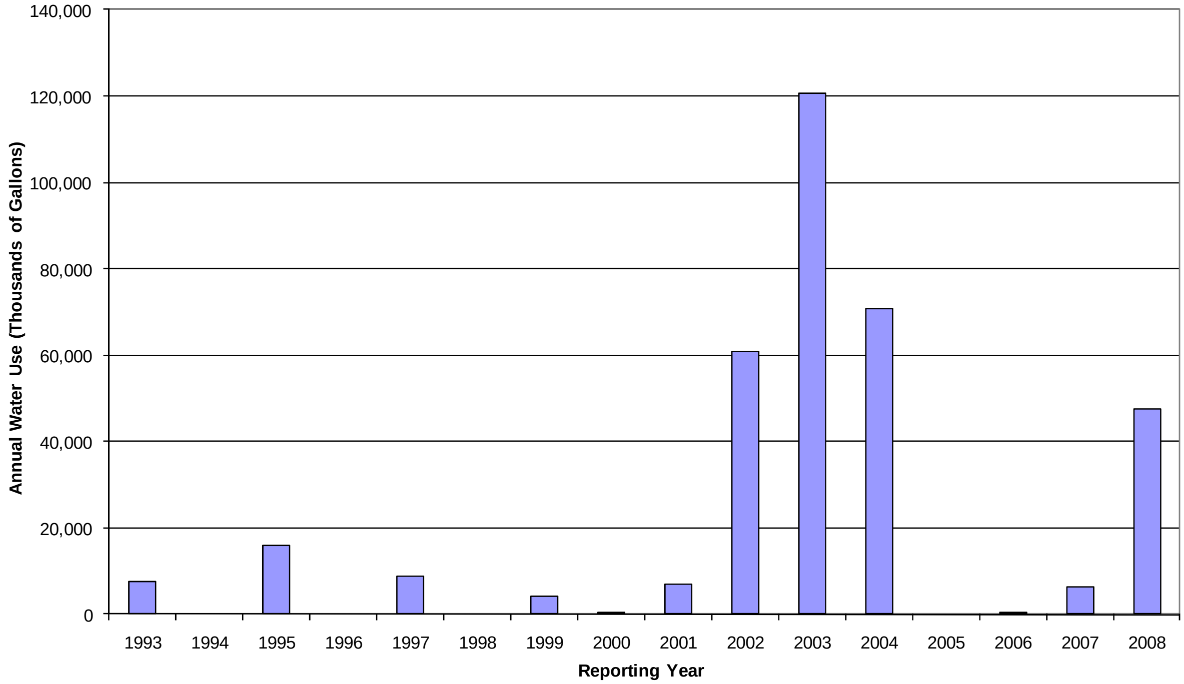


Table 1. UDWS Lamprey River Diversion Average Annual Water Use Statistics (1993 through 2008, years with incomplete data have been omitted).

	Low	High	Average
(thousand gal)	0	121,000	21,900
(cfs)	0	0.5120	0.0929
(cfsm at impact point)	0	0.0028	0.0005
(cfsm at Packers Falls Gage)	0	0.0028	0.0005

Monthly water use from the Lamprey River during this time period was highly variable due largely to seasonal demand, but is was also affected by weather conditions and the availability of water from the Oyster River. The total and average monthly water usage during this time period was greatest during the summer and fall and lowest during the winter (Figure 2). This seasonal use pattern reflects increased use of the Lamprey River due primarily to the return of students to UNH in the fall and summer droughts which limited water availability and quality in the Oyster River.

Figure 2. UDWS Lamprey Diversion Total Monthly Water Use (1993 through 2008).

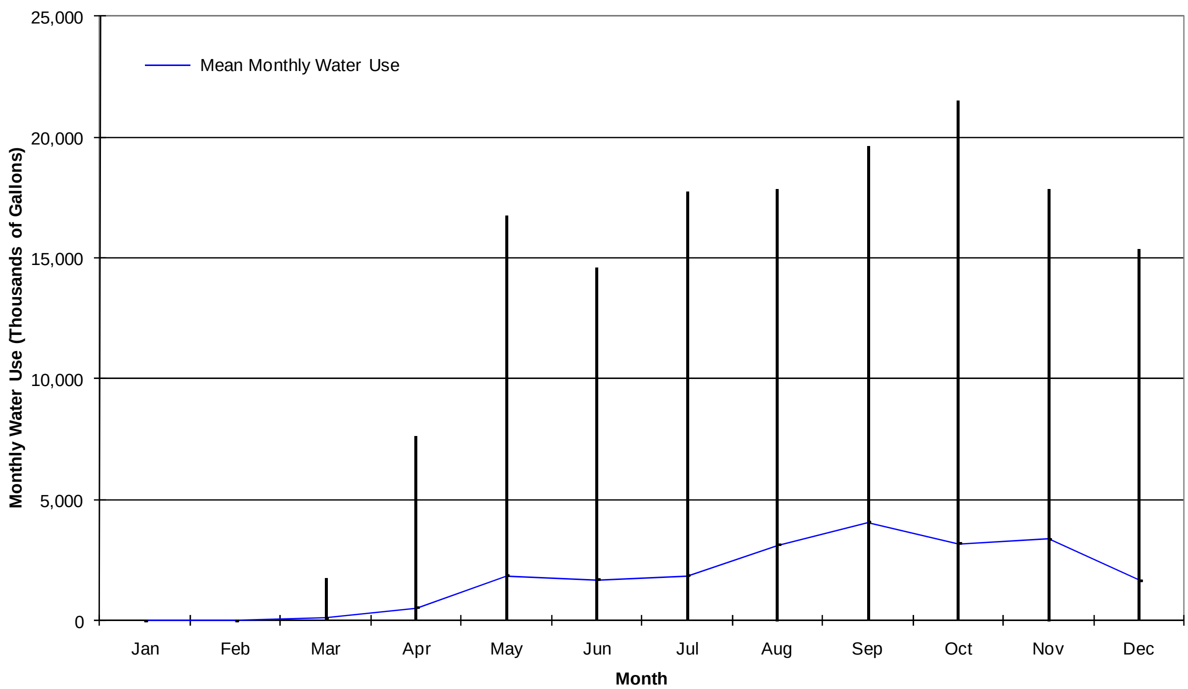


Table 2. UDWS Lamprey Diversion Monthly Water Use Statistics (1993 through 2008).

	Low	High	Average
(thousand gal)	0	21,500	1,780
(cfs)	0	1.0700	0.0904
(cfsm at impact point)	0	0.0058	0.0005
(cfsm at Packers Falls Gage)	0	0.0059	0.0005

The highest total monthly usage from the Lamprey River was 21.5 million gallons (October 2003), while no water use was reported for multiple months during multiple years (Table 2). The average monthly usage from the Lamprey River was 1.83 million gallons for the period January 1993 through December 2008. As described above, between 2002 and 2008 the UDWS was in a period of transition and operationally evaluating the Lamprey River withdrawal and optimizing treatment methods at the Water Treatment Plan which resulted in sporadic usage and therefore it may not be reflective of future use pattern and provides limited value with respect to predicting future use patterns.

The monthly water use data were converted to flow in cubic feet per second by dividing the monthly totals by days and then multiplying this result by a flow unit conversion factor. Based on these values, the total water use of the Lamprey River pump station has ranged from a minimum of 0 cfs (multiple occurrences), to a maximum of 1.07 cfs (0.69 million gallons per day) (during October 2003) with a mean monthly water use of 0.09 cfs (58,169 gallons per day) over the period 1988 to

2008 (Table 2). Again, it should be noted, that withdrawals from the Lamprey River for most of the record were not continuous, so the average includes long periods when no water was withdrawn.

Potential for Water Use Management to Meet Protected Instream Flows

UDWS has the potential to manage water use to support the Protected Instream Flows due to the availability of multiple water sources and the potential for reducing system water demand through the use of water conservation measures. The alternative sources include the Oyster River Reservoir, the Lee Well, and storage in the Wiswall Reservoir. The UDWS also has an established Emergency Response Plan that includes a multi-stage, outside-water-use plan to reduce system demand during periods of drought.

The capacity of the UDWS pump at the withdrawal from the Lamprey Designated River is 2.8 cfs (1.8 million gallons per day.) The effect of withdrawal has the greatest impact during periods when stream flow is lowest, which typically occurs during the months of August and September. August and September also happen to be when water demand by UDWS increases due to the arrival of UNH students to begin the fall semester.

UDWS has alternative water sources available from the Oyster River and the Lee Well. The Oyster River reservoir has an estimated usable storage volume of 9 million gallons (Underwood Engineers, Inc. 2007). Water withdrawn from the Oyster River is treated and then distributed to the water supply system. The Oyster River watershed is more than ten times smaller than the Lamprey watershed and so has less water available for consumptive use. Due to the requirement for treatment, water supply from the Lamprey River and Oyster River is limited by the maximum capacity of the Arthur Rollins treatment plant, which is 1.55 million gallons per day. The Lee Well has an estimated sustainable yield of 0.54 million gallons per day and discharges directly into the water distribution system after disinfection.

UDWS has an established Emergency Response Plan with a multi-stage, outside-water-use reduction and public awareness/voluntary conservation plan that applies during periods of drought. UDWS has indicated an interest and a willingness to coordinate reasonable reduction goals for outside water use during agreed upon with stream flow conditions in order to reduce system demand and support the protected flows.

This Water Use Plan must be coordinated with the Dam Management Plan developed for the Wiswall Dam (State Dam ID #071.04).

Water Use Plan Activity and Actions

The main components of the UDWS Water Use Plan are listed below and described further in later paragraphs

- Withdrawals affecting downstream flow may be limited or restricted during designate low flow conditions.

- Withdrawals from reservoir storage are available so long as the Water Use Plan conditions for water level drawdown, rate of drawdown and downstream flow are effectively met.
- UDWS will manage withdrawals from the Lamprey River in cooperation with operation of the Wiswall Dam to effectively maintain downstream flows and Reservoir operating conditions.
- UDWS will acknowledge receipt of DES notifications when a relief flow release is to be made.
- During the relief flow releases UDWS will actively manage their withdrawal from the Wiswall Reservoir to ensure that inflow or sufficient flow to exceed the Critical Protected Flow magnitude is effectively passed.
- Summertime outside watering use restrictions and conservation measures as outlined in the Water Conservation Plan will be implemented when limited source water availability corresponds with low river flow periods in order to limit the impacts of water demands on the Lamprey River flow.
- UDWS will have access to 0.20 cfs of the de minimis flow of 0.21 cfs.
- Longer periods at lower pumping rates will be the preferred operational procedure for withdrawals from the Lamprey River especially during instream flow management events.

The prompts for these Water Use Plan actions are determined from flow measurements at the USGS gaging station on the Lamprey River at Packers Falls near Newmarket (0173500). UDWS will monitor flow conditions and act on the Water Use Plan based on mean daily flow conditions recorded at this gage.

If the UDWS or the Commissioner declares that a water supply emergency[1] exists or if an event occurs which affects public health and safety and requires continued withdrawal, then the conditions in this plan will be set aside until conditions allow for the provisions of the Water Use Plan to resume. UDWS will notify DES immediately upon declaration of emergency conditions and provide the Commissioner with written description of the factors that resulted in the emergency and an estimation of expected duration and corrective action being taken. During the emergency, UDWS shall maintain written records of: river flow at the USGS Lamprey near Newmarket gage, start and end dates and times of uniform withdrawal rates and the pumping flow rate; daily withdrawal volumes from all sources, date and time of beginning and end of emergency conditions, reasons for the emergency, and the name and office of the public official who declared the emergency. Within 60 days of the end of emergency operations, the UDWS shall file with DES a report describing the cause(s) of the emergency and water use and Lamprey withdrawal conditions on a daily basis, including the times and amounts of water withdrawal and reservoir water levels and rates of change. Unless the emergency was caused by one-time, non-recurring circumstances such as fire or a contamination event, the report will detail specific steps to be taken by UDWS to avoid recurrence of emergency conditions.

Insert footnot[1]: A water supply emergency may be caused by an unforeseen event or conditions that deems one of more water sources unusable and/or causes a system wide water shortage resulting in Stage 4 status, and as defined by RSA 4:45 and RSA 483:9-c, IV. Such an event or conditions could be, but is not limited to, a major operational or equipment failure, a natural or environmental disaster, an act of terrorism, or a statewide drought declaration.

The UDWS withdrawal on the Lamprey River (20066-S02) may be operated at up to its maximum pumping capacity of 2.8 cfs when stream flow is greater than or equal to 16 cfs. When stream flows in the Lamprey are below 16 cfs, the UDWS's other water sources will be balanced with Lamprey River withdrawal to satisfy the protected instream flow requirements and meet minimum UDWS demands. .

When stream flow is less than 16 cfs, the UDWS withdrawal on the Lamprey River may be operated at up to its maximum pumping capacity of 2.8 cfs so long as Wiswall Reservoir operating conditions under its Dam Management Plan are effectively met.

When protected flow conditions are not met resulting in catastrophic conditions, DES may release periodic relief flows from impoundments upstream of Wiswall Reservoir. During the effective period of a relief flow release conducted under the Lamprey Water Management Plan, UDWS will take water only from Wiswall Reservoir from storage (maintain outflow from the Wiswall Reservoir equal to inflow.) The effective period of a relief flow release is expected to be approximately three days: DES estimates that the release flow pulse once begun will take approximately 23 hours to reach the Packers Falls Gage and will then continue for 48 hours.

DES will send UDWS a notification of an approaching relief flow release at least 72 hours prior to its arrival at Wiswall Dam stating the scheduled start time and the anticipated arrival time at Wiswall Dam. UDWS will acknowledge receipt of the notification within 24 hours unless the notification is received on a Friday or a weekend in which case acknowledgment will be provide on the following Monday. UDWS will coordinate with the designated Wiswall Dam Operator to monitor inflow and change in storage to the Wiswall Reservoir. During the effective period of the relief pulse, the Wiswall Dam will be operated (i.e., open gates or remove stop logs in the Wiswall Dam) to pass the relief flow effectively equal to the volume and rate that it arrives in the Wiswall Reservoir (outflow equals inflow.) Alternatively, the Wiswall Dam Operator may, with approval of the UDWS, operate the dam to create a relief flow that exceeds the current bioperiod's rare flow magnitude (See Table 1) at the USGS Lamprey gage near Newmarket.

Outside water use is typically heaviest during the summer and early fall. Plans for outside water use reduction will be applied during the two bioperiods (June 20 through October 6) in accordance with the Water Conservation Plan. Summertime outside water use reductions and calls for conservation measures as outlined below will be implemented by the UDWS to reduce the impact of outside water use on the Lamprey River and the UDWS water supply during defined flow and water system conditions. Measures to reduce outside water use will be enacted as part of the UDWS Emergency Response Plan (UNH/Durham Water Supply, 2009 or most recent version). Under this Water Use Plan, the goal of reducing outdoor water use will be accomplished in four water conservation stages based on Lamprey River flow and system demand as compared to the maximum available capacity of the combined system source water. Maximum available capacity is defined as the amount of water available to the UDWS from the system's combined water sources on a given day.

The four water conservation stages progress from alert messages and voluntary measures under Stage 1 to a mandatory ban on outside water use and broader restrictions under Stage 4 per UDWS Emergency Response Plan (2009 or most recent version):

> Stage 1 Alert. The first action is an alert that voluntary water conservation measures should be taken and further actions may begin soon. The alert will be enacted by the UDWS on the day after daily mean discharge at the gage falls below 16 cfs (the Critical protected flow level) and when system demand is ≥ 75% of the maximum available capacity. UDWS will inform its water users through its notification process to implement voluntary water conservation measures and prepare for further actions as described in **Stage 1** of the Emergency Response Plan. An alert is rescinded when daily mean discharge exceeds 25 cfs for two consecutive weeks.
>
> Stage 2 Alert. When daily mean discharge in the Lamprey Designated River continues to decline and fall below the Critical protected flow level of 16 cfs for longer than 15 days, and when system demand is ≥ 80% of the maximum available capacity, then UDWS will implement outside water use restrictions as described in **Stage 2** of the Emergency Response Plan. These restrictions include, but are not limited to, a ban on vehicle washing and swimming pool filling, and limited watering of lawns and gardens. These restrictions will be rescinded when daily mean discharge exceeds 16 cfs for five consecutive days.
>
> Stage 3 Alert. When daily mean discharge in the Lamprey Designated River falls below the Rare protected flow level of 16 cfs during this period for longer than 20 days, and when system demand is ≥ 85% of the maximum available capacity, then the actions described under **Stage 3** of the Emergency Response Plan will be imposed, including, but not limited to, bans on vehicle washing, swimming pool filling, and watering of lawns and limited watering of vegetable gardens. These restrictions on outside water use will be rescinded when daily mean discharge exceeds 16 cfs for two consecutive days.
>
> Stage 4 Alert. When daily mean discharge in the Lamprey Designated River falls below the Rare protected flow level of 16 cfs during this period for longer than the 25 days, and when system demand is ≥ 90% of the maximum available capacity, and/or the UDWS or the Commissioner declare a water emergancy, then a complete ban on outdoor water use will be imposed as described under **Stage 4** of the Emergency Response Plan, including, but not limited to, bans on vehicle washing, swimming pool filling, and lawn and garden watering. These restrictions on outside water use will be rescinded when daily mean discharge exceeds 16 cfs for two consecutive days.

The Town's water system customers and the students at the University of New Hampshire will be notified of the implementation of the water conservation stages through a public notice process by the Town and the University. This process will include mailings, posters, emails and notices on the Town and University web sites. The Town will also publish an emergency notice in the local newspaper and post notices in ten prominent areas around the Town (Town of Durham 1999) in the event of a Stage 4 Alert.

Currently UDWS has the ability to request only voluntary conservation measures of its water users. The legal authority to impose mandatory water use restrictions on Town of Durham water users is conditional upon the Durham Town Council adopting a water use restriction ordinance defining such authority, conditions of restrictions, and commensurate penalties. UDWS shall work with the Town and UNH to establish procedures to implement mandatory water use restrictions and water conservation measures consistent with this Water Use Plan .

Adaptive management will be applied to evaluate the timing of implementation of water conservation stages. The demand to capacity ratios defining the Stage conditions used to initiate the outside water use reductions described below are under review. DES and UDWS will evaluate the effectiveness of these magnitudes in starting and ending outside water use reductions appropriate to meet UDWS's water needs through their critical period of August 15 through October 15. UDWS and DES will evaluate the applied management during the summers of 2013 and 2014 and continue if more examples are needed. Similarly, UDWS will develop algorithms to define the demand to capacity ratio values. The algorithms will be reviewed and revised with DES support. Conditions that will be reviewed are the comparable conservation stage of other public water suppliers in the watershed and how the schedule of use of the UDWS water sources affects demand versus capacity ratios. Careful review and analysis of the management techniques and Emergency Response Plan may lead to improvement to operations by changing the timing of withdrawals from different sources and revision of the capacity ratios.

Approximately 0.20 cfs will be available to UDWS under the de minimis withdrawal under any river flow. The calculated de minimis withdrawal for the Lamprey River is 0.21 cfs. UDWS is one of two direct surface water withdrawals in the Lamprey tributary system.

Whenever operational considerations of the water treatment plant, pumping station, water use, etc. allow, it is recommended that UDWS operate the Lamprey River withdrawal at lower withdrawal rates over longer periods in preference to higher withdrawal rates for shorter periods.

Whenever operational considerations of the water treatment plant, pumping station, water use, etc. allow, it is recommended that UDWS operate surface water withdrawals to take make use of high flows so that their groundwater sources are rested by operating at lower rates to preserve the capacity of their groundwater sources.

Nothing in this plan precludes the UDWS from implementing more restrictive water use actions on its own initiative.

Estimated Water Use Plan Implementation Costs

The management activities would be performed by UNH and Town staff and/or a consultant and the annual costs to implement and maintain the water use plan is expected to range from $10,000 to $30,000.

To implement this Water Use Plan UDWS will implement their Draft Lamprey Flow Monitoring Plan dated August 25, 2009. The purpose of the monitoring plan is to implement accurate measurements of inflow to the Wiswall Reservoir to determine and meet conditions for Reservoir outflow management. UDWS installed a water level gage in the Wiswall Reservoir to provide remote measurements of the reservoir level in order to manage withdrawals according to this plan. UDWS will also develop either a flow measurement at the outlet of the Wiswall Dam or use the USGS gage Lamprey near Newmarket to provide accurate reservoir outflow data with which to manage withdrawals. The estimated cost for the design and installation of these gages is $10,000 to $50,000 depending upon the technology used to record and transmit the water level data.

Water Use Management Plan Implementation Schedule

By June 1, 2014, UDWS will implement its Water Use Plan and will institute the proposed measures for the management of outdoor water use during the summer and early fall when flows on the Lamprey Designated River fall below the Critical or Rare protected instream flow levels.

Water User Contact Information

Water User: University of New Hampshire/Town of Durham Water System

Address: Town of Durham Department of Public Works
100 Stone Quarry Drive, Durham, NH 03824
Contact: David Cedarholm, Town Engineer
Phone: 868-5578
Email: dcedarholm@ci.durham.nh.us

Address: UNH Energy and Utilities
17 Leavitt Lane, Durham, NH 03824
Contact: Jim Dombrosk, Director Energy and Utilities
Phone: 862-2345
Email: jim.dombrosk@unh.edu

Conversion Factors for Volume and Flow Units

1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	448.86	gpm
1	cfs =	646,358.4	gpd

1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Sources of Information

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/29/03.

Department of Environmental Services (DES) 2009. Final Lamprey Protected Instream Flow Report. Prepared by Normandeau Associates, Inc., Rushing Rivers Institute and the University of New Hampshire. NHDES-R-WD-08-26.

UNH/Durham Water Supply 2009. UNH/Durham Water Supply Emergency Response Plan. Prepared by Wesley R. East, Chief Operator. Original date August 2002 and Revised March 2009.

Personal communication with David Cedarholm, P.E., Town of Durham.

Personal communication with Wesley East. UNH/Durham Water System.

Survey of Lamprey River Affected Water Users performed by Normandeau Associates, Inc. completed by Wesley East. UNH/Durham Water System.

Underwood Engineers, Inc. 2007. Draft Update to Water Resources Management Plan Durham NH University of New Hampshire dated October 2007.

Water use reports on file with the Department of Environmental Services (DES).

Underwood
Engineers, Inc.
Civil~Environmental

99 North State Street, Concord, NH 03301-4334
603-230-9898 Fax 603-230-9899

MEMORANDUM

DATE: July 30, 2010 – Revision 1 **FILE: 1439-03**

TO: David Cedarholm, P.E.

FROM: Michael B. Metcalf, P.E.

SUBJECT: Update on Current UNH/Durham Water Supply Capacity and Demand

This memorandum documents an update to the water supply capacity and demand figures given in the Draft October 2007 Water Resources Management Plan.

SUPPLY CAPACITY

Maximum Supply Capacity

Arthur Rollins WTP

- As of July 2010, the Chief Operator at the Arthur Rollins WTP indicates that the maximum capacity of the plant remains at about 1.5 MGD.

Lee Well

- Town officials indicate that there is no change in the capacity of the Lee Well or the reserves which are set aside for the Town of Lee and the Technology Drive Office/Research Park.

No new sources have been developed so the maximum supply capacity is the same as it was in 2007 as shown in ***Table 1*** below.

TABLE 1
MAXIMUM SUPPLY CAPACITY
(Gallons Per Day)

Source	Total Capacity	Reserved Volume	Maximum Capacity
Arthur Rollins WTP	1,500,000	0	1,500,000
Lee Well	540,000	135,000[1]	405,000
TOTAL	**2,040,000**	**135,000[1]**	**1,905,000**

[1]54,000 gpd for Town of Lee plus 81,000 gpd for Technology Drive office/research park

Critical Supply Capacity

Lamprey River

- Supply capacity is still governed by the 401 Water Quality Certificate (401). However, DES has indicated they are amenable to changing the 0.5 inch maximum drawdown of the Wiswall Reservoir in 24 hours to 1.0 inch.
- Wiswall Reservoir holds about 6,160,678 gallons in top 6 inches or about 1,027,000 gallons per inch.
- Based on this change we have revised the supply capacity for each trigger flow in the 401.
    - Flow between 45 and 21 cfs
        - 1.8 cfs = 808 gpm ≈ 1,163,000 gpd
        - 1.0 inch drawdown ≈ 1,027,000 gpd
    - Flow between 21 and 13 cfs
        - 0.4 cfs = 180 gpm ≈ 259,000 gpd
        - 1.0 inch drawdown ≈ 1,027,000 gpd
    - Flow less than 13 cfs
        - Inflow = outflow
        - 1.0 inch drawdown ≈ 1,027,000 gpd

Oyster River

- For 10 year period, 1999-2009, average production rate at ARWTP was 539,000 gpd (0.83 cfs) and for last 4 years it was 604,000 gpd (0.94 cfs)
- Using area transposition method (i.e. cfs/mi^2), can determine flows at USGS gauge on Oyster River corresponding to Lamprey River trigger flows. Flow into Oyster River Reservoir would be this amount plus that from 4.4 mi^2 below gauge. Can use these figures to estimate available flow for WTP and flow going over dam assuming WTP operating at 604,000 gpd or 0.94 cfs (***Table 2)***.

TABLE 2
ESTIMATED OYSTER RIVER LOW FLOWS

Lamprey Trigger Flow (cfs)	Flow at OR Gauge (cfs)	Additional Flow Below Gauge (cfs)[1]	Total Flow into OR Res (cfs)	Flow Used at WTP[2] (cfs)	Flow Over OR Res Dam (cfs)
Q_{60}: 45	2.98	1.08	4.06	0.94	3.12
Q_{80}: 21	1.39	0.50	1.89	0.94	0.95
Q_{90}: 13	0.86	0.31	1.17	0.94	0.23

[1] Estimated by getting cfs/mi^2 above gauge and multiplying by 4.4 mi^2 below gauge and above dam
[2] Assumes WTP is operating at 604,000 gpd

- For critical low flows in the Oyster River (i.e. to correspond with Lamprey River when flow is significantly below 13 cfs), use September 2002 mean flow of 0.4 cfs as measured at the USGS Oyster River gauge.
  - 4.4 mi^2 downstream of gauge and upstream of Oyster River Reservoir still provides 0.15 cfs for release downstream of reservoir.
  - 0.4 cfs = 180 gpm ≈ 259,000 gpd

Lee Well

- Not affected by low flows so capacity is the same as for maximum capacity.

Critical supply capacity is as shown in ***Table 3***. It is noted that we have shown the total available assuming all three sources are being used since there is the ability to pump Lamprey River water into the Oyster River Reservoir. However, in actual practice to date, the WTP has been run using only one source at a time. Therefore we have shown the critical supply capacity if only one surface supply is being used at a time.

TABLE 3
CRITICAL SUPPLY CAPACITY
(Gallons Per Day)

	Lamprey River Flow		
Supply Source	**45 – 21 cfs**	**21 – 13 cfs**	**< 13 cfs**
Lamprey River	2,190,000	1,286,000	1,027,000
Oyster River	604,000	604,000	259,000
Lee Well	405,000	405,000	405,000
TOTAL	**1,905,000**[1]	**1,905,000**[1]	**1,691,000**
Total Using Only Lamprey	**1,905,000**[1]	**1,691,000**	**1,432,000**
Total Using Only Oyster	**1,009,000**	**1,009,000**	**664,000**

[1]While the sum of the supply capacity from each source is greater, this amount is based on the capacity of the WTP and the Lee Well from Table 1

Additional Supply Capacity

Spruce Hole Groundwater Supply

- EGGI Preliminary Hydrogeologic Investigation Report notes that the intent is to develop a 250 gpm (360,000 gpd) well in the Spruce Hole aquifer.
- Installed production well is capable of producing up to 700 gpm. Pump test is proposed at higher rate to determine what is actually sustainable.

WATER DEMAND

Average Day Demand

- Demand has been based on water production figures. Water production from 1999 to 2009 is shown in ***Table 4***. This is plotted on ***Figure 1***, attached.

TABLE 4
WATER PRODUCTION
1999 - 2009

Year	Avg Daily Flow ARWTP (gpd)	Avg Daily Flow Lee Well (gpd)	Avg Daily Flow Combined (gpd)
1999	485,000	301,000	786,000
2000	528,000	332,000	860,000
2001	492,000	326,000	817,000
2002	457,000	321,000	778,000
2003	577,000	219,000	796,000
2004	475,000	280,000	755,000
2005	500,000	270,000	770,000
2006	601,000	243,000	844,000
2007	603,000	217,000	819,000
2008	602,000	199,000	801,000
2009	612,000	223,000	835,000
AVG	**539,000**	**266,000**	**806,000**

- Broke water demand up into periods when UNH is in and out of session for 2004 – 2009. See ***Figures 2 & 3*** attached. Also looked at September demand which is consistently the highest demand month. Average daily production for these timeframes is given below:
  - UNH in Session (September – May)
    - ARWTP - 593,000 gpd
    - Lee Well - 253,000 gpd
    - Combined - 846,000 gpd
  - UNH not in session (June – August)
    - ARWTP - 486,000 gpd
    - Lee Well - 206,000 gpd
    - Combined - 692,000 gpd
  - September
    - ARWTP - 755,000 gpd
    - Lee Well - 311,000 gpd
    - Combined - 1,066,000 gpd

Maximum Day Demand

- Based it on 3 day average using day before and after highest demand each month (***Table 5)***. This is also shown on ***Figure 4***, attached.

TABLE 5
MAXIMUM DAY DEMAND USING 3 DAY AVERAGE
2004 - 2009

	2004	2005	2006	2007	2008	2009	2010
Jan	775,377	1,113,667	879,263	951,653	925,020	948,750	1,018,100
Feb	809,007	757,867	1,035,993	892,443	870,777	1,043,293	1,069,557
Mar	789,687	828,490	910,807	971,030	831,783	1,029,253	997,757
Apr	802,720	984,127	1,020,793	842,827	868,860	1,047,180	847,167
May	1,066,640	984,560	1,041,613	1,037,597	1,183,027	1,248,963	1,285,450
Jun	905,363	727,433	865,547	782,837	1,100,543	905,183	
Jul	731,407	788,160	996,523	929,703	770,293	741,603	
Aug	766,947	1,168,610	1,033,627	731,183	908,800	937,290	
Sep	865,000	1,180,940	1,155,983	1,166,743	1,188,187	1,398,220	
Oct	1,251,713	1,020,277	1,299,807	1,113,670	1,187,157	1,261,860	
Nov	748,230	1,114,247	990,830	1,043,710	953,650	1,220,090	
Dec	1,059,370	841,970	742,773	972,003	956,633	998,270	

- Max Day Demand using a 3 day average varies from 1.2 to 1.4 MGD.
- Max Day Demand occurs the most in September or October. High demands in May might be due to system flushing.
- Summary of current demand figures (based on water production)
  - o Average Day Demand (ADD) – UNH in session - 846,000 gpd
  - o Average Day Demand – UNH not in session - 692,000 gpd
  - o Average September Day Demand - 1,066,000 gpd
  - o Maximum Day Demand (MDD) - 1,400,000 gpd
- In terms of planning, the worst case condition is when UNH is in session and maximum day demands exceed average September demand so these will be used for projection of future demand and looking at the adequacy of supply.
- Peaking Factor for use in planning
  - o ADD to MDD – UNH in session - 1.65

UNH and Durham Demand Components

- Weston & Sampson did a detailed analysis of 2007 – 2008 metered use for UNH and the Town. This looked at actual use as opposed to water production and was broken out to reflect UNH in session and out of session. This data was compared with the water production figures for UNH both in and out of session for the same time period.

- UNH & Town Metered Use

	UNH in Session	% Use	UNH not in Session	% Use
UNH	474,255 gpd	65%	308,175 gpd	51%
Town	252,019 gpd	35%	290,831 gpd	49%
Total	762,274 gpd		599,006	

- 2007 – 2008 Water Production and Metered Use

	UNH in Session	UNH not in Session
Total Production	850,812 gpd	689,265 gpd
Metered Use	726,274 gpd	599,006 gpd
Unaccounted	124,538 gpd (14.6%)	90,259 gpd (13.1%)

- Per Capita Use
    - Weston and Sampson calculated per capita use specific to UNH dorms and dining halls and 5/8" Town services (i.e. single family homes). However, for predictive use, per capita figures are needed that capture all UNH and Town use. We therefore used total UNH and Town population served by the water system as calculated in the 2007 report along with total metered use when UNH is in session
    - UNH per capita use
        - 474,257 gpd/7049 served = 67.3 gpcd
    - Town per capita use
        - 252,019 gpd/3091 served = 81.5 gpcd
    - Note that difference in per capita use between UNH and Town makes sense given homes with water using appliances, lawn irrigation, etc.

Future Estimated Demand

Several methods were used to estimate future demand.

- Trend lines as shown on the combined production plots in Figures 1, 2 and 3 were extended out to 2030.
    - The Total Water Production plot (***Figure 5***), using annual average day demand from 1999 to 2009 shows that the future demand will essentially stay flat. However, we do not feel this projection is representative of actual increases in demand as it includes years where UNH was instituting measures that reduced demand even though the UNH population served was increasing.
    - The plot of Average Daily Production - UNH in Session (***Figure 6***) uses data from 2004 to 2009, a period where UNH water saving measures were already in place and the population served was increasing. We feel this plot is more representative of

actual water demand increases than the Total Water Production plot or the plot of Average Daily Production – UNH not in Session (***Figure 7***). Based on this plot, future estimated average daily demand is as shown below:

- 2015 - 940,000 gpd
- 2020 - 990,000 gpd
- 2025 - 1,040,000 gpd
- 2030 - 1,100,000 gpd

- The second method to estimate future demand was to use the per capita demand calculated for UNH and the Town and then estimate the future population served and apply the per capita use. Since the per capita figures were estimated based on the actual metered data, it is necessary to add in the unaccounted percentage calculated previously.
  - Data from the 2007 report was used for the future UNH population
    - 1,300 additional beds and 180 family apartments through 2024
    - Estimated additional population served = 1,696
  - For future Town population served, the list of potential developments and commercial uses from the 2007 was updated as shown in ***Table 6*** on the following page.
  - Estimated additional commercial demand from the 2007 report is unchanged at 42,000 gpd (based on 15 gpd/100 ft^2 in NH Code of Administrative Rules)
  - We have assumed that the future estimated population served for both UNH and the Town would apply in the year 2030
  - 2030 estimated demand by the per capita method
    - UNH current demand - 474,256 gpd
    - Increase of 1,696 @ 67.3 gpcd - 114,141 gpd
    - 2030 UNH Demand - 588,397 gpd

    - Town current demand - 252,019 gpd
    - Increase of 4,397 @ 81.5 gpcd - 358,356 gpd
    - Increased commercial demand - 42,000 gpd
    - 2030 Town Demand - 652,375 gpd

    - Total UNH and Town demand - 1,240,772 gpd
    - Add 14.6% unaccounted - 181,153 gpd
    - Total 2030 Avg Day Demand - 1,421,925 gpd

- The per capita method yields a result about 29% higher than extension of the trend lines. We have used the more conservative per capita method for planning purposes, rounded off to 1,422,000 gpd
- Maximum day demand is estimated using the peaking factor of 1.65
  - 1,422,000 gpd x 1.65 = 2,346,300 or about 2,346,000 gpd

TABLE 6
POTENTIAL TOWN DEVELOPMENT

Residential/Student Housing	**Units/Apts**	**Beds/Residents/Students**
Fitts Farm (remaining out of 67 units)	12	34
Spruce Woods (elderly housing)	92	184
Bagdad & Canney Road (Sophie Lane)	9	25
~~Gangwar Land (low potential)~~	~~30~~	~~84~~
~~99 Madbury Road (elderly housing)~~	~~66~~	~~132~~
~~Strafford Ave (16 apartments)~~	~~16~~	~~45~~
Old Concord Road (Rivers Edge)	48 (2 Bed Rm)	96
Old Concord Road (married students)	25	50
Bryant Development	36 (4 Bed Rm)	144
MacNeil Development (student housing)	unknown	1400
Garvey/Farrell Development	unknown	650
9-11 Madbury Road	9 (4 Bed Rm)	36
Jenkins Court	3 (4 Bed Rm)	12
Anderson downtown infill	13 (4 Bed Rm)	52
Edgewood Rd Ext (elderly housing)	12 units	24
Mill Plaza	150 units	420
Capstone Development (Technology Drive)	unknown	600
Place Properties-Tecce Farm-Mast Road)	unknown	600
10 Pettee Brook Lane	unknown	70
TOTAL		~~**3,388 Beds/ppl**~~
~~***REVISED TOTAL – JULY 2010***~~		~~**2,477 Beds/ppl**~~
REVISED TOTAL – AUGUST 2010		**4397 Beds/ppl**
Commercial/Retail/Offices		**Square Feet**
Durham Business Park	-	50,000 ft^2
Stone Quarry Drive Professional Park	-	15,000 ft^2*
Strafford Ave (retail/offices)	-	4,000 ft^2
Anderson downtown infill	-	10,000 ft^2
Mill Plaza	-	200,000 ft^2
TOTAL		**279,000 ft^2**

* Information was 15 units. It is assumed each unit is 1,000 ft^2

- Summary of future estimated 2030 demand
  - 2030 Average Day Demand - 1,422,000 gpd
  - 2030 Maximum Day Demand - 2,346,000 gpd
- It is noted that the future estimated demand figures do not take into account conservation measures that may be put in place by the Town and University. A conservation plan will be a requirement of the large groundwater withdrawal permit associated with the Spruce Hole groundwater supply. Therefore along with using the more conservative demand projection, these figures can be considered doubly conservative.

SUPPLY CAPACITY AND DEMAND COMPARISON

- The ability of existing supplies to meet current and estimated demands are shown in the following ***Tables 7, 8, 9 and 10.*** We have used the supply capacity assuming that the Lamprey and Oyster River supplies can be used simultaneously meaning that water pumped from the Lamprey River would be directed into the Oyster River Reservoir.

TABLE 7
SUPPLY CAPACITY vs. EXISTING AVERAGE DAY DEMAND-UNH IN SESSION
(gpd)

Lamprey Flow Status	Supply Capacity	Average Day Demand	Surplus/ (Deficit)
45 – 21 cfs	1,905,000	846,000	1,059,000
21 – 13 cfs	1,905,000	846,000	1,059,000
<13 cfs	1,691,000	846,000	845,000

TABLE 8
SUPPLY CAPACITY vs. EXISTING MAXIMUM DAY DEMAND
(gpd)

Lamprey Flow Status	Supply Capacity	Maximum Day Demand	Surplus/ (Deficit)
45 – 21 cfs	1,955,000	1,400,000	555,000
21 – 13 cfs	1,905,000	1,400,000	555,000
<13 cfs	1,691,000	1,400,000	291,000

TABLE 9
SUPPLY CAPACITY vs. 2030 AVERAGE DAY DEMAND-UNH IN SESSION
(gpd)

Lamprey Flow Status	Supply Capacity	Average Day Demand	Surplus/ (Deficit)
45 – 21 cfs	1,905,000	1,422,000	483,000
21 – 13 cfs	1,905,000	1,422,000	483,000
<13 cfs	1,691,000	1,422,000	269,000

TABLE 10
SUPPLY CAPACITY vs. 2030 MAXIMUM DAY DEMAND
(gpd)

Lamprey Flow Status	Supply Capacity	Maximum Day Demand	Surplus/ (Deficit)
45 – 21 cfs	1,905,000	2,346,000	(441,000)
21 – 13 cfs	1,905,000	2,346,000	(441,000)
<13 cfs	1,691,000	2,346,000	(655,000)

- Existing supplies are capable of meeting both existing and future average day demands through the year 2030 even when the flow in the Lamprey River is below 13 cfs. This is a change from 2007 and is due to the fact that DES will allow a 1 inch per day drawdown of the Wiswall Reservoir as opposed to 0.5 inches. An issue that will need to be addressed is the duration of drawdowns since there is a maximum total withdrawal of either 12 inches or 18 inches.
- As shown in ***Table 10***, existing supplies cannot meet maximum day demand under any flow condition in the year 2030.
- ***Figure 8*** is a plot of future average and maximum day demand to see at what point maximum day demand exceeds supply. As shown, when the Lamprey River flow is less than 13 cfs existing supplies will not be able to meet maximum day demand around 2016. At flows above 13 cfs, existing supplies will no longer meet maximum day demand around the year 2021.
- ***Figure 9*** is the same plot as Figure 8 with a Spruce Hole groundwater source added to the supply capacity. The current recommendation based on a step test of the recently installed production well (DGD-PW2) is to operate the well at 700 gpm for a duration to be determined from a five day pumping test. For the rest of the year the pumping schedule would be limited such that the annual withdrawal does not exceed the sustainable capacity of the aquifer. For the purposes of the plot, it has been assumed that the well would be operated at the higher rate when the Lamprey River flow was less than 13 cfs which is typically the time when demands are greatest, and at a lower rate (assumed at 250 gpm) when the flow is greater than 13 cfs. The plot shows that adding 700 gpm to the critical supply capacity at low Lamprey River flows will allow maximum day demand to be met through the year 2030 and beyond.

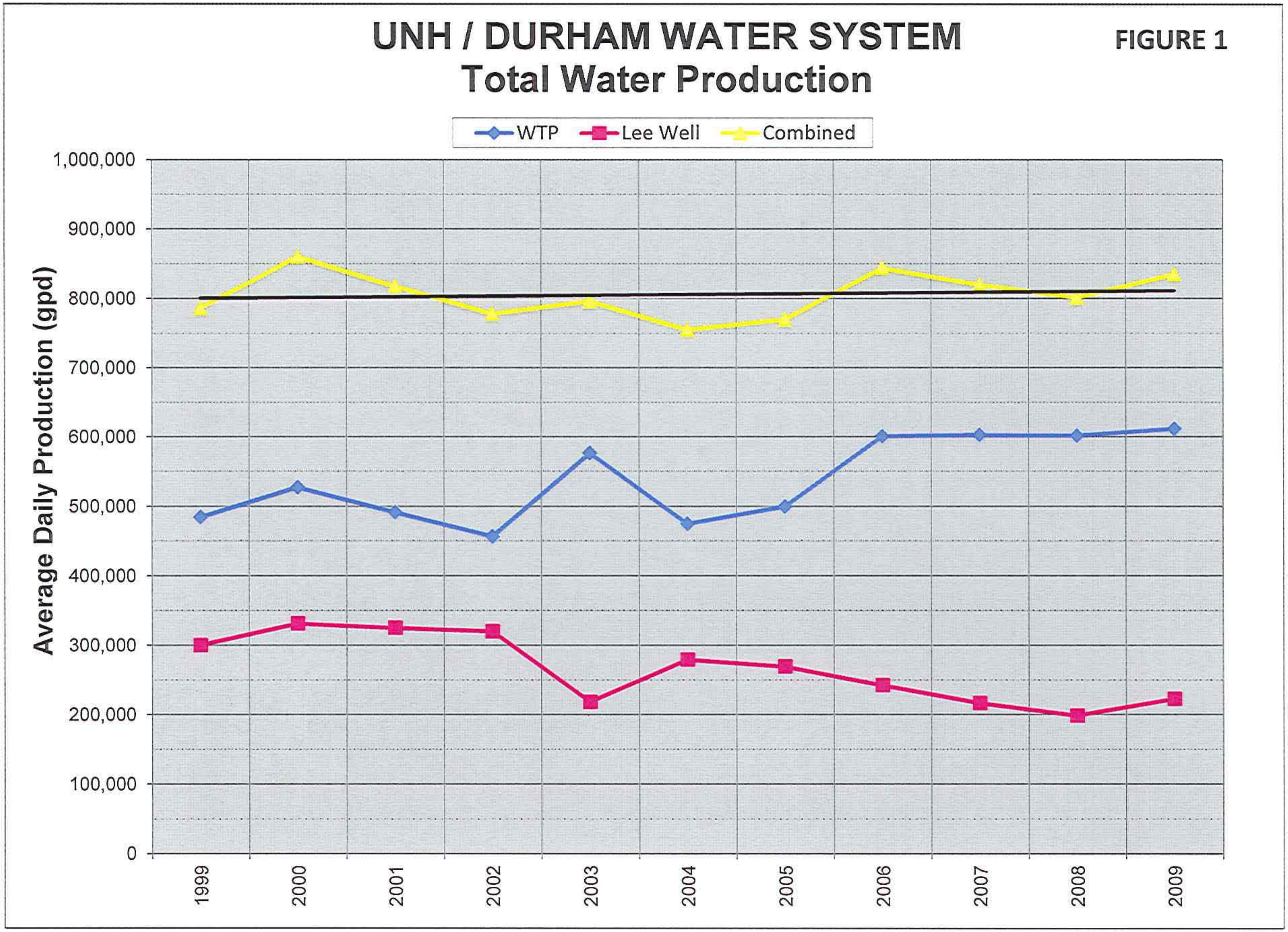

UNH / DURHAM WATER SYSTEM
Total Water Production
FIGURE 1
WTP
Lee Well
Combined
Average Daily Production (gpd)
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009

FIGURE 2

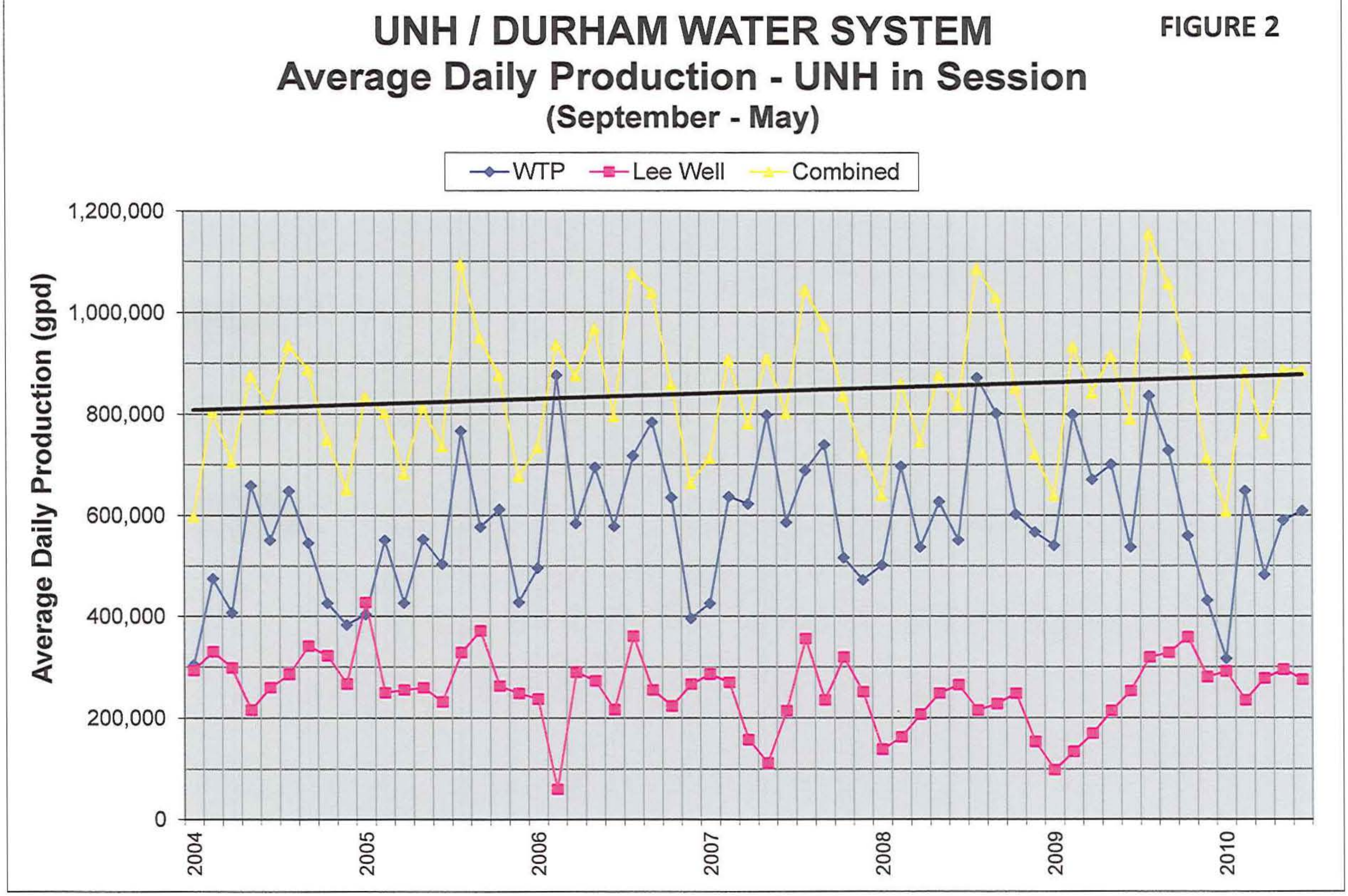
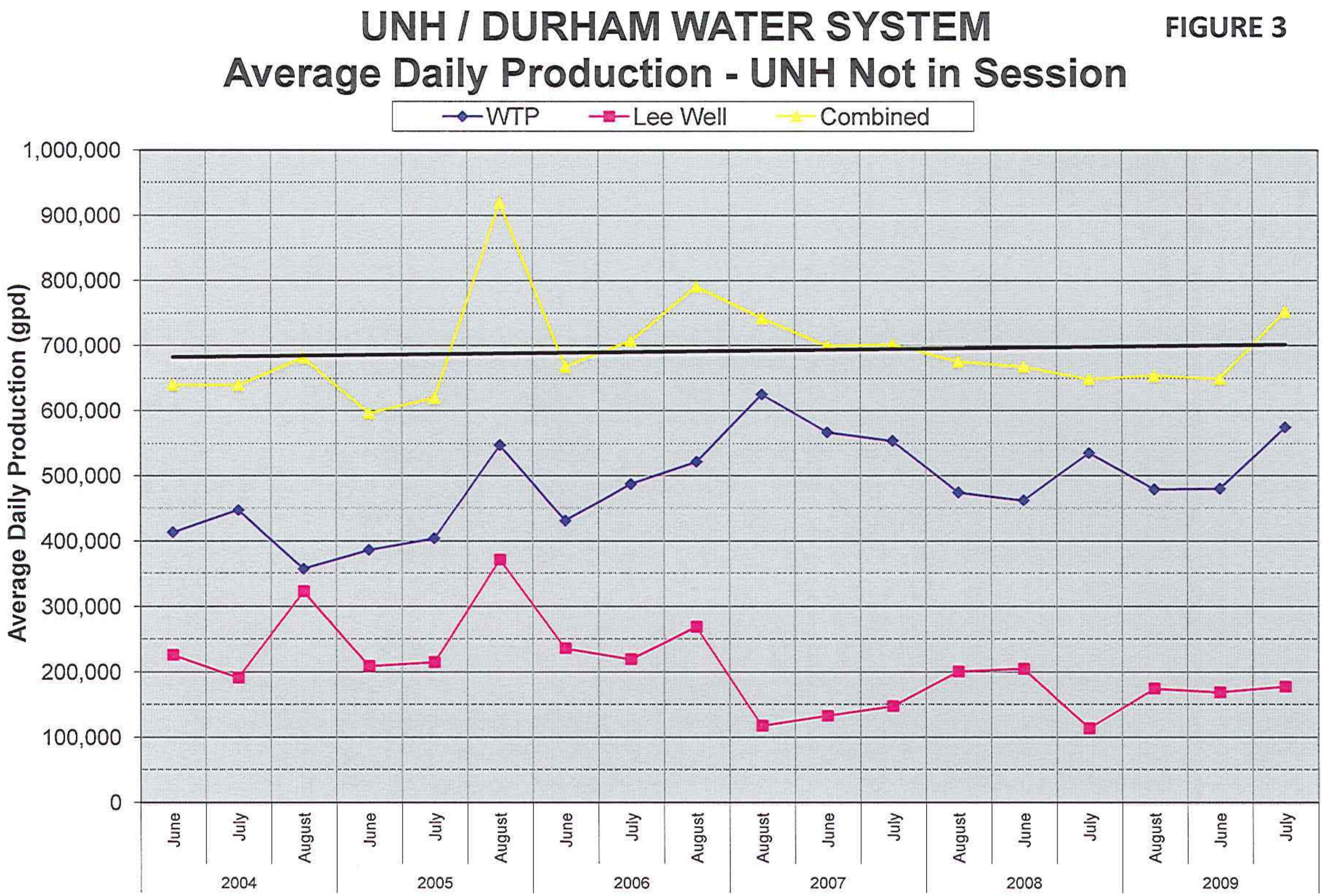
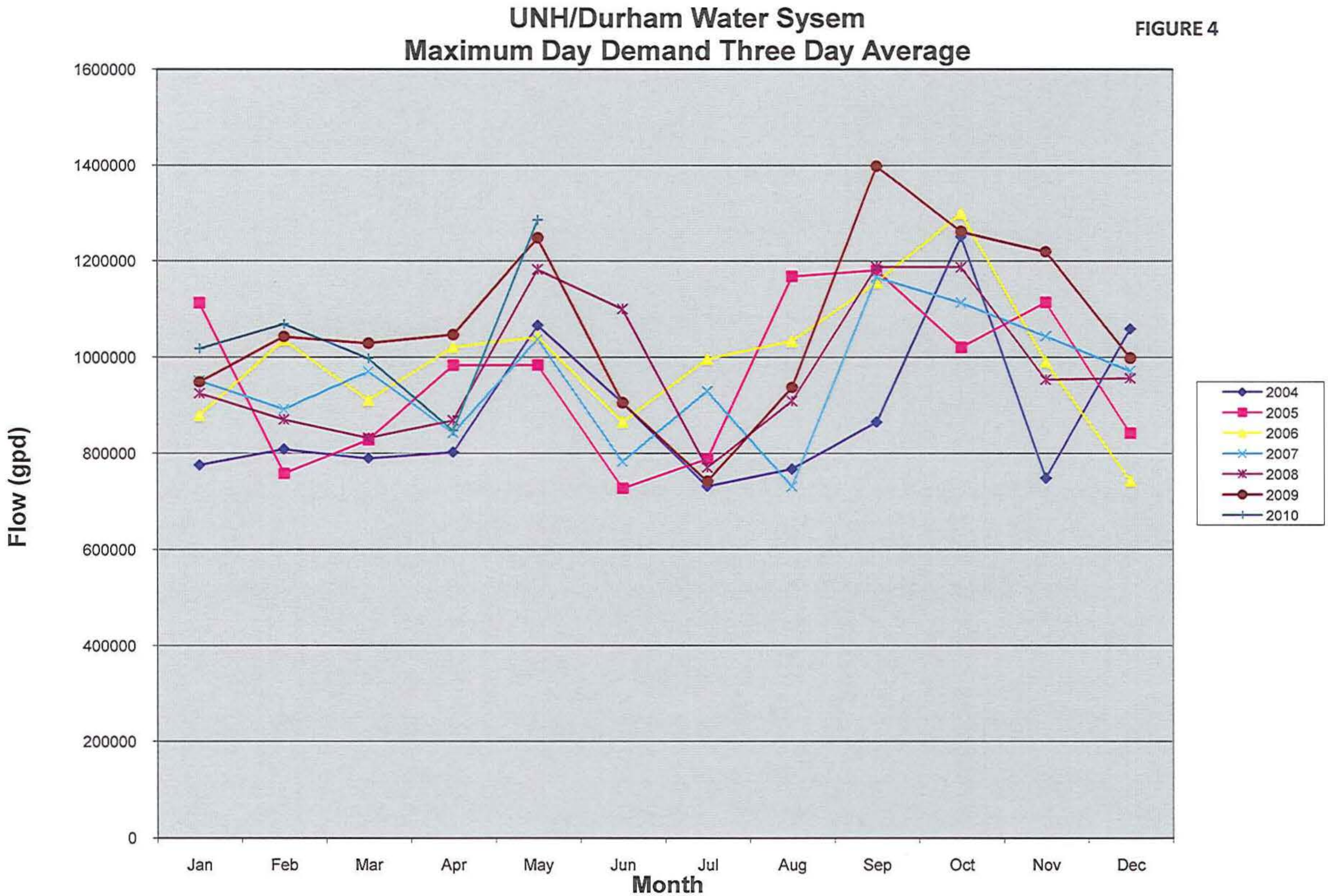

UNH / DURHAM WATER SYSTEM
Average Daily Production - UNH in Session
(September - May)
WTP
Lee Well
Combined
Average Daily Production (gpd)
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2004
2005
2006
2007
2008
2009
2010

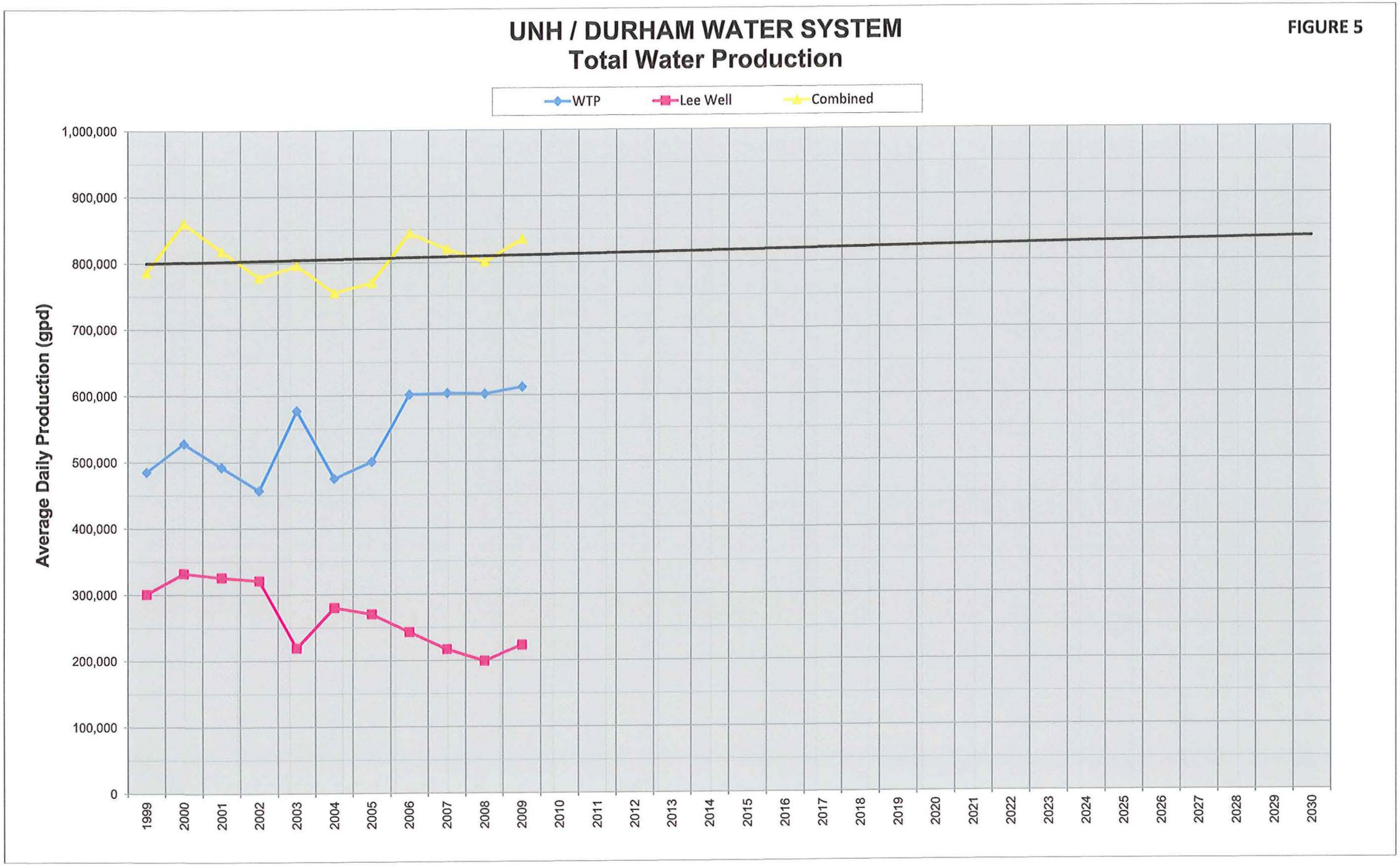
FIGURE 3



UNH / DURHAM WATER SYSTEM
Average Daily Production - UNH Not in Session
WTP
Lee Well
Combined
Average Daily Production (gpd)
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
June
July
August
June
July
August
June
July
August
August
June
July
August
June
July
August
June
July
2004
2005
2006
2007
2008
2009

FIGURE 4


UNH/Durham Water Sysem
Maximum Day Demand Three Day Average
Flow (gpd)
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
2004
2005
2006
2007
2008
2009
2010



UNH / DURHAM WATER SYSTEM
Total Water Production
FIGURE 5
WTP
Lee Well
Combined
Average Daily Production (gpd)
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030

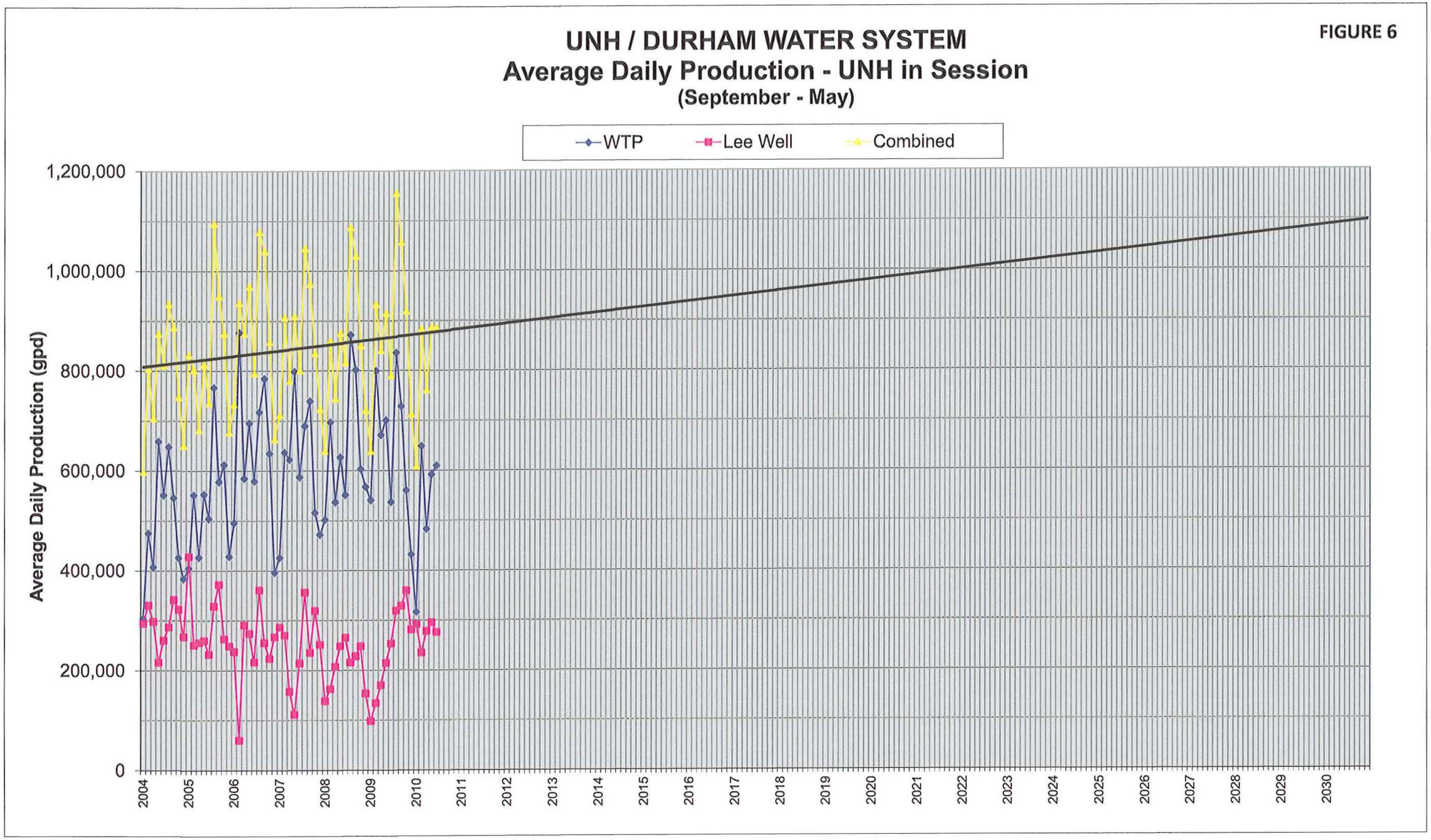
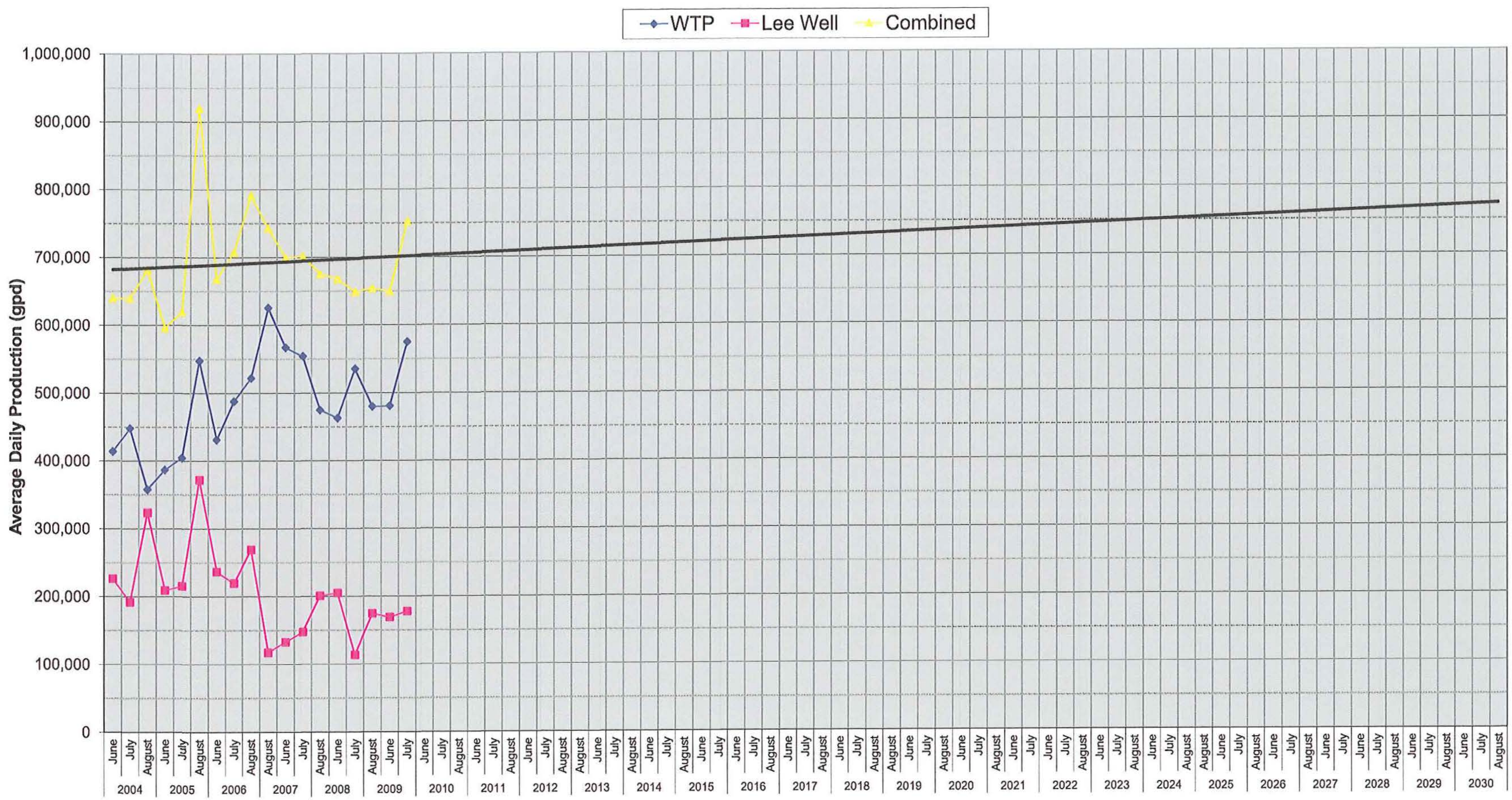
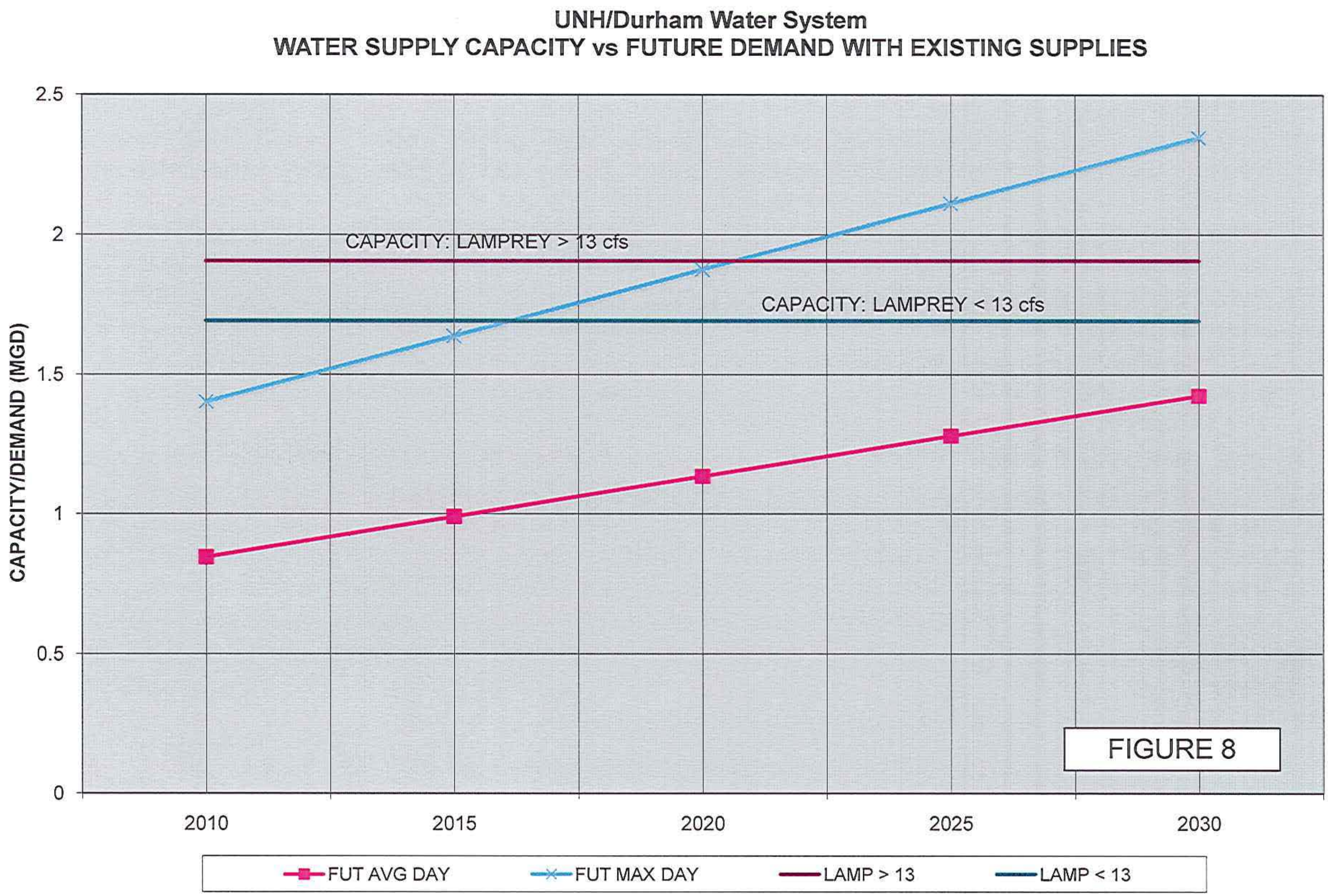


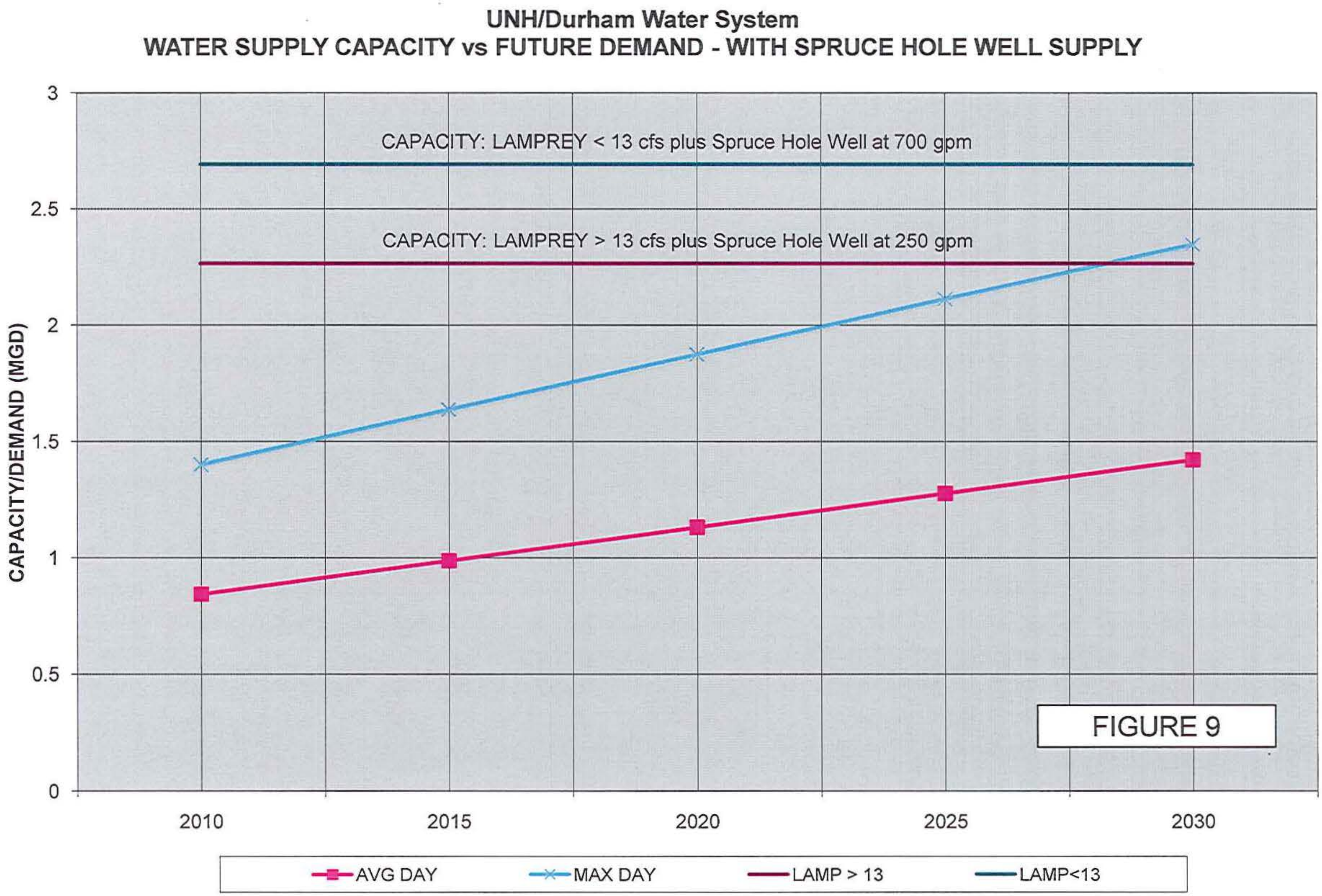
FIGURE 6
UNH / DURHAM WATER SYSTEM
Average Daily Production - UNH in Session
(September - May)
WTP
Lee Well
Combined
Average Daily Production (gpd)
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030

FIGURE 7

UNH / DURHAM WATER SYSTEM
Average Daily Production - UNH Not in Session




UNH/Durham Water System
WATER SUPPLY CAPACITY vs FUTURE DEMAND WITH EXISTING SUPPLIES
CAPACITY/DEMAND (MGD)
2.5
2
1.5
1
0.5
0
2010
2015
2020
2025
2030
CAPACITY: LAMPREY > 13 cfs
CAPACITY: LAMPREY < 13 cfs
FUT AVG DAY
FUT MAX DAY
LAMP > 13
LAMP < 13
FIGURE 8


UNH/Durham Water System
WATER SUPPLY CAPACITY vs FUTURE DEMAND - WITH SPRUCE HOLE WELL SUPPLY
CAPACITY: LAMPREY < 13 cfs plus Spruce Hole Well at 700 gpm
CAPACITY: LAMPREY > 13 cfs plus Spruce Hole Well at 250 gpm
CAPACITY/DEMAND (MGD)
3
2.5
2
1.5
1
0.5
0
2010
2015
2020
2025
2030
AVG DAY
MAX DAY
LAMP > 13
LAMP<13
FIGURE 9

UNH – Facilities Division
Tel: (603) 862-1390
Fax: (603) 862-0143

UNH/DURHAM WATER SYSTEM
100 STONE QUARRY DRIVE
DURHAM, NH 03824

Town of Durham Public Works
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Fax: (603) 868-8063

WATER CONSERVATION PLAN

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Submitted to:
New Hampshire Dept. of Environmental Services

September 4, 2012

TABLE OF CONTENTS

UNH/ Durham Water System

Water Conservation Plan

September 4, 2012

Section 1 - Introduction

The UNH/Durham Water System (UDWS) has maintained a water conservation program for a decade or more; however in 2007 it created a comprehensive written plan to be more easily to shared and referenced by the Durham and UNH community. This Water Conservation Plan (Plan) operates within the boundaries of the UDWS's Water Resource Management Plan. The written water conservation plan was originally submitted in draft form as part of the Preliminary Hydrogeological Investigation Report prepared by Emery & Garrett Groundwater, Inc. (EGGI) dated May 2008 and entitled Preliminary Hydrogeological Investigation, Town of Durham-University of New Hampshire, Groundwater Development, UNH/Durham Production Well #2 (DGD-PW2), and the associated Large Groundwater Withdrawal Permit Application for a proposed public water supply well. This new overburden production well DGD-PW2 was installed in the winter of 2010 in what is known as the Spruce Hole Aquifer. When connected to the distribution system (possibly in 2013) this new well will service both the Town and UNH.

This updated version of the Plan includes new information related to the water metering program for the water system's sources of supply and the system's individual customer meters. It also provides updated information as required in the New Hampshire DES's written comments on the draft submittal issued via letter to EGGI on August 11, 2008. It also provides updated information in Section 5 relating to the UDWS's outreach efforts and water conservation measures implemented in response to the near drought conditions experienced during the late summer of 2010, and the Source Water Management Protocol recently developed to balance the use of the system's water sources when peak demand coincides with limited surface water availability.

Water Conservation Management Plan

In accordance with New Hampshire RSA Chapter 485-C:21 V-b, "The application (for a new large groundwater withdrawal permit) shall be based on a demonstrated need for the withdrawal." This need shall include a conservation management plan. Following the guidance given in Env-Wq 2101, this conservation plan was developed for the UNH/Durham Water System (UDWS) and is also part of the UNH/Durham Production Well #2 application. The following graphic provides a summary of the requirements per the New Hampshire Department of Environmental Services (NHDES):

Requirements for All Large Community Water Systems and All New Small Community Water Systems Developing New Sources of Water

1. Install and maintain meters for all water withdrawals and service connections.

2. Implement a water audit, leak detection and leak repair program in accordance with the "Manual of Water Supply Practices, Water Audits and Leak Detection", document identification number AWWA M36, American Water Works Association, 1999.

3. When applicable, development and implementation of response plans to reduce unaccounted for water to less than 15%.

4. Implement a rate structure that encourages efficient water use.

5. Implement a water conservation educational outreach initiative.

per: http://des.nh.gov/organization/divisions/water/dwgb/water_conservation/documents/summary_of_rule.pdf

Section 2 - Water Metering and Billing

2.1 - Source and Customer Meters

All sources that distribute potable water into the UDWS are currently metered. This metered information is recorded daily by the UDWS. These sources include water treated at the Arthur Rollins Water Treatment Plant and the Lee Well. Water that is treated at the Water Treatment Plant originates at either the Oyster or Lamprey River. These sources are also individually metered.

All customers and facilities on the UDWS are metered. The Town's individual water customers are all metered as are all of the University's facilities. Final construction of the UNH/Durham Production Well #2 plans include the installation of a new meter prior to the well being put into service in the UDWS.

2.2 - Meter Sizing

The UDWS's source meters are sized in accordance with manufacturer recommendations. The UDWS performed a water audit in 2007, which included a measurement of the accuracy of the two source meters. The findings were as follows:

> Master meter tests were conducted at the Town's Lee Well and at the UNH Arthur Rollins Water Treatment Plant. The Lee Well master meter was found to be over-registering by 9.5 percent, which is outside the allowable limits of accuracy (+/- 5%). The meter at Lee Well has since been recalibrated. The master meter at the Water Treatment Plant was also found to be over-registering by 3.6 percent, which is within the allowable limits of accuracy.

According to the UDWS chief operator, the source water meters in the system are regularly calibrated. The master meter at the ARWTP is calibrated twice annually and the meter at the Lee well is calibrated at least once annually. Both source meters were recalibrated in May 2012. The future plan is to continue this practice and replace the source meters if they fall outside the accepted operating range and cannot be recalibrated.

The 2007 water audit also included testing of 32 large customer meters. These tests results suggest that approximately 1/3 of these meters may be under-registering. In an effort to address this, the Town submitted an application for New Hampshire DES SRF funding in 2011 to upgrade all of their meters in the system to automatic radio-read units. This would allow the Town the opportunity to replace the older meters in the system and to read all customer meters in less than a day after they are upgraded. Currently, it takes nearly two weeks to read approximately 1,100 meters in the system. Therefore, comparing source water meters with customer meters requires averaging use and comparing data over time rather than being able to read the source and customer meters on the same day. The project made the list of qualified SRF projects in 2011 and it will receive 20% forgiveness on a loan of approximately $418,000 to upgrade the system in 2012. In April 2012, the Town sent out the following notification to all Durham water system customers describing the project:

> In a continuing effort to improve our water service to you, the Town of Durham is implementing a Town wide upgrade to the water meter reading system for all of our 1,100 water system customers. This work will include inspecting all existing water meters and, if necessary, replacing that water meter. These new water meters will be connected through existing water meter wires to an outside mounted radio module that will be used to transmit water meter data to Town staff via a radio system on a monthly basis. Locations that do not need a new water meter will be retrofitted with a new radio module to enable monthly meter readings. This work is mandatory for every customer in our system. To facilitate this work the Town will be hiring a contractor to coordinate the work, schedule appointments and perform the necessary work to upgrade all water meter services. This work is scheduled to begin in June 2012 and is anticipated to be completed by October 2012. The program, once completed will increase the reliability and accuracy of water meter reading operations and the efficiency of

our reading and billing operation. We request your cooperation as we implement this important program for the Town.

An analysis performed in 2012 as part of the design of the customer water meter upgrades for the Town of Durham revealed that 25 meters in the system qualified for downsizing. Therefore, as part of the water meter upgrade project, 19 meters will be downsized from 1-inch to 5/8-inch by the installation contractor and six two-inch meters will be downsized to 1-inch meters. This will likely improve the low-flow accuracy of the water being delivered to these customers. Overall, it is anticipated that 411 older meters in the system will be replaced with new meters, equating to approximately 37% of Durham's customer water meters.

Based on AWWA recommendation for routine testing of meters in service, UDWS plans test meters on average, as follows:

Meter sizes 5/8 in. to 1 in = Every 10 years
Meter sizes 1 in. to 4 in. = Every 5 years
Meter sizes 4 in. and larger = Every year

2.3 - Meter Reading and Billing

Currently the Town reads and bills all customer services twice a year (in April and October). As described in the previous section, the Town will be upgrading all of their water meters to a radio-read system in 2012 and plans to begin read all meters monthly in November 2012. The University already meters all of its buildings via remote radio reading equipment and downloads that data on a monthly basis. UNH's future plans include upgrading their system to allow for real-time meter reading. This will give them the ability to identify and track consumptive patterns within the University and track down potential leaks and high use facilities on a more frequent basis. Combined, these two systems will allow the UDWS managers the ability to have a much clearer picture of UDWS demands. They will also have the capability to identify high water users by category and direct customer outreach to those high users. Providing this feedback will improve their customer service and likely result in much more efficient water use throughout the entire system.

Section 3 - Water Audit and Leak Detection Program

3.1 – Water Audit and Leak Detection

As mentioned previously, the UDWS performed a water audit and leak detection study in 2007. The findings and recommendations of that study are currently being implemented. Metering at the sources and point of use allows the ability to track system unaccounted-for water. This analysis was performed during the 2007 water audit and again as part of this application process. The findings of the analysis were as follows:

- 2007 Water Audit – 5.7% unaccounted for 2006 to 2007 time period (this included adjustments in source and customer meter inaccuracies)
- 2008 Water Conservation Plan (draft) water use analysis – 7.8% unaccounted-for water for the 2005 calendar year (no adjustments to source or customer meters)

The UDWS also performed leak detection during the 2007 Water Audit. According to the report, the leak detection survey conducted during this study on approximately 25 miles of water main identified an estimated 15,000 gallons per day of leakage from one (1) main leak on Oyster River Road at Croghan Lane (*the leak was determined to be from a fire hydrant and was immediately repaired*). The 15,000 gpd of leakage represents approximately 1.9 percent of the average daily production. Based on the results of this study, a comprehensive leak detection survey should not be required next year. However, a comprehensive leak detection survey should be evaluated again next year and annually thereafter, based on water losses and unaccounted-for water.

Estimates of unaccounted-for water will be performed at least once a year. If unaccounted-for water exceeds 15 percent, the system shall develop a response plan in accordance with Env-Wq 2101.05(j) and (k), and submit it to the DES within 60 days. In accordance with NHDES's regulations, the UDWS will make every attempt to implement the response plan soon after receiving approval from DES, and UDWS operations staff, and/or qualified leak detection firms, will promptly initiate a leak detection survey. Leaks identified by the survey will be repaired within 60 days of discovery unless a waiver is obtained from the DES. Those performing the surveys will follow the standards set forth in AWWA M36, Manual of Water Supply Practices, Water Audits and Leak Detection.

3.2 – Tracking Unaccounted-for Water

The UDWS operators plan to begin routinely tracking potential system leaks and demand trends by comparing source pumpage and distribution tank trends. This can be is done via the system's on-line SCADA system.

The UDWS currently has a "Main Breaks" procedure included in its Emergency Response Plan. This procedure will continue to be adhered to and updated as necessary. The UDWS will continue to utilize all of these tools to track their leaks, unaccounted-for water and overall water system efficiencies. In accordance with Env-Wq 2101.05(j), if the unaccounted-for water exceeds 15% of the total volume of water introduced to the water system the UDWS shall prepare and submit a correction plan to NHDES within 60 days. The correction plan would identify how the UDWS intends to reduce the percentage of unaccounted-for water to below 15% within 2 years, except for known leaks that have been identified by any water audit or leak detection program. If such a plan becomes necessary, the UDWS will implement the correction plan in accordance with the above schedule upon receiving approval from the NHDES.

The 2012 water meter upgrade project being implemented by the Town to change out all of all its existing meters with automatic radio-read units, and complemented by UNH complete radio-read system, will provide the UDWS much improved ability to track unaccounted-for water. The following is UNH's process for checking meter problems and reading variances. After all readings are entered into our database, a variance report is run on ALL meters to flag meters that are plus/minus 20% from both the previous month and same month of the previous year. The flagged entries are reviewed to determine whether the variance is indicative of meter error, a leak, or seasonal use due to the student schedules (i.e. variation associated with a period of out-of-session vacancy). If an explanation is not already available the Campus Energy Manager physically investigates the meter to determine if it appears broken or if the reading suggests further investigation is necessary (i.e. a plugged meter, etc.). Depending on the results on this investigation, a work order is issued to Water Division to have a technician to correct the problem and/or replace the meter. The Town's protocol for checking meter problems and reading variances will be consistent with UNH's.

3.3 - Water System Pressure

The UDWS currently operates two pressure zones. The main system pressure zone includes most of the system and is supplied primarily from the water treatment plant. Typical operating pressures in this zone are 58 to 68 psi. A relatively higher pressure zone of limited extent consist primarily of the 12-inch diameter transmission main from the Lee well to the Beech Hill Tank and is necessary to pump water from this source to the tank. Typical operating pressures in this zone are 80 to 120 psi. The high pressure zone currently services one industry (Goss International) and approximately 150 customer connections. All customer services in this zone have pressure reducer equipment installed on their services lines or at branches off the main to reduce pressure and flow delivered to their services.

The 0.6 million gallon (MG) Beech Hill Tank is located within the high pressure zone, and the 1.0 MG Edgewood Road Tank and 3 MG Foss Farm Road Tank are both located within the low pressure zone. Water can be fed from the high pressure zone to the low pressure zone via a pressure-reducing valve and a booster pump. Water can also be back-fed from the low pressure zone to the high pressure zone via a bypass valve in the pressure reducing valve pit, however, the Beech Hill tank must operate at a lower level or be shut off completely in order for the low pressure zone to back-feed the high pressure zone.

In accordance with Env-Wq 2101.05(n), the UDWS considered pressure reduction in all or parts of the distribution system and determined that the pressures in the system are consistent with water system industry standards and regulations. In addition, the current system pressures are necessary for public health and safety considerations with regard to maintaining adequate pressures for fire suppression sprinkler system throughout the Town and UNH.

Section 4 - Rate Structure

Since the UDWS is jointly operated by the Town and the University, the UDWS's capital and operational costs are shared through a written agreement between the Town and UNH that balances the totals costs based on actual water used. The University bills it's largest users (residence hall and dining halls) on actual usage. Academic and administrative buildings are billed on an average consumption per net square foot, however, the Energy and Utilities department does monitor the metered consumption for individual buildings and investigates when consumption trends change or when consumption is out of line. For example, recent investigation of high consumption in a building led to the discovery of a failed control valve on a cooling loop.

The Town of Durham customers pay for their water through the Town billing system and the University customers pay for their water through a separate University billing system. The Town's customers pay for water based on a unit price, which is currently $3.97 per 100 cubic feet (2012 rates). The rate is reviewed annually and adjusted as needed by the Town [when this Plan was originally prepared in 2008, the Town's unit price for water was $2.93 per 100 cubic feet]. The rate structure is the same for all customer classes. If excessive customer water use becomes an issue in the future, the Town may consider implementing an inclining block rate, where rates would increase with the volume of water consumed.

Section 5 - Water Conservation Outreach

The UDWS regularly circulates water conservation outreach information and materials both in the Town and the University portions of the system. The following water conservation outreach steps either have and/or will be implemented by the UDWS:

<u>5.1 - Town of Durham</u>

The Town of Durham periodically sends out water conservation outreach materials with its bi-annual water bills. Past items have included:

- Toilet tank displacement devices, which reduce the amount of water flushed in an old-style toilet by 3 quarts.
- Customer leak detection tablets and information.
- Water saving tips are regularly published in the Town's "Friday Updates" on its list server (see below) and UNH's email notices.

The UDWS in particular ramps up these efforts when peak water demand coincides with limited surface water availability. During these times UDWS provides water system information and water saving tips as part of a weekly Town newsletter that is emailed to well over 1,500 residents each Friday. The following excerpts provide examples of this information:

"FRIDAY UPDATES"

May 9, 2008

Hydrant Flushing

A reminder that hydrant flushing began on May 5 and will continue through May 15th from 11PM to 7AM (overnight). During flushing there is a high chance of discolored water. If this happens, run water from the faucet until it becomes clear. It is advisable to wash white laundry on the weekend or when the water clears to avoid discoloring of whites. This is the process by which Public Works staff goes to each hydrant and flushes them at maximum capacity for a few minutes to flow out any debris that may have collected in the system. There are two vehicles involved with emergency lighting for the protection of the employees and to warn people to take caution around the water flow. Please do not be alarmed if you see these orange flashing lights during flushing times. Questions: call UNH Water Treatment plant, Wesley East at 862-1390 or Durham Public Works at 868-5578. Thank you for your cooperation during this routine maintenance.

"Friday Updates"

Friday, April 25, 2008

Spring Water and Sewer Bill

The spring water and sewer bill has been mailed to property owners. Payments are due May 27, 2008.

Spring Water Conservation Tips

Spring is here and everyone is anxious to get their landscaping underway. Here are a few tips for water conservation relative to the season:

- *If you water with a sprinkler system, make sure to audit your system regularly for leaks. In addition, install water-conserving devices like a rain shut-off device and/ or soil sensors.*
- *When choosing plants, shrubs, or trees for your property try to choose species that are native to our New England climate or ones that require little watering. These species will cut down on your water use and will prosper with lower maintenance. Check with local nurseries or gardening centers to see what your choices are.*
- *Mulch, mulch, mulch - Mulching helps to slow the evaporation of moisture from the soil and keeps the soil and roots cool. It also protects the soil and roots from events such as freezing, which we all know is not out of the realm of possibility up here in New Hampshire, even if it's late April.*

5.2 - University of New Hampshire

The University has been active with implementing sustainability initiatives throughout their campus and curriculum. Tom Kelly, Director of the UNH Office of Sustainability has stated in the University's "Sustainability Program Profile" that, "Ours is an endowed, university-wide effort to integrate sustainability into the fabric of the institution in a comprehensive and systematic way." Part of that effort is to make their buildings as efficient as possible, including their water use. A commitment to install only Energy Star appliances in their facilities will provide the added benefit of water use reduction, as Energy Star appliances such as washers and dishwashers are also more efficient with respect to water use. The University is also incorporating water conservation measures in their building projects. These include installing low-flow showerheads and faucets, high-efficiency toilets and waterless urinals. The James Hall renovation project included a rainwater cistern and gray water recycling system which provides all the water needed for toilet flushing within the building.

5.3 - Water Supply & Demand Status

The UDWS has established a Water Supply and Demand Status system to graphically inform water customers of the current status of water availability within the system, and the corresponding five (5) stages of water conservation measures to protect adequate water capacity for domestic/commercial uses and public safety, while maintaining a sustainable yield of the system's three water sources.

As stated earlier, the UDWS currently relies upon two surface water sources - the Oyster and Lamprey Rivers – that supply water to the Arthur Rollins Water Treatment Plant (WTP), and a groundwater source - which is a gravel pack well located in the Town of Lee known as the Lee Well. Groundwater from the Lee Well is disinfected at the wellhead and pumped directly into the high pressure zone of the distribution system. These sources are all blended within UDWS's approximately 25 miles of water distribution piping.

When surface water sources are limited during periods of drought the system's source water availability of becomes a factor of diminishing water stored in the system's two reservoirs and the sustainable safe yield of the Lee Well. To balance the use of the three water sources when peak demand coincides with limited surface water availability UDWS developed a Source Water Management Protocol. Drought conditions sometimes persist into August and September which ends up overlapping with the UDWS's annual period of peak demand; at which time carefully balancing the use of systems water sources becomes critically important. The period of overlapping peak demand and limited source water availability has a typical duration of approximately 60 days from about August 15th to October 15th. Prior to August 15th, the summer population of Durham is relatively low because the UNH resident student population is reduced with system demand being typically less than about 60-70% of the total available source capacity. On or around August 15th, the UNH students begin returning for the fall semester and water system demand noticeably increases. By about September 1st, system demand reaches its peak and if the surface water is critically limited because of low flow river conditions the system demand can rise above 75% of the available combined source water capacity. October 15 is about when the Lamprey River flow increases significantly due to the start of NHDES Dam Bureau's release of water from Lake Pawtuckaway and Mendums Pond for their regular annual winter drawdown.

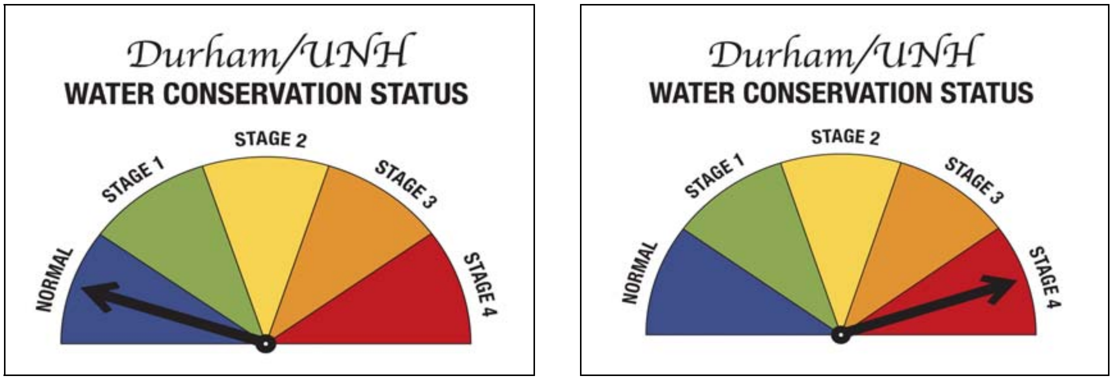
The Source Water Management Protocol is based on a comparison of System Demand and Maximum Available Capacity according to the following definitions:

System Demand is calculated as the sum of the production from the Arthur Rollins Water Treatment Plant (ARWTP) and the withdrawal from the Lee Well. It is an average gallon per day (gpd) rate based on averaging at least the previous 3 days of production to smooth out operational high and lows (i.e. topping off water tanks for the weekend, filling heating and cooling systems, backwashing, etc.).

Maximum Available Capacity is calculated as the sum of the daily available water storage volume in the Wiswall and Oyster River reservoirs, plus the available instream flow from the Lamprey or Oyster Rivers, plus the safe yield of the Lee Well. (Water stored in the UDWS's three water tanks is small compared to the Wiswall and Oyster River Reservoirs, and their primary purpose is to maintain adequate pressure in the system; therefore, water tank storage is not factored into the above available water storage volume.) Maximum Available Capacity, like System Demand, has units of gallons per day (gpd) and is calculated on a daily basis by estimating the total available storage on a given day in the top 18" of the Wiswall Reservoir and the top 5 feet of the Oyster River Reservoir, and dividing it by the number of days remaining until October 15 (to produce a gpd capacity), and adding that to the combined available instream flow (in gpd) plus the safe yield of the Lee Well (in gpd).

5.3.1 Water Conservation Status Chart System

During periods of drought, the UDWS steps up its implementation of water conservation measures. The **Water Conservation Status** that corresponds with the graphical Water Conservation Status chart system introduced above includes five levels: Normal, Stage 1, Stage 2, Stage 3, and Stage 4. The following graphic is utilized for public outreach to communicate the system's Water Supply & Demand Status:



Examples of UNH/Durham Water Conservation Status
Stage Graphics for Public Outreach

The water supply and demand status, water conservation measures to be implemented, and Source Water Management Protocol associated with each Stage is as follows:

5.3.2 Normal water system conditions are typically experienced between late October and May. Normal status is evident when the Lee Well is fully operational, and both the Oyster River and the Lamprey River have abundant available water for withdrawal by the UNH Arthur Rollins Water Treatment Plant (WTP). Even when the system status is Normal, residents are encouraged to use water responsibly and routinely practice water conservation, such as never leaving a running faucet unattended, watering lawns and gardens during early morning or evening hours, maintaining plumbing in good working order, repairing all leaks immediately, and replacing inefficient water fixtures and appliances with more efficient ones.

5.3.3 Stage 1 goes into effect when the Lamprey River flow approaches 16 cfs, no substantial rain is in the near or extended forecast, and system demand is at or approaching 75% of the maximum available source water capacity at which time the Oyster River is used to supply the ARWTP. Whether the ARWTP is drawing from the

Oyster or Lamprey River at this stage is up for debate. Currently, (due to the 401 Certificate) the ARWTP utilizes the Lamprey River until the flow starts to approach 21 cfs; however, when the Lamprey River Water Management Plan is adopted it is expected that this trigger flow will be the Lamprey River designated protected instream “Rare” flow of 16 cfs. It is expected that upon declaration of Stage 1 the ARWTP would cease withdrawing from the Lamprey River and start withdrawing from the Oyster River if it isn’t already doing so. Regardless of river flow conditions, Stage 1 might also be triggered by a condition of degraded water quality, unusually high system water demand (or anticipated water demand in September when UNH classes begin), and/or an operational problem in the distribution system or at either the WTP or the Lee Well.

Stage 1 will be initiated through a public notice process (i.e. mailings, posters, emails, Town and University Websites, etc.) to Durham residents and the UNH Campus and to encourage the following voluntary water conservation measures:

- Limited watering of gardens and lawns,
- Less frequent vehicle washing,
- Refraining from filling swimming pools, and
- The goal of Stage 1 measures is to hold water demand at constant rate for at least a two week period following its implementation.

The Lamprey River Pump Station would be operated on a limited basis in accordance with a flow monitoring plan approved by NHDES, or the Lamprey River will be reserved for emergency use. Stage 1 was formerly referred to as “Drought Watch”.

5.3.4 Stage 2 is declared when the Lamprey River flow has been below 16 cfs for 10 or more days, no substantial rain is in the near or 7 day forecast, and system demand (as defined above) is ≥ 80% of the maximum available source water capacity. Upon the declaration of Stage 2 is declared, the ARWTP would return to withdrawing from the Lamprey River. Only water from storage in the Wiswall Reservoir would be used (i.e. maintaining reservoir inflow equal to outflow) with a maximum drawdown of the Wiswall Reservoir of 18 inches (1.5 feet). Each day the UDWS would assess how many days remain until October 15th and to what degree the withdrawal from the Lee Well could be increased to elevate the maximum available capacity to get us closer to October 15th. Regardless of river flow conditions, Stage 2 might also be triggered by a condition of degraded water quality, unusually high system water demand (or anticipated peak water demand in September) and/or an operational problem in the distribution system or at either the WTP or the Lee Well.

Stage 2 will be initiated through a public notice process (i.e. mailings, posters, emails, news media, Town and University Websites, etc.) to Durham residents and the UNH Campus requiring the implementation of <u>mandatory</u> water conservation measures which are to include, but not limited to the following:

- A ban on vehicle washing and filling of swimming pools,
- Limited watering of lawns and gardens,
- A shut-down of non-essential water cooling systems where possible, and
- A goal of decreasing average daily demand by 10 percent within two weeks of its implementation is currently being suggested for Stage 2.

If Stage 2 is declared, the Lamprey River Pump Station would be operated on a limited basis in accordance with a flow monitoring plan approved by NHDES, or the Lamprey River will be reserved for emergency use. Stage 2 was formerly referred to as “Drought Warning”.

<u>**5.3.5 Stage 3**</u> is declared when the Wiswall Reservoir is drawn down 18 inches (1.5 feet), the Lamprey flow has been below 16 cfs for 15 or more days, no substantial rain is in the near or 7day forecast, system demand is ≥ 85% of the maximum available capacity, and the withdrawal from Lee Well is at its maximum safe yield. At this time, the ARWTP would switch back to the Oyster River and drawdown the Oyster River Reservoir a maximum of 5 feet while continuing to release enough flow to sustain an acceptable instream flow downstream from the reservoir. Regardless of river flow conditions, Stage 3 might also be triggered by a condition of degraded water quality, unusually high system water demand (or anticipated water demand in September when

UNH classes begin) and/or an operational problem in the distribution system or at either the WTP or the Lee Well.

Stage 3 will be initiated through a public notice process (i.e mailings, posters, emails, news media, Town and University Websites, etc.) to the residents and the UNH Campus requiring the implementation of a heightened level of mandatory water conservation measures. These measures are to include, but not limited to the following:

- A ban on vehicle washing and filling of swimming pools,
- No watering of lawns,
- Limited watering of vegetable gardens and other essential uses,
- Continued shut-down of non-essential water cooling systems, and
-
- A goal of decreasing average daily demand by 25 percent is currently being suggested for Stage 3 within two weeks of its implementation.

If Stage 3 is declared, the Lamprey River Pump Station would be operated on a limited basis in accordance with a flow monitoring plan approved by NHDES. Stage 3 was formerly referred to as Drought Pre-Emergency.

5.3.6 Stage 4 (Water Emergency) is declared when the forecast of no substantial rain continues, system demand is ≥ 90% of the maximum available capacity and the Oyster River Reservoir is drawn down 5 feet, or the Oyster River water quality has degraded to the point where the Treatment Plant has difficulty satisfactorily treating it. Declaring Stage 4 is effectively declaring a "water emergency" with respect to the current 401 Water Quality Certificate. The UDWS would immediately notify NHDES of the "water emergency" condition, and unless NHDES issued a written disapproval within 24 hours, the UDWS would begin drawing down the storage in the Wiswall reservoir beyond 18 inches below the Wiswall Dam spillway crest. Although, there is no record of the UDWS ever declaring a "water emergency", the likelihood of doing so is elevated when the Oyster and Lamprey Rivers are at critically low flows for more than a few weeks. Regardless of river flow conditions, Stage 4 might also be triggered by a condition of seriously degraded water quality, an environmental accident (i.e. oil tanker spill near the Oyster River), unusually high system water demand (or anticipated water demand in September when UNH classes begin), and/or an operational problem in the distribution system or at either the WTP or the Lee Well.

Stage 4 will be initiated through a public notice process (i.e mailings, posters, emails, news media, Town and University Websites, etc.) to Durham residents and the UNH Campus mandating the implementation of strict water conservation measures. These measures include, but are not limited to the following:

- A ban on vehicle washing,
- No filling of swimming pools, No lawn and garden watering,
- Shut-down of all cooling systems and ice makers,
- No commercial laundry facilities,
- No daily use permits,
-
- A tentative goal of decreasing average daily demand by at least 40 percent is currently being suggested for Stage 4.

If Stage 4 is declared, the Lamprey River Pump Station will be operated in a controlled fashion and monitoring of water levels flow conditions will. Stage 4 was formerly referred to as “Drought Emergency”.

The conditions triggering the above water conservation stages may be revised if supply increases (i.e. a new source is added) above the trigger levels set for each stage or demands are cut to the extent that the water system is capable of serving an increase population. These stages do not apply to water and irrigation systems supplied by their own water source (well or other) within the UDWS. A list of these systems will be maintained by the UDWS. Users of these systems must demonstrate that their systems are physically separated from the UDWS and will be subject to inspection for verification.

5.4 Enacting Water Conservation Measures During the Summer of 2010

The summer of 2010 became hot and dry in August. Subsequently, flows in the UDWS's sources reached points where they required the activation water conservation measures. The following excerpts provide the timeline of the outreach effort that the University and the Town jointly performed. Articles appeared on both websites, and local newspapers published articles that notified Durham residents and those at the University that water conservation measures were necessary. This effort was quite effective and at no time did the UDWS experience water demands that exceeded their supply capabilities. The following graphics highlight some of the outreach components:

Article published Jul 14, 2010

Durham residents asked to conserve water as river levels lower

DURHAM — Residents are asked to keep water conservation in mind as the extended hot and dry weather is causing low water levels in rivers that supply the municipal water system for the town and the University of New Hampshire.

Director of Public Works Mike Lynch said the water level at the Oyster River reservoir has reached the trigger point for Stage 1 of the town's water emergency response plan.

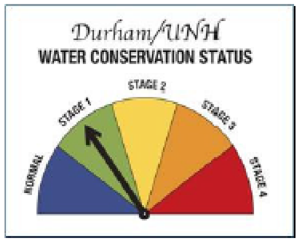
Lynch said Stage 1 isn't a critical point.

"It's a friendly reminder to conserve when you can," Lynch said. "It's meant to draw attention to the fact that it's hot out and we haven't had substantial rain in a long time."

The town's water emergency response plan has five levels, from Normal to Stage 4.

Voluntary conservation measures suggested by the town include limiting watering of gardens and lawns, less frequent vehicle washing and refraining from filling swimming pools.

Excerpt from Foster's Daily Democrat Newspaper – July 14, 2010



WATER CONSERVATION STATUS

Although we received a small amount of rainfall in the past few days, it has only made a small impact on the drought situation. Town and UNH officials met on Tuesday and agreed that we are still in need of keeping the Stage 1 water conservation alert active. The UDWS is operated jointly by the Town of Durham and UNH, and the system maintains a Water Conservation Plan with 4 Stages of water conservation measures. Stage 1 is primarily about informing the System's water users that the water resources are beginning to be stressed and to be cautious about how and when water is used. These are common sense measures such as watering your lawn or garden early in the morning rather than the middle day, waiting until your dishwasher is completely full, or doing only full loads of laundry instead of partial loads. The message of the day is to conserve water whenever possible and don't use water unnecessarily.

Town of Durham Weekly Update Excerpt – August 26, 2010

Contact Directories Map MyUNH Emergency/Storm

Search

Don't Let the Rain Fool You; Stage 1 Drought Conditions Remain in Effect

Stage 1 Drought Conditions Remain in Effect

Dry weather and low water levels in rivers that supply the municipal water system for Durham and UNH are continuing into the start of the fall semester. Stage 1 of the UNH/Durham water emergency response plan remains in effect. The water emergency response plan has five levels, from Normal to Stage 4. Members of the UNH community and Durham residents normally practice water conservation, however current conditions call for voluntary conservation measures above and beyond normal practices. Recommended Stage 1 voluntary water conservation measures include limiting watering of gardens and lawns, less frequent vehicle washing and refraining from filling swimming pools. Additional water conservation tips include doing only full loads of laundry, taking shorter showers, shutting of the water while brushing your teeth and not leaving faucets running when not needed.

Unless we have significant and prolonged rainfall events, it is likely that water levels will reach the trigger point for Stage 2 mandatory water conservation measures within the next week or two. Stage 2 mandatory water conservation measures include a ban on vehicle washing and filling of swimming pools, limited watering of lawns and gardens, and a shutdown of non-essential water cooling systems. Future updates on water supply conditions will be posted on UNHtoday as warranted. Thank you for your efforts to conserve water.

University of New Hampshire Website – August 26, 2010

Article published Aug 26, 2010

Durham still on water plan watch despite recent rain

DURHAM — Despite what has seemed like an endless amount of rain the last few days, the town continues to ask residents to be cautious of their water use.

Mike Lynch, the town's director of public works, said Stage 1 of the UNH/Durham water response plan remains in effect. The water emergency response plan has five levels, from Normal to Stage 4.

Stage 1 of the plan call for voluntary conservation measures, such as limiting watering of gardens and lawns, less frequent vehicle washing and refraining from filling swimming pools, to name a few.

Lynch said the wet weather will provide a few days of relief but noted the extended forecast is calling for dry and hot conditions.

In addition, the town is getting ready to welcome back thousands of UNH students on Friday.

"It's definitely a concern," Lynch said. "Our water usage obviously goes up. You can't add 14,000 people all of a sudden and not use more water."

It's possible the town could soon move into Stage 2 of the water response plan. Stage 2 contains several mandatory water conservation measures, such as a ban on vehicle washing and filling of swimming pools, limited watering of lawns and gardens, and a shutdown of non-essential water-cooling systems.

"We'll make that call on a daily basis and just keep an eye on the water levels," Lynch said.

Excerpt from Article Published in Foster's Daily Democrat Newspaper – August 26, 2010

5.5 - Town of Durham Water Ordinance

The Code of the Town of Durham, NH includes Chapter 158 on Water Service Terms and Conditions. The Town intends to update this Code section to address its Water Management Plan. Updates will include water conservation measures for new customers, water use restriction ordinance for use during water system emergencies or drought, and specifications for water demands and fees for new customer based on historical data from existing customer water demands.

5.6 - Additional Water Conservation Measures

In addition to the items already mentioned in this plan, the Town of Durham's portion of the UDWS will explore other options for improving water efficiency. These options include:

- Exploring options for providing low-flow plumbing fixtures for retrofits of existing Town of Durham water customers.
- Performing water audits on the Town's high use customers to identify areas where they can improve efficiencies.
- Exploring the potential implementation of seasonal water rates or drought rates to implement during high-demand or drought situations.
- Requiring that the installation of new irrigation systems be performed by landscape irrigation professionals who are certified by EPA's WaterSense program to implement water efficiency best practices.
- Requiring new water use applicants to project water demand for both indoor and irrigation water use. These applications will also promote best practices for utilizing water efficiency measures with new construction.
- Consider adopting landscape water efficiency measures into the Town's water ordinance for all new customers and encourage these measures through outreach to all existing customers.

5.7 - Utility Membership in EPA's WaterSense Program

The UDWS is considering applying to be utility member of the EPA's WaterSense program as a utility member. As a member, they will have access to public outreach materials, including:

- Ideas for promotional items, including bill stuffers, magnets, and stickers.
- Templates for a press release, letter-to-the-editor, and opinion-editorial column.

- Guidelines for using the program and partner logos and the promotional labels, as well as electronic versions of these marks.

The UDWS would utilize this information to augment their current outreach efforts, in print, on their website and through bill-stuffers.

Section 6 - Implementation

The UDWS will implement the applicable public notification and outreach requirements to municipal governments within its service area in accordance with Env-Wq 2101.11; and the UDWS will continue to implement an educational outreach initiative for its customers to promote water conservation. These activities shall be completed by UDWS personnel under the supervision of a certified operator pursuant to Env-Ws 367.

In accordance with Env-Wq 2101.11, upon submission of this draft Water Conservation Plan the following letter will be sent out via certified mail to the following governing bodies and regional planning organization:

Town of Durham Town Council

Todd Selig, Town Administrator
Town Hall
15 Newmarket Road
Durham, NH 03824

Town of Lee Board of Selectmen

John LaCourse, Chairman
Town Hall
7 Mast Road
Lee, NH 03861

Strafford Regional Planning Commission

Cynthia Copeland, AICP
Executive Director
2 Ridge Street, Suite 4
Dover, NH 03820-2505

Example of Cover Letter for Public Notification of Water Conservation Plans

(This letter will be produced on Town of Durham's letterhead)

(Date)

(those listed above)

Subject: Water Conservation Plan for the University of New Hampshire/Durham Water System (UDWS) Durham, New Hampshire

Dear _______ (those listed above):

Applicants applying to the New Hampshire Department of Environmenals Services (NHDES) for approval of new drinking water sources for Community Water Systems and applicants for Large Withdrawal Permits are subject to the requirements of Env-Wq 2101, *Water Conservation Rules*. As part of the UNH/Durham Production Well #2 (DGD-PW2) application process, the UDWS is providing the enclosed updated Water Conservation Plan and for your review and comment. The UDWS is also required to perform the following Public Notification tasks:

- Provide copies of a summary of Env-Wq 2101 (prepared by NHDES) and the Water Conservation Plan for the water system to the governing board of the municipality in which the water system is located and the regional planning commission established for the area where the water system is located.
- Request that the governing board of each municipality review the Water Conservation Plan for consistency with Env-Wq 2101 and amend the local site planning requirements to promote water conservation landscaping practices within the service area of the new water system.
- Request that the regional planning commission review the water conservation plan for consistency with Env-Wq 2101 and promote water conservation landscaping and other conserving water use practices among its member towns.

We are requesting that you review the enclosed materials, comment on the Water Conservation Plan, and promote water conservation practices within your jurisdictional area. You have twenty-one (21) days to review and provide comment to NHDES on the UDWS's updated Water Conservation Plan. This 21-day period commences upon the receipt date of certified mailing of this correspondence. Please communicate your comments in writing to NHDES at your earliest convenience and address all comments to:

Derek Bennett
NHDES-DWGB
P. O. Box 95
Concord, N.H. 03302

Please contact the above NHDES staff at (603-271-6685) or NHDES' Public Information Center (PIC) at 271-8808 or http://www.des.state.nh.us/PIC . Thank you for your time and cooperation.

Sincerely,

David Cedarholm, PE
Durham Town Engineer

TOWN OF DURHAM
15 NEWMARKET ROAD
DURHAM, NH 03824-2898
Tel: 603/868-5571
Fax: 603/868-5572

AGENDA ITEM: # 11A

DATE: June 17, 2013

COUNCIL COMMUNICATION

INITIATED BY: Robin Mower, Councilor

AGENDA ITEM: **DISCUSSION REGARDING THE STATE LEGISLATIVE PROCESS AND THE COUNCIL'S ROLE, IF ANY– ROBIN MOWER, COUNCILOR**

CC PREPARED BY: Robin Mower, Councilor

PRESENTED BY: Robin Mower, Councilor

AGENDA DESCRIPTION:

A brief policy discussion may help determine whether and when the Council might wish to comment formally on pending or upcoming State legislation. Questions Councilors may wish to consider include:

- What are the guiding parameters, e.g., the town of Durham is directly affected?
- If a Town board, committee, or commission is directly affected and/or wishes to comment, does the Council have any role to play?
- Should Durham's position be conveyed only through our elected delegates to Concord or directly?
- When should the Council formally direct the Administrator? (The Administrator, currently periodically, comments independently).
- If individual Councilors choose to comment independently, when, if at all, should the Council be advised?

Examples from the current legislative sessions are provided to help further discussion:

- SB191: An act establishing a state energy strategy
- HB575: An act relative to hours of sales of on-premises liquor licensees
- HB393: relative to effluent limitations with regard to nitrogen and phosphorus
- SB102: relative to the selection of members of the conservation commission

This item was placed on previous Council agendas for discussion, however due to the lateness of the hour at these meetings, this item was postponed.

LEGAL AUTHORITY:
N/A

LEGAL OPINION:
N/A

FINANCIAL DETAILS:
N/A

SUGGESTED ACTION OR RECOMMENDATIONS:
No formal action is required. Hold brief discussion. However, the Council may wish to establish a formal policy, and if so, a formal motion and vote may follow.

EXAMPLE OF LEGISLATIVE ADVOCACY RE: BAR CLOSING TIME

Subject: Bar Hours of Operation Bill - story in today's Union Leader

Date: Thursday, June 6, 2013 8:20:23 AM Eastern Daylight Time

From: Todd Selig <tselig@ci.durham.nh.us>

To: Tricia Lucas <tlucas@new-futures.org>, David Kurz <dkurz@ci.durham.nh.us>, mica.stark@unh.edu <mica.stark@unh.edu>, Mitchell, Dana (D.Mitchell@dover.nh.gov) <D.Mitchell@dover.nh.gov>, donna.schlachman@leg.state.nh.us <donna.schlachman@leg.state.nh.us>, James M. Wilson (jwilson@liquor.state.nh.us) <jwilson@liquor.state.nh.us>, Waldvogel, Patricia (pat.waldvogel@usnh.edu) <pat.waldvogel@usnh.edu>, jwilliams@dhhs.state.nh.us <jwilliams@dhhs.state.nh.us>, Valerie.Morgan@dhhs.state.nh.us <Valerie.Morgan@dhhs.state.nh.us>, jessica.blais@dhhs.state.nh.us <jessica.blais@dhhs.state.nh.us>, Mark Rubinstein <mark.rubinstein@unh.edu>, Anne Lawing <Anne.Lawing@unh.edu>

Dear All,

It appears from today's article in the Union Leader that the Senate and the House have agreed on the "opt in" provision relative to extending bar closing from 1 AM until 2 AM. Thank you for all of your support and advocacy as part of this effort.

Todd

Todd I. Selig, Administrator
Town of Durham, NH
603.868.5571 | www.ci.durham.nh.us

House OKs later closing time for bars, restaurants

Waiting for signature: Bill gives cities and towns option to allow businesses that serve alcohol to stay open until 2 a.m.

Union Leader
State House Bureau

CONCORD — Gov. Maggie Hassan is "inclined" to sign into law legislation finalized Wednesday that would give cities and towns the option of authorizing bars and restaurants to serve alcohol in their communities until 2 a.m.

The House concurred with the Senate version of House Bill 575 on Wednesday by a vote of 220-109, avoiding a committee of conference.

The version of the bill passed by the House earlier in the session would have changed the "last call" hour for restaurants serving alcohol and bars statewide until 2 a.m., but would have allowed city and town governing bodies to "opt out" of the law by by adopting ordinances prohibiting sales by "on-premise licensees" after 1 a.m.

The Senate version is, instead, an "opt in" approach.

After the vote Hassan spokesman Marc Goldberg said, "As the bill as amended now allows local communities to decide whether or not to opt-in to the new last call, the Governor is inclined to sign the legislation."

Extra business is always welcome, but some Mancheste pubs aren't writing up new hours just yet. The city would still need to approve before bar owners decide whether an extra hour is in the future.

"We're in kind of a wait-and-see mode," said Chris Mansfield, manager at Milly's Tavern in the Millyard. "For places on Elm Street it might be a good move, but for places kind of off the beaten path it's a little different."

Mansfield said Milly's would likely try a 2 a.m. closing time on weekend nights.

James Pliakos, co-owner of the Shaskeen on Elm Street, said many bars shut down before 1 a.m. already, so he doesn't expect much of a change should Manchester enact the new time ordinance.

If it does, Pliakos said the Irish pub would likely stay open another hour on weekend nights, but not during the week.

"I don't see a Tuesday night crowd staying until 2 a.m.," he said.

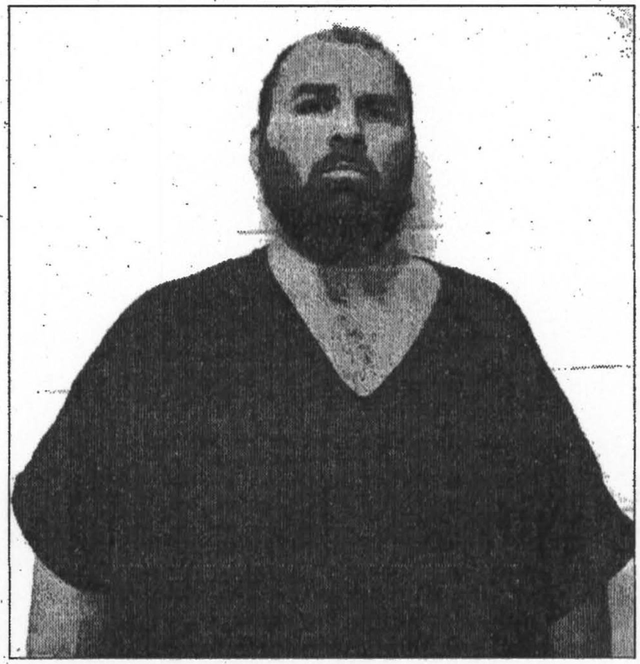
Rep. Steve Vaillancourt, R-Manchester, called on the House to reject the Senate version and set up a committee of conference to negotiate a compromise. He said the House version was "saner" and the House should not "roll over."

But Rep. Ed Butler, R-Hart's Location, an innkeeper, supported concurrence, saying the Senate version "improves the options given to our towns and cities."

And should the local municipalities approve, Pliakos noted 2 a.m. is not a mandate.

"The bars don't have to do it," he said. "Every bar has got its own choice."

Teen told no fish story: He's the official derby winner



Kyle Berry's lawyer said his client thought he was due to appear in court on another day, not Wednesday. Berry did not make it to a bail revocation hearing in Brentwood.

Auburn man arrested in YouTube marijuana case fails to show up for court

By JAMES A. KIMBLE
Union Leader Correspondent

A judge issued a warrant for Kyle Berry, 40, for failing to appear at a bail-revocation hearing, stemming from his latest pot-growing arrest in Lawrence, Mass., last month.

BRENTWOOD — An Auburn man who was arrested for allegedly showing off his marijuana-growing operation on YouTube could be jailed for failing to show up for a court hearing Tuesday.

A judge issued a warrant for Kyle Berry, 40, for failing to appear at a bail-revocation hearing, stemming from his latest pot-growing arrest in Lawrence, Mass., last month.

Prosecutors want Berry held without bail pending his trial on charges alleging he grew $16,000 worth of marijuana plants at his Auburn apartment in November and chronicled his progress on YouTube.

Rockingham County sheriff deputies said they used the videos – which also captured Berry's face reflected on a foil covered wall – to obtain arrest and search warrants in the case.

his apartment as well.

When confronted about the marijuana smell coming from his apartment, Berry invited police officers into the apartment and showed where plants were growing in his closet, police reported.

Berry told police, "It's legal. I have a prescription" and handed officers paperwork

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By JOHN
Senior Politic

CONCORD — Wednesday kil that would ch ments for regis but agreed to the state Senate versions of a se dressing forms c required when into the polling ballot.

The House co with Senate ch voter registrati agreed with Rep son that "there breach that divic ence committee 104, to "non-co Senate.

On the vote House voted 2 concur" but al Senate for a con ference to negoti

Voter registrat

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The bill passe removed any refe vehicle laws. Bu serted similar, bu language as curr

The Senate person registerin sign a form ackn he is subject to state, including