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February 9, 2018

Mark D. Marini, Secretary
Department of Public Utilities
One South Station, 5th Floor
Boston, MA 02110

Re: Aquarion Water Company of Massachusetts, Inc., D.P.U. 17-90

Dear Secretary Marini,

Enclosed for filing on behalf of Aquarion Water Company of Massachusetts, Inc. (the "Company"), is the Company's Motion for Leave to Amend its Initial Filing in the above-referenced proceeding (the "Motion"). Together with the Motion, the Company is enclosing the supplemental testimony of Troy M. Dixon and supporting exhibits AWC-TMD-2 through AWC-TMD-5.

The Company is proposing this amended filing to address the following three factors that have arisen after the initial filing in this matter: (1) savings resulting from the change in control approved by the Department in D.P.U. 17-115 pursuant to which Eversource Energy became the owner and operator of the Company; (2) the recently enacted 2017 federal tax act that reduces the corporate tax rate from 35 to 21 percent; and (3) customer support for accelerated investment in infrastructure for reliability and water-quality purposes expressed during the public comment phase of this proceeding. To address these factors, the Company is proposing both a revised cost of service and a Water Reliability Investment Mechanism.

In order to provide an opportunity for sufficient review by the Department and meaningful participation by stakeholders, the Company has included a proposal for a revised procedural schedule in its Motion. This schedule extends the discovery and public comment period, provides an opportunity for supplemental intervenor testimony and results in a one-month delay of rate implementation until August 1, 2018.

Please contact me with any questions you may have. Thank you for your attention to this matter.

Sincerely,

Jessica Buno Ralston

cc: Kerri Phillips, Esq., Hearing Officer
Service List, D.P.U. 17-90

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC UTILITIES

Aquarion Water Company of Massachusetts, Inc.	)	D.P.U. 17-90

MOTION FOR AMENDMENT OF FILING AND PROCEDURAL SCHEDULE BY AQUARION WATER COMPANY OF MASSACHUSETTS, INC.

Aquarion Water Company of Massachusetts, Inc. ("Aquarion" or the "Company") hereby requests that the Department of Public Utilities (the "Department") grant leave to for amendment of the Company's initial filing in this proceeding in accordance with 220 CMR § 1.04(3), and for modifications to the current procedural schedule in order to accommodate this amendment.

Specifically, with this Motion, the Company is requesting to amend its initial filing submitted to the Department on April 13, 2017 to incorporate certain changes to the request for a base-rate change (the "Amendment"). Collectively, the changes to the Company's initial filing proposed in this Amendment reduce the Company's requested rate relief from $2.347 million to $2.121 million, or by $226,000. The reduction of the proposed requested increase is enabled by the federal "Tax Cuts and Jobs Act," enacted December 22, 2017 ("2017 Tax Act"), along with other circumstances.

In addition, the Company is proposing to put a mechanism in place to enable the accelerated replacement of water mains and system upgrade activities, and to increase annual investment on reliability-related capital work by more than $1 million. This incremental investment will help to improve the reliability and quality of water service in the Towns of Hull, Hingham, Cohasset, Millbury and Oxford. As explained in the

testimony and supporting exhibits filed herewith in support of the amendment, the bill impacts associated with the mechanism would be minimal, with federal tax reductions offsetting the impact by half in the first year and limiting bill impacts to a range of 1-2 percent annually. Acceleration of the Company's main-replacement plan would be directly and critically important to customers and the reduction in federal tax expense creates a matchless opportunity to step up the amount of system investment without a material bill impact for customers.

To allow for additional discovery and direct testimony by the intervenors in this proceeding (as well as for the Department's consideration of the changes to the Company's Initial Filing), the Company is proposing to extend the suspension period for this case for an additional 30 days. The specific, proposed changes to the procedural schedule are set forth below and are intended to facilitate sufficient review by the Department and the parties of this amended proposal. The effective date for new rates resulting from this proceeding would be October 1, 2018 (i.e., a one month delay for implementation of new rates).[1] Prior to making this filing, the Company has had discussions with representatives for the Towns of Cohasset, Hingham, Hull, Oxford and Millbury to provide notice and to obtain input.

I. LEGAL STANDARD

The Department is authorized to allow leave to file amended pleadings as a matter of discretion. 220 C.M.R. § 1.04(3). The Department or the Hearing Officer similarly has the discretion, for good cause shown, to amend the procedural schedule including the

[1] Based on the original filing date of April 13, 2017, the suspension period would have terminated on March 1, 2018. The six-month abeyance associated with the Department's consideration of the change-of-control in D.P.U. 17-115, delayed the effective date to September 1, 2018. See, Eversource Energy/Macquarie Utilities, D.P.U. 17-115, at 1-2, fn.2 (2017).

current deadlines for issuing discovery and briefs in this matter pursuant to 200 C.M.R. § 1.02(5).

II. AMENDMENT OF THE COMPANY'S PETITION FOR APPROVAL

The Department, as an administrative agency, has broad discretion over procedural issues in proceedings pending before it. NSTAR Electric Company and Western Massachusetts Electric Company each d/b/a Eversource Energy, D.P.U. 15-122, at 6 (2017), citing Zachs v. Dep't of Pub. Utilities, 406 Mass. 217, 227 (1989); New Boston Garden corp. v. Assessors of Boston, 24 Mass. App. Ct. 122, 125 (1987).

Here, it is appropriate to exercise this discretion and grant the Company's request for leave to amend its filing on the basis that three significant changes have occurred since the Initial Filing on April 13, 2017. Collectively, the changes to the Company's initial filing proposed in this Amendment reduce the Company's requested rate relief from $2.347 million to $2.121 million, or by $226,000. The reduction of the proposed requested increase is enabled by the federal "Tax Cuts and Jobs Act," enacted December 22, 2017 ("2017 Tax Act"), along with other circumstances. These changed circumstances are creating a rare opportunity for the Company to achieve customer benefits not anticipated at the time of the Initial Filing.

Specifically, these three changes in circumstances are as follows:

First, on November 28, 2017, the Department approved the Petition for Change in Control of Macquarie Utilities Inc., a holding company of AWC-MA pursuant to G.L. c. 165, § 2, and G.L. c. 164, § 96, authorizing Eversource Energy to become the owner and operator of AWC-MA. In the Department's final decision in that proceeding, D.P.U. 17-115, the Department found that the change in control would result in certain savings related

to legal costs, shared corporate services and the cost of short-term debt. D.P.U. 17-115, at 29-34. The Company has incorporated these findings into the cost of service, as explained in detail in the supplemental testimony.

Second, the 2017 Tax Act reduces the corporate tax rate from 35 to 21 percent. Although the ratemaking impacts of this reduction are somewhat unique for water utilities, the reduction in the corporate tax rate directly impacts the Company's cost of service, and therefore, warrants a downward adjustment in this proceeding. The adjustment is discussed in the supplemental testimony.

Third, through the public proceedings conducted over the summer in both D.P.U. 17-90 and 17-115, the Company's customers expressed support for accelerated investment in infrastructure for reliability and water-quality purposes. For example, customers testified that the demographic changes in the Town of Hull, warrant accelerated infrastructure investment and that associated rate increases would be acceptable for the purpose (Tr. 1, at 23-25). In fact, increased investment will benefit all customers and the increased investment is made more affordable for customers with the reduction in federal tax expense. As a result, there is an important opportunity to achieve affordable, significant service-quality improvements for customers. In the supporting testimony and exhibits, the Company presents its proposal accomplishing a step-up in capital investment with minimal rate impacts for customers.

The Company's proposal for a capital investment cost recovery mechanism is appropriate for review together with the Company's initial filing because issues related to the capital investment cost recovery mechanism are intertwined with the Company's general base rate proposal. For example, the Company's base rate proposal also includes

capital investments and therefore it will be administratively efficient to review the capital investment proposals together in the same proceeding.

In addition, as detailed in the supplemental testimony of Troy M. Dixon, the Department has received numerous public comments relating to the need for additional investment in infrastructure during the course of this proceeding. The Company's infrastructure investment proposal is directly responsive to these concerns. Allowing the Company to amend its initial filing in order to directly address public comments is not only within the Department's discretion but ensures that public participation in the administrative review process is meaningful.

Lastly, because the Company is simultaneously proposing to amend the procedural schedule there is no danger that procedural due process rights will be impaired. Pursuant to the amended procedural schedule set forth below there will be additional opportunities for public comments, as well as, an extended discovery period to allow for investigation specifically of the proposed amendments to the Company's filing. For these reasons, the Department should find that it is within its discretion to grant leave to Aquarion to amend its filing through the provision of supplemental testimony and exhibits.

III. MODIFICATION OF THE PROCEDURAL SCHEDULE

As set forth above, the Company is proposing to amend its Initial Filing to reduce the requested revenue increase and to incorporate a proposal for accelerated capital investment and the associated cost recovery. The Company is submitting supplemental testimony and exhibits to support its proposed Amendment.

Under the current procedural schedule, the deadline for intervenor testimony was February 1, 2018 and the deadline to issue discovery is March 2, 2018. The Company

proposes to modify these deadlines to allow for discovery on the Company's supplemental testimony and exhibits through March 23, 2018;[2] the filing of supplemental intervenor testimony on March 30, 2018 and the issuance of discovery by the Company on the intervenor supplemental testimony by April 6, 2018. Discovery responses from the intervenors would then be due on April 23, 2018.[3] The Company would also propose an extended public comment period through April 30, 2018 with additional notice requirements to be determined by the Department.

In order to accommodate this additional period of discovery, the Company proposes moving the dates for evidentiary hearings to a two-week period, starting Monday, May 7, 2017 and Monday, May 14, 2018; record requests would be due five business days following the date of issuance with final responses due on May 25, 2018. Under the current procedural schedule, briefing is staggered with intervenor initial briefs due two weeks following the deadline for final record request responses. Keeping this timing convention, the Company proposes a revised briefing schedule as follows:

Intervenor Initial Briefs Due: June 8, 2018
Company Initial Brief Due: June 22, 2018
Intervenor Reply Briefs Due: June 29, 2018
Company Reply Brief Due: July 9, 2018[4]

This proposed procedural schedule allows more than sufficient time for consideration of the Company's amended filing while preserving procedural due process

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[2] The Company will endeavor to file responses to any discovery issued on March 23, 2018 by close of business March 30, 2018.

[3] Pursuant to the Procedural Notice and Ground Rules (the "Ground Rules"), responses to discovery requests are due within ten business days (Ground Rules, § III€(1); Monday, April 16, 2018 is Patriot's Day and thus not a business day for the Department (Ground Rules, fn. 2). As such, Monday April 23, 2018 is the tenth business day following the proposed deadline to issue discovery.

[4] The due date for the Company's reply brief has been extended due to the July 4th holiday; July 4, 2018 is not a business day and is thus not used in the calculation of time.

rights for all parties. The schedule effectively provides six weeks for evaluation of the rate reduction and proposal to accelerate capital investment, prior to the filing of supplemental intervenor testimony; five weeks between the filing of supplemental intervenor testimony and hearings; and maintains a three-month period for the Department's consideration of the issues and issuance of a final decision. In addition, the Company plans to meet with the intervenors and attempt to resolve issues involved the case in the interim to see whether the scope of contested issues might be narrowed.

Accordingly, the Company requests that the Department allow this Motion in the interests of addressing the unique circumstances that have materialized and to do so in the interests of customers.

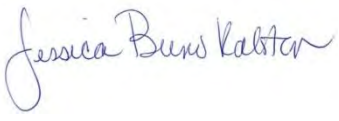
III. CONCLUSION

WHEREFORE, for the reasons stated above, the Company respectfully requests that the Department grant its motion for leave to amend its initial filing and to revise the procedural schedule.

Respectfully submitted,

AQUARION WATER COMPANY OF MASSACHUSETTS, INC.

By its attorney,



Jessica Buno Ralston, Esq.
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Dated: February 9, 2018

COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF PUBLIC UTILITIES

Petition of Aquarion Water Company of Massachusetts For Approval of an Increase in Base Distribution Rates Pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00	D.P.U. 17-90

DIRECT TESTIMONY OF
TROY M. DIXON

ON BEHALF OF

AQUARION WATER COMPANY OF MASSACHUSETTS, INC.

February 9, 2018

COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF PUBLIC UTILITIES

DIRECT TESTIMONY OF TROY M. DIXON

I. Introduction

Q. Please state your name and business address.

A. My name is Troy M. Dixon and my business address is 600 Lindley Street, Bridgeport, Connecticut 06606.

Q. By whom are you employed?

A. I am employed by Aquarion Water Company of Connecticut ("AWC-CT"), an affiliate of Aquarion Water Company of Massachusetts, Inc. ("AWC-MA" or the "Company"), as Director of Rates and Regulation.

Q. Please describe your educational background.

A. I have a Bachelor's Degree in economics and accounting from the College of the Holy Cross in Worcester, Massachusetts. I am currently pursuing a Master of Business Administration at New York University's Stern School of Business.

Q. What has been your business experience?

A. I was hired by AWC-CT in February 2003, as a Regulatory Compliance Specialist. During my employment, I have taken on positions of increasing responsibility. In October 2009, I was promoted to Director of Rates and Regulation for AWC-CT where I am responsible for the preparation and

presentation of rate case and other various filings for the Company and each of its regulated water affiliates that are all owned by Aquarion Water Company ("AWC").

Q. Have you previously testified or submitted written testimony in a regulatory proceeding?

A. Yes. I have testified on behalf of AWC's regulated water utility subsidiaries in rate filings and/or other proceedings in Connecticut, New Hampshire and Massachusetts. In Massachusetts, I testified on behalf of AWC-MA before the Department of Public Utilities ("Department"), in the Company's 2008 and 2011 rate proceedings, which were docketed as D.P.U. 08-27 and D.P.U. 11-43, respectively. I also testified in two of the Company's rate-reduction proceedings, D.P.U. 12-84 and D.P.U. 14-58. Lastly, I provided pre-filed testimony in the Company's proceeding to introduce reduced private fire protection rates, D.P.U. 16-140.

Q. What is the purpose of this supplemental testimony?

A. With this filing, the Company is requesting to amend its initial filing submitted to the Department on April 13, 2017 to incorporate certain changes to the request for a base-rate change (the "Amendment"). Collectively, the changes to the Company's initial filing proposed in this Amendment reduce the Company's requested rate relief from $2.347 million to $2.121 million, or by $226,000. The reduction of the proposed requested increase is enabled by the federal "Tax Cuts and Jobs Act," enacted December 22, 2017 ("2017 Tax Act"), along with other circumstances. With this Amendment, the Company is also proposing to put a

mechanism in place to enable the accelerated replacement of water mains and system upgrade activities, and to increase annual investment on reliability-related capital work by more than $1 million. This incremental investment will help to improve the reliability and quality of water service in the Towns of Hull, Hingham, Cohasset, Millbury and Oxford. As explained in my testimony below, the bill impacts associated with the mechanism would be minimal, with federal tax reductions offsetting the impact by half in the first year and limiting bill impacts to a range of 1-2 percent annually. Acceleration of the Company's main-replacement plan would be directly and critically important to customers and the reduction in federal tax expense creates a matchless opportunity to step up the amount of system investment without a material bill impact for customers.

Q. What are the specific factors compelling this Amendment of the Company's Initial Filing?

There are three factors causing the Company to propose an amendment to its Initial Filing at this time. Collectively, these factors are creating a rare opportunity for the Company to achieve customer benefits not anticipated at the time of the Initial Filing.

First, on November 28, 2017, the Department approved the Petition for Change in Control of Macquarie Utilities Inc., a holding company of AWC-MA pursuant to G.L. c. 165, § 2, and G.L. c. 164, § 96, authorizing Eversource Energy to become the owner and operator of AWC-MA. In the Department's final decision in that proceeding, D.P.U. 17-115, the Department found that the change in control would result in certain savings related to legal costs, shared corporate services and

the cost of short-term debt. D.P.U. 17-115, at 29-34. The Company has incorporated these findings into the cost of service, as explained in detail below.

Second, the 2017 Tax Act reduces the corporate tax rate from 35 to 21 percent. Although the ratemaking impacts of this reduction are somewhat unique for water utilities, the reduction in the corporate tax rate directly impacts the Company's cost of service, and therefore, warrants a downward adjustment in this proceeding. The Company's specific proposals regarding the tax changes are discussed below.

Third, through the public proceedings conducted over the summer in both D.P.U. 17-90 and 17-115, the Company's customers expressed support for accelerated investment in infrastructure for reliability and water-quality purposes. For example, customers testified that the demographic changes in the Town of Hull, warrant accelerated infrastructure investment and that associated rate increases would be acceptable for the purpose (Tr. 1, at 23-25). In fact, increased investment will benefit all customers and the increased investment is made more affordable for customers with the reduction in federal tax expense. As a result, there is an important opportunity to achieve affordable, significant service-quality improvements for customers. Below, the Company presents its proposal accomplishing a step-up in capital investment with minimal rate impacts for customers.

Q. How is your supplemental testimony organized below?

A. Section I of this testimony is the Introduction. Section II discusses the changes that the Company has made to the proposed revenue requirement, resulting in a

downward adjustment of $226,000. Section II also covers the Company's proposals with respect to the 2017 Tax Act. Section III discusses the Company's proposed Water Reliability Improvement Mechanism ("WRIM"), which the Company is proposing to implement to support an accelerated pace of replacement for aging infrastructure. Section IV is the Conclusion.

II. Revenue Requirement Adjustments

Q. Would you please summarize the changes to the revenue-requirement that are included in Exhibit AWC-TMD-5, reducing the Company's request to $2.121 million in this case?

A. Yes. As referenced above, the collective changes to the Company's proposed revenue requirement result in a net reduction of $226,000. The breakdown of these adjustments is as follows:

1. The Company has incorporated a **reduction** of approximately **($14,000)** to Test Year legal expenses to reflect the known and measurable changes recognized by the Department in its decision approving the change in control for AWC-MA. See, D.P.U. 17-115, at 19, 26, 28.

2. The Company has incorporated a **reduction** of **($3,000)** to reflect anticipated changes in the internal services that Eversource can provide in the areas of audit, tax compliance, legal, director and officer liability insurance expense, and bank fees. These cost changes were recognized by the Department as known and measurable in its decision approving the change in control for AWC-MA. See, D.P.U. 17-115, at 25, 31-32.

3. The Company has corrected the capital structure to eliminate the use of short-term debt to: (1) incorporate the Department's finding that the cost of short-term debt will decrease as a result of the change in control; and (2) align the proposed capital structure with the Department's ratemaking practices, which do not include short-term debt in the capital structure. This change produces an **increase** to the cost of service of **$153,000**.

4. The Company has incorporated the impact of the reduction in the federal corporate tax rate from 35 percent to 21 percent to the revenue-requirement gross-up factor, producing a **reduction** in the cost of service of **($152,000)**.

5. The Company has made several other corrections and updates arising primarily from the discovery process. A specific listing of these corrections and updates is provided in Exhibit AWC-TMD-5. Some of these corrections and updates are upward changes and others are downward changes. The collective result of these changes is a **net reduction** of **($210,000)**.

Q. Would you please explain the first adjustment relating to reduced legal expenses?

A. Yes. In the change of control proceeding, D.P.U. 17-115, Eversource asserted that it could provide legal services to AWC-MA at a savings of $14,000 annually through the use of internal or external resources, or a combination of both, at an hourly rate less than 40 percent of the average hourly rate for standard services currently paid by Aquarion. D.P.U. 17-115, at 26. The Department found the estimate to be substantiated by past experience and supported by logical reasoning. Id. at 32. As a result, the Department found this amount to be appropriately included in net savings. Id. Because the changes in legal expense are known and measurable and were included in the Department's computation of net savings, the Company is incorporating that cost change into the cost of service.

Q. Would you please explain the second adjustment relating to reduced Corporate Services?

A. Yes. During the proceeding in D.P.U. 17-90, Eversource asserted that it had identified between $1,000 and $3,000 in estimated annual savings for select corporate services currently provided by MUI, including audit, tax compliance, legal, director and officer liability insurance expense, and bank fees. D.P.U. 17-

115, at 31. Eversource calculated estimated annual savings for corporate services using the 2016 charges allocated to AWC-MA from MUI, and based on a savings proxy of two to five percent. Id. In its final decision, the Department included the estimate of $1,000 to $3,000 in its net savings. Id. at 31-32. Therefore, the Company is incorporating this change into the cost of service.

Q. Would you please explain the third adjustment relating to the capital structure?

A. Yes. In the Company's original filing, the Company computed the proposed revenue requirement using a capital structure as follows:

Capital Structure as Filed

Component	%	Cost	Weighted Cost
Common Equity	44.91%	10.50%	4.72%
Short Term Debt	4.01%	1.76%	0.07%
Long Term Debt	51.08%	5.81%	2.97%
Total	100.00%		7.76%

During the change-in-control proceeding in D.P.U. 17-115, Eversource asserted that AWC's higher credit rating would be likely to improve interest rates by five to ten basis points as a result of the transfer of ownership to Eversource Energy. D.P.U. 17-115, at 29. In addition, Eversource asserted that, as with its other operating companies, Eversource's commercial paper program will be available to AWC-MA for short-term cash needs subsequent to the transaction. Id. at 24-25. Eversource indicated that, as of July 31, 2017, AWC-MA was subject to a 2.50 percent interest rate for short-term debt, as compared to a weighted average rate of 1.34 percent under Eversource's commercial paper program. Id. at 25. Although the Department did not

include savings associated with a reduction in short-term debt costs in its computation of net savings, the Department found that the record demonstrated that AWC-MA would have access to more favorable interest rates on short-term debt after the change-in-control through Eversource's commercial paper program than those currently available to the Company. Id. at 30-31.

Q. How does the reduction in the cost of short-term debt affect the computation of the revenue requirement?

A. On November 4, 2017, almost immediately after the Department issued its decision in D.P.U. 17-115, the credit rating for Aquarion Water Company was upgraded from BBB to A+. In addition, as discussed during D.P.U. 17-115, AWC-MA is now participating in the Eversource Energy commercial paper program. Therefore, the cost of short-term debt has decreased from approximately 2.80 percent in January 2018 to an average rate for the month of January 2018 of 1.77 percent. The changed circumstances for short-term debt costs were acknowledged by the Department as likely in its decision approving the change-of-control. D.P.U. 17-115, at 34.

This point is important because, in the Company's initial filing, the Company included short-term debt in the capital structure. Incorporating the reduced cost of short-term debt, although known and measurable, would result in an inordinately and inappropriately low cost of capital. Given the cost change and that short-term debt is not included in the capital structure under Department ratemaking principles, the Company has removed the short-term debt component

from the actual capital structure computed at the end of the Test Year. This adjustment results in the following capital structure and weighted cost of capital:

Capital Structure as Amended			
Component	**%**	**Cost**	**Weighted Cost**
Common Equity	46.79%	10.50%	4.91%
Long Term Debt	53.21%	5.81%	3.09%
Total	100.00%		8.00%

The impact to the cost of service is relatively small, producing a cost change of $153,000, which is more than offset by changes reducing the cost of service. Of this amount, $32,000 is associated with the substitution of long-term debt for short-term debt and $121,000 is associated with the greater component of equity that results from the removal of short-term debt from the overall capital structure. However, even with this change, the equity component is only 46.79 percent, which is well below the 50 percent equity ratio that the Department typically will allow for smaller companies. Therefore, the resulting capital structure is consistent with Department ratemaking practice and appropriate for those purposes.

Q. Would you please explain the fourth adjustment relating to the Tax Cuts and Jobs Act?

A. Yes. On December 22, 2017, a change to the federal tax code was enacted reducing federal corporate income tax rates from 35 percent to 21 percent. The change in the federal corporate income-tax rate will have two impacts for regulated utility revenue requirements. These changes are as follows:

1. The lower statutory tax rate of 21 percent will reduce the Company's cost of service and lower revenue requirements from January 1, 2018 onward; and

2. The accumulated deferred income tax liability (ADIT) on the Company's books must be restated to reflect the lower tax rate, with the consequent reduction re-classified to a regulatory liability to be amortized over the average life of the assets.

On February 2, 2018, the Department issued directives to all public utility companies subject to its jurisdiction regarding the ratemaking implication of the Tax Cuts and Jobs Act. Notice of Investigation into the Effect of the Reduction in Federal Income Tax Rates on the Rates Charged by Electric, Gas, and Water Companies, D.P.U. 18-15 (February 2, 2018) ("NOI"). The Department's directives relevant to the Company's cost of service presented for review in this proceeding include the following:

- Each company shall, as of January 1, 2018 account for any revenues associated with the difference between the previous and current corporate income tax rates (NOI at 5);
- Each company shall account for excess recovery in rates of ADIT resulting from the lower federal corporate income tax rate. Such amounts shall be booked as regulatory liabilities, effective January 1, 2018, to be refunded to ratepayers in a manner to be determined by the Department (id.);
- On or before May 1, 2018, each company shall file a proposal to address the effects of the Act and, in particular, a proposal to reduce its rates through the establishment of a revised cost of service incorporating the lower federal corporate income tax rate as of January 1, 2018, and holding all other components used to design rates constant (id.);
- The calculation of the revised cost of service and methods to implement adjustments in rates shall be accompanied by testimony and supporting documentation from each company (id. at 6).

- Each company shall base all calculations on the cost of service and billing determinants approved in its most recent rate case. All calculations shall assume that, for ratemaking purposes, adjustments will occur for rates effective July 1, 2018 (id.);

- In addition, each company shall identify the effect, if any, of the federal corporate income tax rate decrease on its various reconciling mechanisms (id.); and

- The filing may include any other issues related to the effects of the Act that the companies find appropriate to raise (id.).

Q. How is the Company accounting for the Department's directives in this filing for Amendment of the Company's Initial Filing?

A. In the NOI, the Department encouraged companies to collaborate on the development of a joint proposal for Department review regarding the appropriate methods to implement the directed adjustments in rates (id. at 6). However, the Company's situation is unique in that there is an ongoing rate proceeding, currently scheduled to put rates in effect September 1, 2018. Therefore, to move ahead and address the Department's directives in the context of the Department's review of the Company's cost of service in this proceeding, the Company is making certain proposals to comply with the Department's directives in a way that substantially benefits the interests of customers. These proposals are discussed in turn below.

Q. Does the Department's NOI recognize that water utilities may be in a different position than gas and electric companies in relation to the currently effective federal tax rates?

A. Yes. Consistent with the Department's acknowledgement in the NOI, it is important to note that the Company's *current rates* do not reflect a federal tax rate equal to 35 percent. More specifically, the Tangible Property Regulations applicable to water utilities ("TPR") allow utilities to deduct large portions of

their capital budgets for tax purposes. This deduction has a profound impact on the cost of service for water utilities, particularly those water utilities that utilize the "flow-through" method. Under the flow-through method, taxable income is significantly reduced, reducing the effective tax rate and income tax expenses of the utility. This is in contrast to a utility using the normalized tax payer method where the deferred tax expense is recorded and recovered through the utility's cost of service. As a result of the large TPR deduction, the Company's effective tax rate in the test year was essentially zero. The same effective rate (or lower) is projected for calendar year 2018.

After adopting TPR in 2013, and subsequent to the Department's order in D.P.U. 14-58, the Company instituted a $400,000 credit for customers. The credit resulted from the adoption of the TPR flow-through method because the Company was able to claim deductions for the periods of 2007-2013, which produced refunds that were passed directly through to customers. In Massachusetts, the customer refund resulted in a three percent rate reduction to customers over the 2015 calendar year. As a result of this tax treatment, the Company's effective tax rate is effectively zero, well below the 21 percent corporate income tax rate established by the 2017 Tax Act.

Q. Would you please summarize the Company proposals to incorporate the impact of the 2017 Tax Act for its customers?

A. Yes. In that regard, there are three aspects of the Company's proposal to account for the reduced federal corporate tax rate. These three aspects are as follows:

1. Reduction to Income Tax Expense in the Revenue Requirement

In Exhibit AWC-TMD-5, the Company has adjusted the federal tax rate used in the gross-up of the cost of service from 35 percent to 21 percent. This adjustment reduced income-tax expense by $152,000 in the proposed revenue requirement. This reduction will take effect as of the effective date of new base rates approved in the proceeding, which is September 1, 2018.

2. Flow Through of Excess ADIT Credit

As discussed below, the Company's is proposing to pass the reduction of ADIT back to customers through an annual rate credit, as anticipated by the Department's NOI. The Company has determined that its excess deferred income taxes as of December 31, 2017 were $2.84 million. This amount would be amortized over the 26.24 remaining useful life of the underlying assets creating an annual amortization of $108,000. After the gross-up factor of 1.376 is applied, this yields an annual revenue requirement impact of $149,000. The Company is proposing to flow this refund through a new rate mechanism established to recover the cost of incremental capital investment between rate cases to allow for acceleration of the Company's mains replacement plan.

3. Refund for the Period January 1, 2018 through Rates Effective Date

For the period beginning January 1, 2018 through the implementation of new rates locking the reduced federal corporate tax rate into base rates, the

Company's effective tax rate will be zero or less than zero. Accordingly there is no refund due to customers from this period of time.

4. Other Mechanisms: The reduced federal tax rate also impacts elements of the surcharges associated with the Hingham Water Treatment Plant. These updates have been reflected in Exhibit AWC-TMD-5.

III. Water Reliability Improvement Mechanism

Q. What is the Company proposing in terms of the Water Reliability Improvement Mechanism?

A. In this Amendment, the Company is proposing to implement a Water Reliability Improvement Mechanism (WRIM) to enable the acceleration of main replacements and infrastructure investment on the Company's system. The Company's proposed WRIM is generally consistent with the mechanisms already implemented for Aquarion affiliates in Connecticut and New Hampshire and is also similar to mechanisms implemented for water utilities in a number of other jurisdictions, including California, Connecticut, Delaware, Illinois, Indiana, Missouri, New Hampshire, New Jersey, New York, Ohio and Pennsylvania. The specific terms of the Company's proposed WRIM are set forth in a tariff presented in Exhibit AWC-TMD-2.

Q. What is the purpose of the WRIM?

A. The WRIM is designed to enable the acceleration of mains replacement projects that will have direct benefits for customers in terms of water quality and service in the Company's service territory, and to provide associated recovery of the incremental investment necessary to accomplish the acceleration. Acceleration of

the water mains replacement program will increase system reliability, improve service to customers and reduce water loss due to leakage. Although the acceleration of mains replacement would produce direct, important benefits for customers, it is difficult to institute a step-up in investment given the resulting bill impact for customers. The federal tax change has created circumstances where a step-up in investment in the system can be accomplished with minimal bill impacts for customers.

More specifically, through the Company's current capital plan for 2018 through 2021, the Company plans to complete approximately $2.1M of capital additions each year for distribution infrastructure, including water main replacements totaling approximately $1.5M annually. With an investment of $1.5M per year for main replacements, the Company is planning to replace on average 5,100 feet of water main each year. Through the WRIM, the Company would be in a position to accelerate the pace of replacement by almost double, or to approximately 9,100 feet of main per year on average, assuming incremental investment of approximately $1 million per year. This would be a significant increase in the investment in replacement water mains considering the current plan to invest $1.5M on average.

Q. How does the Company know whether a customer benefit would result from acceleration of the mains replacement work plan?

A. Aging infrastructure is a challenge that the water industry has been facing for many years and the Company's systems in Massachusetts are no exception. Aging water mains are the primary cause of water discoloration and interruptions

of service. Replacement and rehabilitation of water mains is critical to address these issues. Water mains represent the most significant category of assets in the system and are the category of assets where the most investment is needed. As of the end of the Company's test year in this proceeding, transmission and distribution investments represented two-thirds of the total utility plant investment for the Company. Within the transmission and distribution category, water mains represented 74 percent of the total.

With respect to the Company's main inventory, the Company owns and operates a total of 188 miles of water mains serving Hull, Hingham, and Cohasset. In these three municipalities, the average age of the Company's mains inventory is 64 years old. The Millbury system is comprised of 52 miles of main, averaging 60 years of age. The Oxford system is comprised of 46 miles of main, averaging 49 years of age. The depreciable life of water mains is 70 years. Although the actual useful life of water mains can extend beyond the depreciable life without a loss of system integrity, more than 32 percent of the Company's existing mains are *greater than* 70 years old, with 18 percent greater than 100 years old. Consequently, circumstances are that almost one-fifth of the system main is greater than 100 years old, well beyond the depreciable life.

Q. What steps has the Company taken to evaluate whether the pace of replacement is adequate to maintain safe and reliable service, or whether an accelerated pace would benefit customers?

A. As an initial matter, the Company has maintained safe and reliable service through a considerate, annual evaluation of the optimal combination of capital investment and diligent maintenance practices. However, the Company incurs

ongoing operating and maintenance expense to maintain older vintage mains, which could be reduced with capital investment to replace older vintages with new main. Therefore, it is incumbent upon the Company to continually evaluate whether the mix of capital investment and operating expense is optimal or whether customers would benefit from additional capital investment. Moreover, the Company cannot prolong the useful of its assets indefinitely. At some point, a step-up in investment is required to keep up with needed replacement in aging infrastructure.

Therefore, to assess the appropriate replacement pace for its mains inventory, Aquarion developed a KANEW Model[1] for its Massachusetts system that analyzes the investments needed to minimize service disruptions and avoid the need to dramatically increase spending in the future to address failing water mains. The KANEW Model solves for the optimal balance of main replacement and rehabilitation, while limiting the overall break rate to a reasonable level.

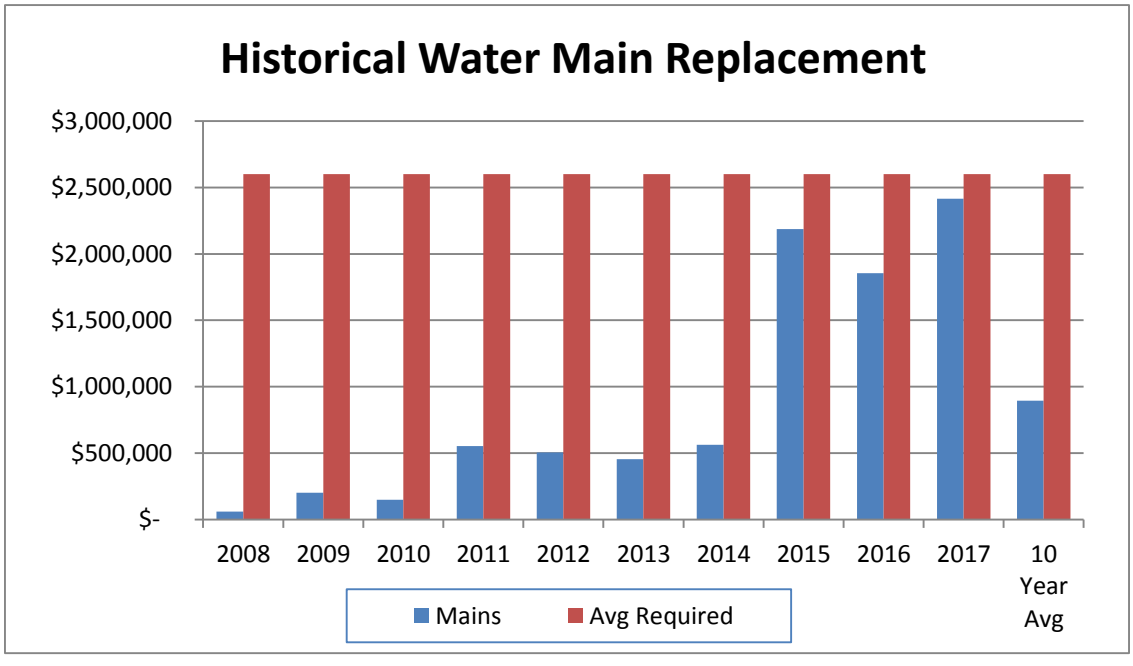
The KANEW Model indicates that the Company's replacement plan should target an investment level of $2.6 million annually for main replacement and rehabilitation on the Company's system. This recommendation is based on a replacement cost of $275 per linear foot on average for replacement of water main, and achieves replacement of 1.8 miles each year. The overall costs will vary based on the size of the water main, number of services and restoration

[1] KANEW is a software company. KANEW allows the user to simulate various scenarios of renewal and replacement, and ultimately, generate the optimal renewal and replacement plan based on the length of mains that reach the end of their effective useful life each year and various constraints on desired service levels (cost, length of work per year, and acceptable break rate).

requirements for each project. The KANEW Model results are contained in Exhibit AWC-TMD-4.

Q. Has the Company's historical capital investment level for mains replacement and rehabilitation achieved the level indicated by the KANEW Model?

A. No. As shown in the graph below, the Company historically has not been able to achieve investment levels of $2.6 million or greater, annually for mains replacement and rehabilitation. Investing $2.6 million on an annual basis exclusively for mains replacement and rehabilitation is not possible within the Company's current capital budget. This level of investment would greatly exceed depreciation levels and would substantially impair the Company's ability to maintain adequate investment levels in other important asset categories, including treatment, source of supply, pumping, and other distribution system assets such as meters, hydrants, service lines and water tanks.



At the Company's current historical annual investment rate (i.e. replacing about 3,250 feet of the 286 miles of water main each year as per the chart above), the imputed useful life of the average main will be 465 years. Consequently, the Company's current rate of replacement is not sustainable. Water mains are not expected to last 465 years. Therefore, Aquarion needs to accelerate its investment in water mains to a material extent to maintain a safe and reliable system for customers. The only impediment to this acceleration is customer bill impact. Given the relatively small size of the system, acceleration of capital investment through a recovery mechanism would normally create a noticeable bill impact for customers, which makes it difficult to make the step change necessary to improve the replacement pace. However, current circumstances represent an unprecedented opportunity to make this step change for the benefit of customers.

Q. Has the Company identified specific projects in each of the towns in its service territory where there are projects that could be accelerated with implementation of the WRIM?

A. Yes. Exhibit AWC-TMD-3 identifies a set of replacement and rehabilitation projects in each town within the Company's service territory (Hingham, Hull, Millbury, Cohasset, and Oxford) that could be accelerated with implementation of the WRIM and a $1M increase in capital expenditure. The identified projects would have a direct benefit for the distribution system. The project listing attempts to ensure that the spending in each community is equitable and balanced with the proportion of customers in those communities.

Q. Would you please describe some of the projects that would be possible with implementation of the WRIM mechanism and the benefits thereof?

A. Yes. WRIM-Eligible Plant Additions will include all transmission and distribution infrastructure except main extensions, new meters and new services. In general, the eligible projects that are intended to improve or protect the quality and reliability of service to customers would fall into the following categories:

- Mains, valves, services, customer meters and hydrants;
- Main cleaning and re-lining projects;
- Relocations that are non-reimbursable;
- Storage tanks and improvements (not applicable to tank painting);
- Purchase of leak detection equipment; and
- Installation of production meters and pressure reducing valves.

Examples of specific projects are listed in Exhibit AWC-TMD-3. These projects as well as those transmission and distribution projects already in the Company's five year capital budget would be eligible for inclusion in the WRIM. However, as discussed below, the Company plans to conduct an active stakeholder process that would allow for review and input on the Company's mains replacement projects on a rolling three-year cycle. This approach will allow the Company to work with its municipalities to select projects that have the biggest impact on reliability and water quality, and that may be completed in tandem with municipal paving work to reduce project costs.

Q. Would you please describe how the proposed WRIM would work on a year-to-year basis?

A. Yes. As referenced above, the Company has included Exhibit AWC-TMD-2 presenting the proposed tariff for the WRIM factor. However, the proposed WRIM mechanism is designed to follow the model set by Department-approved infrastructure mechanisms for natural gas distribution companies. For example, the WRIM factor would recover the revenue requirement associated with the original cost of completed eligible projects, using the authorized rate of return, grossed up for income taxes, plus associated depreciation and property tax expense; divided by the total retail water revenues approved in the most recent filing for the regulated activities of the Company. In addition, the proposed WRIM includes a bill-impact cap that limits the annual change in revenue requirement and protects customers from uneven bill impacts over time.

Q. How is the Company proposing to offset the cost of the WRIM with reductions made available as a result of the 2017 Tax Act?

A. As mentioned above, there are two impacts that must be accounted for arising from the 2017 Tax Act. The first impact is the reduction to income-tax expense in the revenue requirement. As discussed above, the Company has reduced the proposed revenue requirement to account for this impact.

The Company is proposing to use the benefit of the reduced ADIT to offset the cost of the WRIM for customers. Specifically, the Company is proposing that the flow-through of excess ADIT credit be incorporated within the WRIM. The Company has calculated an ADIT reduction of approximately $2.8M as a product of the 2017 Tax Act. The remaining book life of the assets associated with the

balance of ADIT is approximately 26 years. Therefore, the Company is proposing to pass the reduction of ADIT back to customers through an annual credit to the WRIM computation of $149,000.

Q. What are the bill impacts that the Company is forecasting with the implementation of the WRIM in conjunction with the tax changes?

A. In conjunction with the savings from the federal tax change, the Company's forecast of customer impact for the WRIM would be in the range of 1-2 percent period year, as shown below:

	2017A	2018B	2019B	2020B	2021B	5 Year Total
Annual Surcharge	309,880	393,455	463,849	410,045	448,734	2,025,963
EDIT Amortization	(148,927)	(148,927)	(148,927)	(148,927)	(148,927)	(744,634)
Net Annual Customer Impact	160,953	244,528	314,923	261,118	299,807	1,281,329
Net Surcharge	1.17%	1.79%	2.30%	1.91%	2.19%	

Q. What is the Company proposing for a filing process and schedule for the Department's review and approval of the annual filing?

A. If approved by the Department, the Company would become eligible to make a filing each year by no later than 60 days of the close of the calendar year (i.e., by February 28th of each year, reporting on capital improvement projects eligible for recovery through the WRIM factor completed and in service in the prior twelve month period (January 1 through December 31). The adjustment would be implemented following review and approval by the Department on September 1st of each year. The annual change in revenue requirement recovered through the factor would be limited to five percent of the prior calendar year revenues and capped at 10 percent in the aggregate before the filing of the next general rate application, at which time the rate base recovered through the WRIM factor

would be rolled into the rate base recovered through base rates and the WRIM factor would be reset to zero.

Q. Does the Company plan to report its progress on mains replacement to the Department each year with its annual WRIM filing?

A. Yes. The objective of the WRIM is to enable the acceleration of main replacements and rehabilitation projects that would produce a direct, material improvement to water quality and/or reliability. If the WRIM is implemented, the Company intends to file an infrastructure assessment report detailing the capital improvement projects eligible for acceleration, along with a description of the factors influencing the prioritization. The assessment would take into account asset management (break history, size of pipe, material, water quality, soil type, age, location, and town paving projects), hydraulic improvements and the need for redundancy.

Thereafter, with each annual filing, Aquarion would submit a work-plan that outlines its planned main replacement projects for the upcoming three years. Prior to making the annual filing, Aquarion would work closely with the towns it serves to obtain their input on replacement priorities and scheduling issues that may help to reduce cost of anticipated projects. The Company would include information in its annual filing about the results of the stakeholder collaboration in its annual report for the upcoming three-year rolling cycle. The Company will update the report annually to reflect progress and areas of ongoing challenge and would use the report as the basis for stakeholder collaboration. The Company understands that that the implementation of the WRIM would not be an automatic

entitlement, and must be fully and continually justified with progress reports and stakeholder collaboration. Given the critical importance of the acceleration program, the Company is committed to making sure the annual process operates smoothly and with the coordination of the towns.

Q. What is the Company's expectation in relation to collaboration with the towns served by its system?

A. Accelerating the main replacement program will provide immediate value to customers by reducing water main breaks and the resulting service disruptions and water discoloration, reducing water leakage, and improving flow capacity and pressure. This acceleration of the water main replacement program will ensure that there is a long-term sustainable solution to aging infrastructure and ensure that aging infrastructure is not simply passed on to future generations. Based on the historic level of replacement, water mains are being replaced at a pace that would require 465 years to complete replacements across the system. Water mains simply cannot last for this extended period of time (i.e., a period of time that is over six times the mains' depreciable life). The Company's expectation is that the towns that it serves recognize the substantial benefit that would be associated with an accelerated replacement program.

In that regard, the Company's customers have expressed support for an accelerated investment in aging infrastructure. For example, at the public hearing held on July 13, 2017 in this proceeding, several customers expressed concerns regarding investment in infrastructure (Tr. 1, at 23-25, 28-29). In particular, one customer stated that the Town of Hull requires investment because the

demographics of Hull have changed from a summer community to a year-round community putting a greater strain on the system (Tr. 1, at 23-25). Other customers also submitted written comments specifically expressing support for increased rates if such rates were approved in order to allow increased investments in the infrastructure system (see, e.g., Comments of Ray Clouthier, Comments of Ed Demko).

Q. What other benefits do the local communities experience as a result of the WRIM program?

A. The communities within the Company's service territory will have increased visibility and input into the projects which the Company is pursuing. Town representatives will also be well informed as to the rate impacts associated with the investments. This added transparency will provide significant benefit in the planning process.

Q. Can you please summarize the Company's position regarding implementation of the WRIM?

A. Accelerating the main replacement program will provide immediate value to customers in terms of fewer main breaks, less discolored water, and less leakage. Accelerating the main replacement program will also ensure that there is a long-term sustainable solution to aging infrastructure, and that the problem of aging infrastructure is not simply passed on to future generations. The Towns of Hingham and Hull agree that Aquarion should increase its investment in water mains. On numerous occasions those towns have expressed desire in seeing more capital spending from the Company. A regulatory cost recovery mechanism in

place for the water utility will serve to encourage the increased spending levels needed to ensure the long-term safety and reliability of the water system.

If implemented by the Department, the WRIM will prove to be a critical tool in addressing the need to replace aging water-system infrastructure. This includes infrastructure that is aged, or in such condition that it is likely to negatively impact water quality or reliability of service if it is not replaced. In addition to service-quality improvements, the WRIM will provide a benefit to customers by helping to support accelerated investment that will preserve natural resources by reducing lost and unaccounted for water.

IV. Conclusion

Q. Does this conclude your testimony?

A. Yes, it does.

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WATER RELIABILITY IMPROVEMENT MECHANISM

I. General Description

A. ***Purpose*:** The Water Reliability Improvement Mechanism ("WRIM") provides the Company with recovery of project costs to support the accelerated replacement and rehabilitation of water system infrastructure for the purpose of improving or protecting water quality and reliability of service. With implementation of the WRIM, the Company will recover the fixed costs (depreciation, property taxes, return and income taxes) of non-revenue producing system-improvement plant additions completed and placed in service annually, and recorded in the individual accounts noted below. The WRIM will be reduced by the Excess Deferred Income Tax ("EDIT") amortization created as a result of the 2017 Tax Cuts and Jobs Act. WRIM will also be adjusted for an annual reconciliation of prior WRIM amounts. Recovery shall occur after review and approval of the Department of Public Utilities (the "Department").

B. ***Eligible Plant Additions***: WRIM-eligible plant additions will consist of the following:

i. (Account 104) Replacement of meters (customer and production) and pressure-reducing valves.

ii. (Account 108) Non-revenue producing mains installed as replacements for existing mains that have reached the end of useful life and/or are contributing to safety, reliability, water quality, or other operational issues.

iii. (Account 108) Valves installed: (a) to replace existing valves as part of a main replacement project; (b) to replace existing valves that have reached the end of useful life or are no longer operational; or (c) to improve system reliability.

iv. (Account 108) Main cleaning and re-lining projects and relocations that are non-reimbursable. Maintenance and replacement of water storage tanks.

v. (Account 109) Company-segment services installed as in-kind replacements.

vi. (Account 112) Company-owned hydrants installed to replace existing hydrants that have reached the end of useful life and/or to replace existing hydrants that are not operating properly.

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II. Computation of the WRIM

Calculation: The WRIM adjustment factor will become effective September 1, 2019, and will recover the fixed costs of Eligible Plant Additions placed in service between January 1, 2017 and December 31, 2018, which are not reflected in the Company's rate base. Thereafter, the WRIM adjustment factor will be updated on an annual basis to incorporate recovery of costs associated with Eligible Plant Additions placed in service during the prior calendar year (the "Project Year") as well as a reconciliation of funds collected through the prior year WRIM. The Company will submit an application to the Department each March 1st for the prior calendar year for a rate adjustment effective September 1 of each year. Thus, changes in the WRIM adjustment factor will occur as follows:

Effective Date of WRIM Adjustment Factor	Project Year for WRIM Eligible Plant Additions
September 1, 2018 +1	December 31, 2017 +1

The fixed costs of Eligible Plant Additions will consist of depreciation, property taxes, after-tax return and income taxes. Additional elements of the calculation will include a reduction for EDIT amortization and WRIM reconciliation. The elements are calculated as follows:

Depreciation: Depreciation expense will be calculated by applying the depreciation rates approved in the Company's last base rate case for the respective plant accounts to the original cost of WRIM-Eligible Plant Additions minus the corresponding retirement unit recorded.

Property Taxes: Property tax expense will reflect actual tax expense for such projects based on the property-tax rate in effect for each town at the end of the most recent Project Year completed (the "tax rate"), and shall be applied to the cumulative Project Year ending net book value of all eligible WRIM Plant Additions included from the first Project Year thru the end of the most recent Project Year.

After-Tax Return: The weighted cost of capital will be the cost approved in the Company's last base rate case, D.P.U. 17-90, or a subsequent docket.

Income Taxes: An income tax gross up will be added based on current federal and state tax rates for projects that are not eligible for deduction under the Tangible Property Regulations ("TPR"). TPR projects are treated as flow-through for accounting purposes and as such require no tax gross up.

EDIT Amortization: Amortization of annual Excess Deferred income Tax ("EDIT") as determined in D.P.U. 17-90 utilized to reduce the overall WRIM revenue requirement.

WRIM Reconciliation: Reconciliation of prior year WRIM revenues equivalent to the shortfall or surplus of revenue actually collected as compared to those authorized by the Department.

WRIM Adjustment Factor: The WRIM Adjustment Factor will be expressed as a percentage carried to two decimal places and will be applied to the effective portion of the total amount billed to each customer under the Company's otherwise applicable rates and charges. The WRIM Adjustment Factor will not be applicable to (1) miscellaneous charges, or (2) the surcharge component of bill associated with the Hingham Water Treatment Plant for customers in Hingham, Hull and Cohasset.

Formula: The formula for calculation of the WRIM Adjustment Factor is as follows:

$$WRIM = \frac{(RB \times ATR) + DEP + PT - EDIT +/- REC}{BRWR}$$

Where:

RB= Original cost to the Company of Eligible Plant Additions, less accumulated depreciation and accumulated deferred income taxes.

ATR= After-tax return rate applicable to Eligible Plant Additions.

DEP= Annual depreciation expense related to Eligible Plant Additions.

PT= Annual property taxes related to Eligible Plant Additions.

BRWR= Base retail water revenues as approved by the Department in the Company's last base rate proceeding, D.P.U. 17-90, or a subsequent docket.

REC= Reconciliation of prior year WRIM revenues.

III. Annual Report/Stakeholder Input

On March 1 of each year, as part of the Company's annual filing to the Department to implement the WRIM factor on September 1, the Company will submit a plan that lists the WRIM-Eligible Plant Additions that it plans to construct in the upcoming three years. The plan will include a description of each project, the value that completing the project will provide to customers, the estimated cost, and the proposed year of completion. The plan will also include the computation of the WRIM adjustment factor that would result from the completion of the WRIM-Eligible Plant Additions based on the estimated cost of those plant additions, along with customer bill impacts.

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Prior to the March 1 filing, the Company will consult with town representatives in the towns served by the Company to review the construction plan and to obtain input and coordination on the execution and/or prioritization of those projects. At a minimum, to allow for adequate time to coordinate with town representatives, the Company shall provide a preliminary copy of the plan to the towns no later than 90 days before submitting the plan to the Department. The Company will provide notice to the towns of all filings to the Department relating to the WRIM.

IV. Customer Safeguards

Change in Revenue Requirement Cap: The maximum change in the revenue requirement to be billed in any given year through the Company's WRIM shall not exceed five percent (5%) of annual retail water revenues for the prior calendar year. Application of the Revenue Requirement Cap shall not affect the calculation of WRIM recovery, including WRIM Revenue Requirement, in subsequent periods. However, any WRIM recovery approved by the Department in excess of the Revenue Requirement Cap may be deferred for recovery in the following year.

Project Changes: If, because of changed circumstances or new information, the Company plans to complete projects not included in the WRIM project plan, or to re-prioritize projects contained in the project plan, the Company will promptly notify town representatives in the town where the project is located. The Company will submit updates for approved WRIM projects for subsequent project years, based upon information known on a project year-to-date basis, from the beginning of the project year through the following effective dates, on the associated reporting dates:

New Base Rates: The WRIM adjustment factor will be reset at zero as of the effective date of new base rates that provide for prospective recovery of the annual costs that had theretofore been recovered under the WRIM. Thereafter, only the fixed costs of new eligible plant additions not previously included in the Company's rate base would be reflected in the annual updates of the WRIM.

Customer Notice: The WRIM adjustment factor will be shown as a separate line item on customer bills. Customers shall be notified of changes in the WRIM by including appropriate information on the first bill issued by the Company following any change allowed by the Department.

Aquarion Water Company, MA
Incremental Water Main Replacement Investment

Town: Hingham

Number	Location	From/To	Existing Size "/Type	Issue #1	Issue #2	Value added to Customer	Length (ft)	Cost @ $275/ft	Target Year
1	Forget Me Not Lane	All	2 1/4 CICL	Many Breaks	Small Main	Greater reliability and increased flow.	330	$90,750	2018
2	Beach Road	All	6" AC	Many Breaks	Small Main	Greater reliability and increased flow.	2000	$550,000	2022
3	Beach Lane	All	2"	Many Breaks	Small Main	Greater reliability and increased flow.	210	$57,750	2020
4	Arnold Rd,	Main St to Main St	2 1/4" CICL	Many Breaks	Small Main	Greater reliability and increased flow.	880	$242,000	2021
5	Pleasant St	Main St to Middle Street	6" AC	Many Breaks	AC Pipe	Greater reliability and increased flow.	1600	$440,000	2019
6	Meadow View Road	All	2"	Many Breaks	Small Main	Greater reliability and increased flow.	350	$96,250	2020
7	Bradley Hill Rd	From Hydrant 574	6" AC	Many Breaks	Small Main	Greater reliability and increased flow.	1300	$357,500	2018
8	Bremer Circle	All	2 1/4" CI	Poor Pressure	Small Main	Greater reliability, increased flow and pressure.	160	$44,000	2018
9	Crow Point Lane	Lincoln to Condito Way	1" Galv	Poor Pressure	Small Main	Greater reliability, increased flow and pressure.	600	$165,000	2020
10	Whitcomb Ave	From Hydrant 240	6" AC	Poor Pressure	Small Main	Greater reliability, increased flow and pressure.	2300	$632,500	2023

Town: Hull

Number	Location	From/To	Existing Size "/Type	Issue #1	Issue #2	Value added to Customer			
1	Atlantic Ave	Jerusalem Rd to Hydrant 626	8" CI	Many Breaks		Greater reliability and increased flow.	2600	$715,000	2019
2	G Street	Beach Ave to Nantasket Ave	2" galv	Many Breaks	Small Main	Greater reliability and increased flow.	800	$220,000	2021
3	C Street	Nantasket Ave to Central Ave	2 1/4" CI TO 2"	Many Breaks	Small Main	Greater reliability and increased flow.	700	$192,500	2020
4	Lincoln Street	Nantasket Ave to Samoset Ave	1" TO 2"	Poor Pressure	Small Main	Greater reliability, increased flow and pressure.	440	$121,000	2020
5	B Street	Central Ave to Cadish Ave	4"	Many Breaks	Small Main	Greater reliability and increased flow.	425	$116,875	2022
6	Town Way	Main Street to Channel Street	6"	Many Breaks	Undersized	Greater reliability and increased flow.	320	$88,000	2022
7	Mildred Street	Main Street to Channel Street	2 1/4"	Many Breaks	Small Main	Greater reliability and increased flow.	325	$89,375	2022
8	Arthur Street	Main Street to Channel Street	2 1/4"	Many Breaks	Small Main	Greater reliability and increased flow.	425	$116,875	2020
9	Helen Street	Main Street to Channel Street	2 1/4"	Many Breaks	Small Main	Greater reliability and increased flow.	425	$116,875	2020
10	Circuit Ave	Halvorsen Ave to Milford Street	2 1/4"	Many Breaks	Small Main	Greater reliability and increased flow.	325	$89,375	2020

Town: Cohasset

Number	Location	From/To	Existing Size "/Type	Issue #1	Issue #2	Value added to Customer			
1	Tie in Black Rock Road to Forest Ave Another feed for Forest Ave,		8" DICL to 8" CICL	Reliability	No loop	Greater reliability and Cohasset customers.	700	$192,500	2022
2	Eliminate private 1 1/2" Galv Main		None	Reliability	No loop	Greater reliability and Cohasset customers.	700	$192,500	2021

Town: Millbury

Number	Location	From/To	Existing Size "/Type	Issue #1	Issue #2	Value added to Customer			
1	Leslie Lane		2" CI	Many Breaks	Small Main	Greater reliability, increased flow and pressure.	390	$107,250	2020
2	Epping St		6" CI	Many Breaks	Undersized	Greater reliability and increased flow.	1270	$349,250	2021
3	Elwood St		6" CI	Many Breaks	Undersized	Greater reliability and increased flow.	820	$225,500	2018
4	Parkhill Ave	Mass Pike to Johnson St	2" Steel	Many Breaks	Small Main	Greater reliability, increased flow and pressure.	1400	$385,000	2023

Town: Oxford

Number	Location	From/To	Existing Size "/Type	Issue #1	Issue #2	Value added to Customer	Length (ft)	Cost @ $275/ft	Target Year
1	Church St		6" AC & 2" CI	Many Breaks	Small Main	Greater reliability, increased flow and pressure.	1500	$412,500	2023
2	George St		8" AC	Many Breaks		Greater reliability and increased flow.	1450	$398,750	2018

Totals by Year	Investment Amount
2018	$1,116,500
2019	$1,155,000
2020	$1,062,875
2021	$1,003,750

AQUARION Water Company
Stewards of the Environment™

Asset Management Services

AWC

KANEW Study

MA Systems

Hingham-Hull, Millbury, Oxford

November 6, 2016

Annie Vanrenterghem Raven, PhD

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1 Executive Summary

Introduction

Aquarion Water Company of Connecticut (AWC) has retained infraPLAN to conduct a KANEW study that determines the optimal long-term strategy of Renewal and Replacement (R&R) of the water mains from 2017 to 2050 for its MA water Systems, Hingham-Hull (HH), Oxford (OX) and Millbury (MILL). The overall goal is to balance costs (of investment in R&R) and benefits (mainly reduction in Break Rate). A "KANEW study" is named after the software (KANEW) used for this study.

The KANEW software allows the user to simulate various Scenarios of R&R, and, ultimately, generate the optimal R&R plan, based on the length of mains that reach the end of their Effective Useful Life (EUL) each year, and various constraints on desired service levels (cost, length of work per year, and acceptable Break Rate).

While this is the first KANEW study conducted for the MA Systems, several such studies were previously completed by infraPLAN for the AWC CT Systems between 2009 and 2015. The type of analytical approach adopted for the CT Systems in order to generate the necessary input values (EUL, aging curves, current Break Rate) was not an option for the MA Systems because of inadequate data. We therefore organized the MA mains into cohorts similar to the ones created for the CT Systems, and, when necessary, used some of the 2015 input values we had generated for CT, adjusting them for the MA cohorts.

Data

The MA Systems are made of close to 286 mi of active mains (after data clean up) with an average age of 61 years old, as follows:

- Hingham-Hull: 188 mi; 64.4 yrs. old
- Millbury: 52 mi; 59.5 yrs. old
- Oxford: 45.8 mi; 48.7 yrs. old

The most prevalent MATs are AC, DI, PCI, SCI; other MATs are regrouped in an "ELSE" category. The mains have been organized based on the System, their material (MAT) and diameter (DIAM). A cohort of mains is defined by the System, MAT and DIAM. For example, the HH_DI_L cohort includes DI large mains (DIAM>12") located in Hingham-Hull. Main statistical results (after clean up) and KANEW input values appear in Table 1.

Name	Medium 50% EUL Value *0.15/0.25	2016 Break Rate	Aging Factor	Length-Weighted Average Age	Length (mi)
HH_AC	66/82	0.13	3.35	62.2	27.4
HH_DI_L	75/89	0.025	3.5	23.1	2.0
HH_DI_S	57/71	0.04	4	25.5	43.1
HH_ELSE	71/86	0.096	3.4	72.5	6.3
HH_PCI_L	200/200	0.038	1.3	100.9	5.9
HH_PCI_S	107/129	0.15	2.5	106.5	42.9
HH_SCI_L	200/200	0.025	0.7	56.9	0.9
HH_SCI_S	94/132	0.08	1.35	58.3	49.6
MILL_AC	66/82	0.17	3.35	70.3	0.8
MILL_DI_S	57/71	0.035	4	23.0	15.8
MILL_ELSE	71/86	0.096	3.4	77.0	0.7
MILL_PCI_L	200/200	0.045	1.3	116.0	1.3
MILL_PCI_S	107/129	0.14	2.5	105.0	4.0
MILL_SCI_S	94/132	0.11	1.35	70.0	26.8
OX_AC	66/82	0.13	3.35	62.2	8.9
OX_DI_L	75/89	0.01	3.5	1.6	0.7
OX_DI_S	57/71	0.035	4	23.1	19.0
OX_ELSE	71/89	0.096	3.4	66.0	0.0
OX_PCI_S	107/129	0.16	2.5	109.0	4.9
OX_SCI_S	94/132	0.07	1.35	56.0	10.2

Table 1 Main Statistical Results

*The EUL values that appear in the Table 1 correspond to the age read on the aging curve (Break Rate based on age) of the cohort when the threshold Maximum Break Rate (MBR) values of 0.15 and then 0.25 Breaks/mi./yr., respectively, are reached.

EULs and aging values in red are borrowed from the CT 2015 study.

Summary of the Main Results - Selected Scenario

We first created Scenarios with EULs defined with a MBR of 0.15 Breaks/mi./yr. and an Efficiency Factor (EF) of 1 and then 2 (the notion of EF is explained in 5.1.2.) They resulted in R&R lengths and investment costs, as well as, in some cases, Break Rates that were too high. To limit the size of the report, those results are not shown here. We then solely explored Scenarios with MBR of 0.25 and an EF of 2. These results are shown in the report.

Scenario 1 (also called the “Needs” Scenario; Section 6.4.1) follows the EULs provided as input values (Table 5); it results in an investment cost that is too high. Scenario 4 (Section 6.4.3) is created by imposing the current R&R budget of $1.75 M every year until 2100 for the 3 MA Systems (2060 for MA as a whole.) The backlog after the planning horizon and the Break Rate

are higher than is acceptable. The poor performance of Scenario 1 and Scenario 4 justifies the optimization conducted in Scenario 2.

Scenario 2, the Scenario selected, was generated using the amount of R&R obtained with Scenario 1 ("Needs") optimized at the cohort level (the methodology is described in Section 5.2. The results for Scenario 2 appear in Figure 1 and Figure 2. They show, for medium, short (pessimistic) and long (optimistic) EULs ("service lives"):

- the resulting Break Rate ("Future network Break Rate")
- the investment cost ("Investment cost for rehabilitation")
- the Length of R&R ("Future rehabilitation needs per asset type")

While AWC requested a plan up to 2050, we always looked at predictions past the end of the planning horizon to ensure that the plan we propose does not result in a backlog after that date.

The minimum investment (with Medium EULs, black curve) that is projected is $2.6 M as of 2017, higher than the current yearly budget of $1.5 M - $2 M (we will use $1.75 M) for the 3 Systems. It would need to be ramped up to $3.7 M by 2100 (including the replacement of the new mains by that time). The Break Rate with that Scenario remains around 0.12 Breaks/mi./yr. and it ensures that there be no unmanageable backlog after 2100.

The same series of results is also provided for each System (Scenario 1 "Needs", Scenario 2, and Scenario 4).

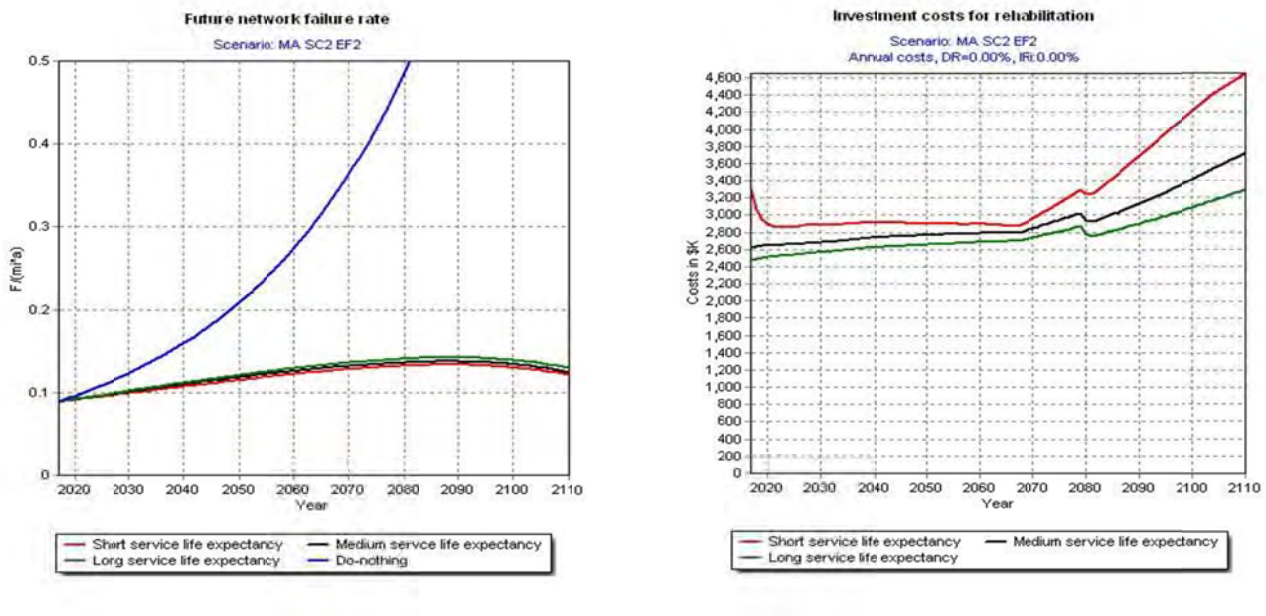


Figure 1 MA Scenario 2 - Break Rate and Investment Cost

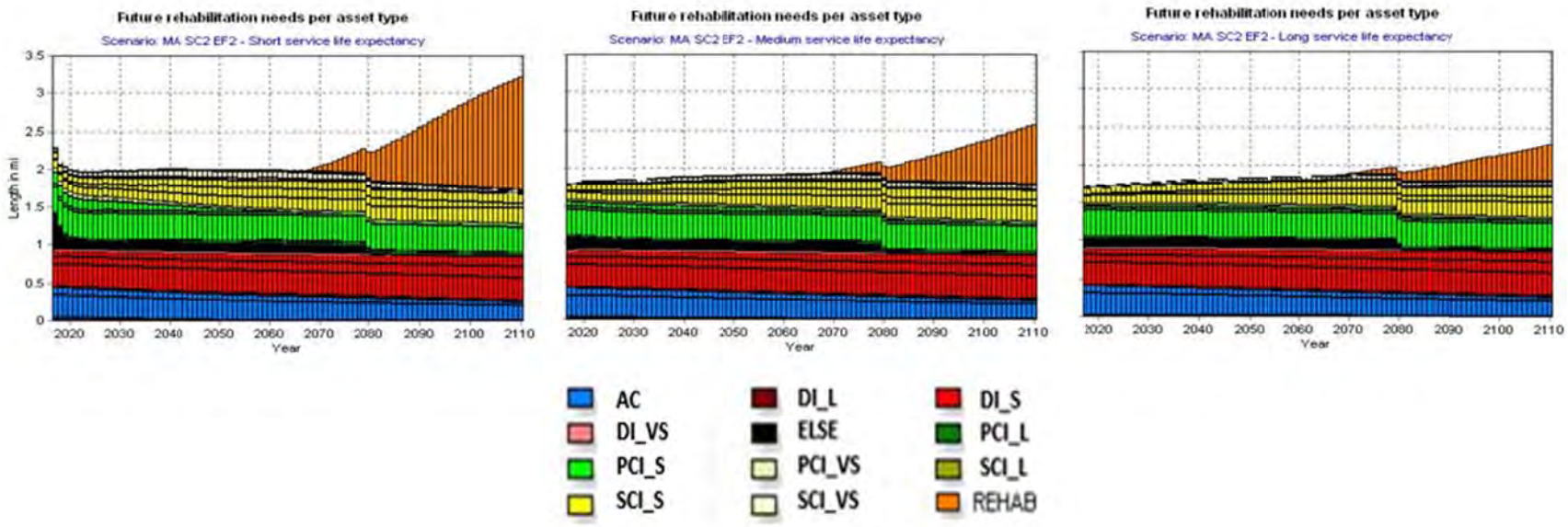


Figure 2 MA Scenario 2 - Future Rehabilitation Needs per Asset Type

The left Figure above reads as follows: In 2030, there is a need for (approximately) 0.4 mile of R&R for AC mains, 0.5 mile of DI_S, and 0.4 mile for PCI_S, etc.

Recommendations – Data Quality

This first KANEW study gave us the opportunity to review the data. We subsequently provide recommendations in order to improve EULs and aging curves when running future similar studies, and ultimately R&R projections.

Mains (GIS layer)

- Each GIS main should be given a unique FeatureID.
- The nature of each GIS main should be reported ("true" main, service, fire line, hydrant lines.) That attribute could also indicate whether a main is proposed "proposed main".
- Only one attribute pertaining to the YOI should be kept. Which may require to combine the 3 YOIs that are currently in the GIS.
- Missing YOI and MAT should be investigated.
- The YOI peaks should be investigated as they may be default values.
- Discrepancies between the CEP and the GIS Mains layer should be reconciled. The CEP should match the GIS as is at the date the CEP was produced.
- An abandoned (ABN) Mains layer should be initiated in the GIS (similar to the CT GIS ABN Mains layer).
- A new main that replaces an ABN main should be given a new ID.
- The Date of Abandonment (DOA) should be reported.
- The report includes recommendations pertaining to the treatment of the ABN mains.

Breaks

- The breaks should be reported in one document, preferably the Breaks layer of the GIS.
- Reporting breaks in the GIS Mains layer does not allow to properly report the Year of the Break (YOB.)
- Each break should be assigned to its main. This is to be done after each main has been given a unique FeatureID.
- The type of break should also be properly identified. Leaks should not be included in the computation of the Break Rate.
- Breaks that occurred on ABN mains should be kept in the GIS Breaks layer even after the main has been physically removed.

Acronyms

Acronyms	Definition
ABN	Abandoned
AC	Asbestos Cement
ACT	Active
AWC	Aquarion Water Company
DI	Ductile Iron
DIAM	Diameter
DOB	Date Of Break
DOI	Date Of Installation
EUL	Effective Useful Life
MAT	Material
MBR	Maximum Break Rate
PCI	Pit Cast Iron
PVC	Plastic
R&R	Rehabilitation & Replacement
SCI	Spun Cast Iron
YOB	Year Of Break
YOI	Year Of Installation

Aquarion Water Company of Connecticut (AWC) has retained infraPLAN to conduct a KANEW study that evaluates long-term strategies of Renewal and Replacement (R&R) of the water mains from 2017 to 2050 for the 3 MA water Systems, Hingham-Hull, Millbury, and Oxford. "KANEW study" is named after the software (KANEW) used for that study. While this is the first KANEW study done for the MA System, such studies were previously conducted by infraPLAN for the AWC CT Systems in 2009, 2011, 2013, and 2015.

2 Methodology

The KANEW software allows the user to simulate Scenarios of R&R, and ultimately generate an optimal plan, based on the length of mains that reach the end of their Effective Useful Life (EUL) each year, and various constraints on desired service levels (cost, amount of work per year, and acceptable Break Rate). The overall goal is to balance costs (of investment in R&R) and benefits (mainly reduction in Break Rate). When data allows, the preferred and more advanced approach, as done for the CT System, consists in determining the EUL of each cohort of mains (group of mains degrading in a similar fashion defined here by System_MAT_DIAM) specific to a System (as opposed to using a generic value). This is done by plotting the aging curve (Break Rate based on age if no R&R is undertaken) of each cohort based on a statistical analysis of the System's mains' attributes and their historic breaks.

For the advanced approach, the failure forecasting model LEYP (Linear Extended Yule Process) is used to generate the Predicted Break Number (PBN) for each year and for each main. That advanced approach was not possible for the MA Systems because the break data was not adequate. We therefore organized the data in cohorts similar to the ones we formed for the CT Systems and used their aging curves and EULs.

It is also possible that even if the break data was improved, some cohorts and the number of breaks would be too small for the advanced approach.

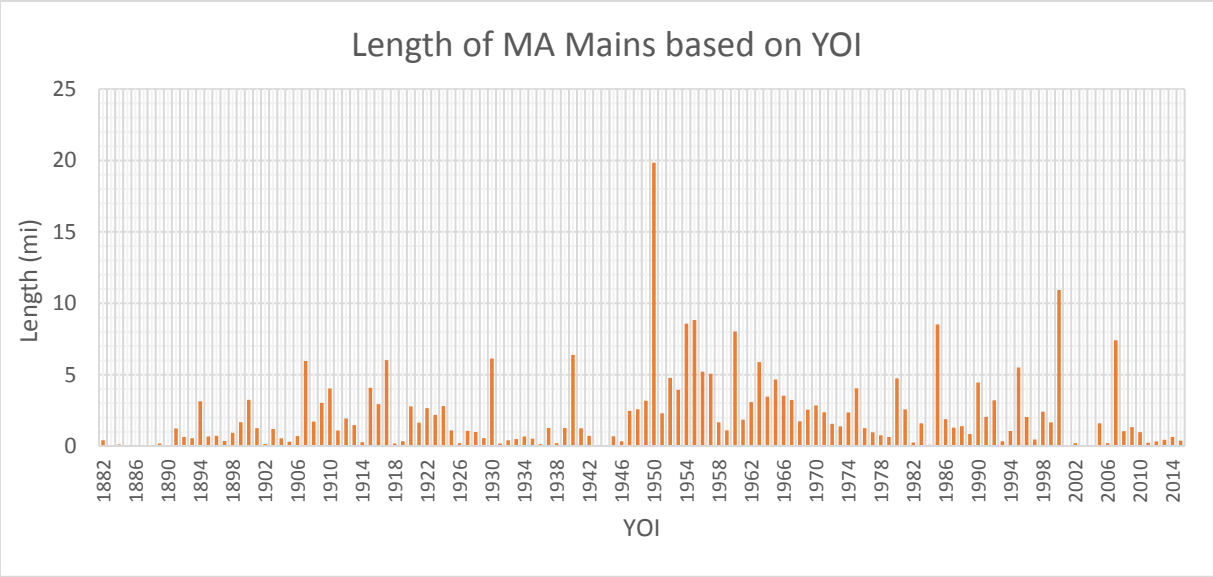
The main data allowed us to determine the average age of each cohort, but the break data did not allow us to compute the current Break Rate of each cohort. It was therefore assumed using the corresponding CT aging curves.

3 Data

3.1 Mains

3.1.1 Original Data

The MA System is made of close to 285.8 mi of mainly AC, CI and DI mains. Installation started as early as in the 1880s (Hingham-Hull). The distribution of the Year of Installation (YOI) varies based on the System. And so do the ages.



Main data received by infraPLAN consists in:
Hingham-Hull

- a GIS layer dated May 3 that includes active (ACT) and abandoned mains (ABN).
- a CEP inventory in the form of an excel spreadsheet provided Aug 23 (“Pipe Input Data”) that lists mains and, for each main, its number of breaks.

Millbury

- a GIS layer dated Aug 11 that includes active (ACT) and abandoned mains (ABN).
- a CEP inventory in the form of an excel spreadsheet provided Aug 31 (“Millbury CEP Pipe Input Data”) that lists a Break Rate per 1,000 feet for each main.

Oxford

- a GIS layer dated Aug 11 that includes active mains (ACT). No information about Life Status.
- a CEP inventory in the form of an excel spreadsheet provided Aug 31 (“Oxford CEP Pipe Input Data”). It just mentions whether a main broke or not.

While the GIS Mains layer and the CEP both list mains, there are discrepancies between those two documents. For example:

Hingham-Hull
Both the CEP and the GIS Mains layer have 1959 entries. There is no Feature ID in GIS but each pipe has a unique ID and Label which also appear in the CEP, which seems to pertain to the same main. It looks as if the CEP and the GIS Mains layer are synchronized. P-1319 appeared twice and was removed. All mains are ACT.

Millbury
The CEP lists 522 mains while the GIS Mains layer has 570. There is no Feature ID in GIS but each pipe has a unique ID, OBJECTID and OBJECTID_1., and a non-unique Label (10 duplicates). The CEP identifies each pipe with a unique Label.
An attribute in the GIS indicates whether the main is active (0=ABN; 1=ACT). There are 31 ABN mains in the GIS. There were removed for this study. 539 are left.

Oxford
The CEP lists 369 mains while the GIS Mains layer has 387. There is no Feature ID in GIS but each pipe has a unique OBJECTID and OBJECTID_1. The CEP identifies each pipe with a unique Label. No information about the Life Status of the mains. All will be considered to be ACT.

The data that appear in the GIS layers (and not the CEP) is kept for this study.

3.1.2 Data Clean up

We look at MAT, DIAM, and YOI.

MAT:

Figure 3 and Table 2 show the distribution of the original MAT based the System.

MAT	Hingham-Hull	Millbury	Oxford	TOTAL
AC	27.4	0.8	8.9	37.2
CI	76.4		0.0	76.5
CU	0.0	0.2	0.0	0.3
DI	43.1	16.5	19.9	79.5
Lined CI (LCL)	34.7	0.1		34.8
GAL	2.9	0.4		3.3
PCI		5.0	4.9	10.0
PL	0.1	0.1		0.1
Prestressed CONC	2.4			2.4
PVC	1.0			1.0
SCI		28.8	11.9	40.8
TOTAL	188.0	52.0	45.8	285.8

Table 2 MA - Length and Number of Mains based on MAT and System – Original Data

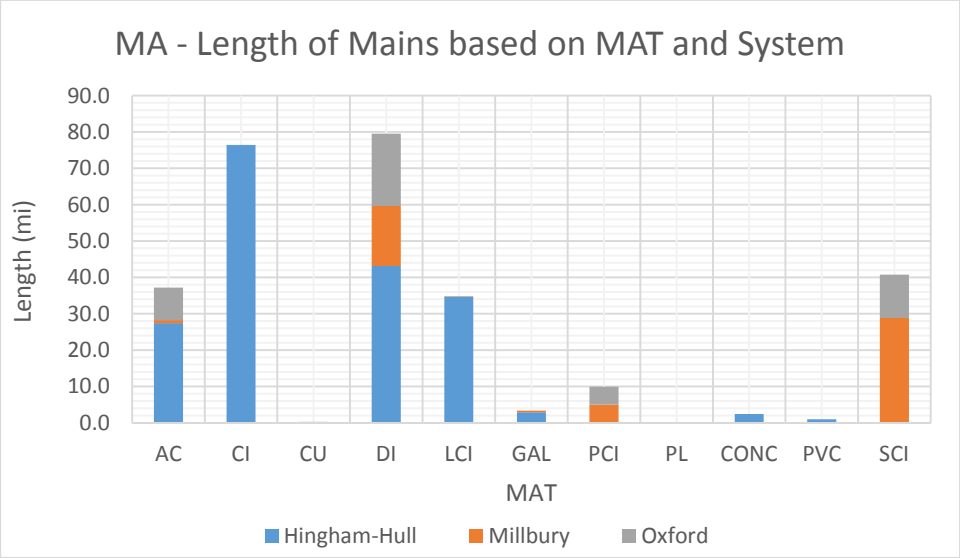


Figure 3 MA - Number and Length of Mains based on MAT - Original Data

PL, PVC, GAL, CU, CONC, and PL are minor MAT. They are regrouped under the "ELSE" category. There is no UNK MAT.

In order to align the cohorts with the work done at AWC we make the following changes of MAT:

- if a CI or DI main was installed before 1927, we make it a PCI main.
- if a CI main was installed in 1927 or after, but before 1975, we make it a SCI main.
- If a CI main was installed after 1975 we make it a DI main.
- if a DI main was installed in 1927 or after, but before 1965, we make it a SCI.

We are left with the following distribution:

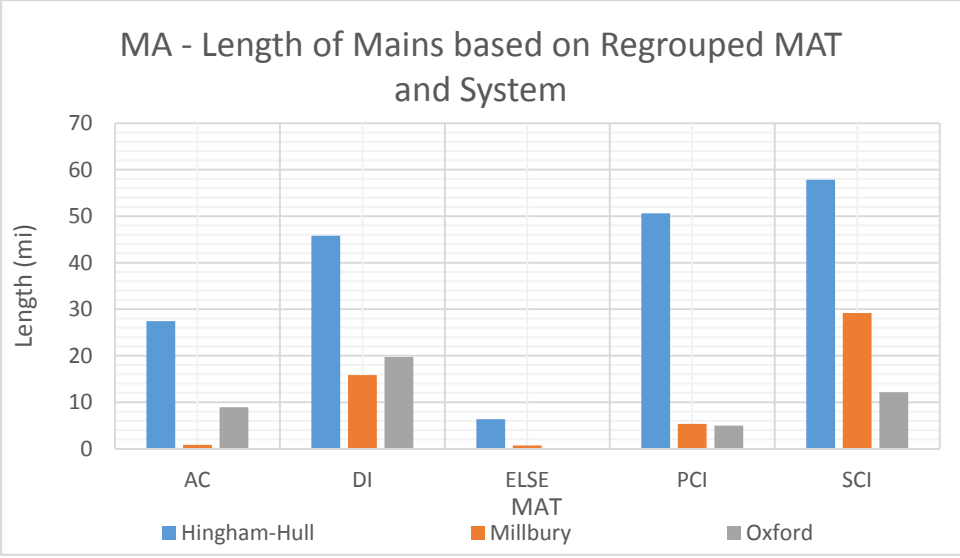


Figure 4 MA - Length of Mains based on Regrouped MAT and System - Original Data

DIAM:

As seen in Table 3 and Figure 5, the DIAMs vary between 1 and 24".
There is no missing diameter (DIAM).
17.4 mi have a DIAM that is smaller than 3". It was not clear whether they are service mains. They have been kept in the study. The type of main should be identified in the GIS.
In the definition of the KANEW cohorts we break down the 3 main MAT (DI, PCI and SCI) based on the DIAM (Large = larger than 12", and Small = 12" and smaller). The (post clean-up) distribution of Length based on System, MAT and DIAM is shown in Figure 8.

DIAM	1	1.25	1.5	2	2.25	3	4	6	8	10	12	14	16	20	24	TOTAL
length	0.6	0	0.2	9.2	7.3	0.4	6.9	84.2	112.3	5.3	46.4	0.6	3.1	7.3	2	285.9

Table 3 MA - Length of Mains based on DIAM and System - Original Data

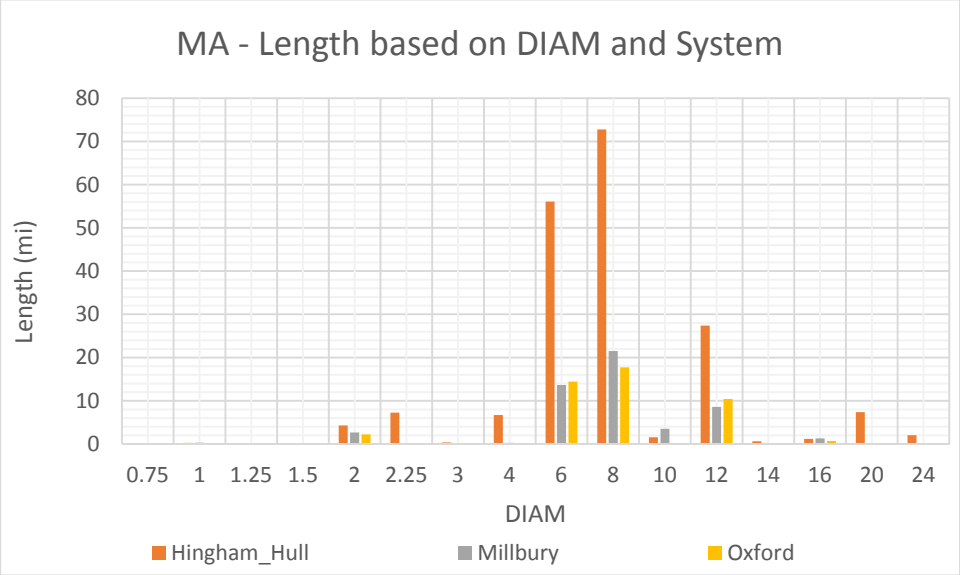


Figure 5 MA - Length of Mains based on DIAM - Original Data

The KANEW cohorts are defined using the System and the MAT. The main MAT (DI, PCI and SCI) are further broken down based on the DIAM (Large = larger than 12", and Small = 12" and smaller). The (post clean-up) distribution of Length based on System, MAT and DIAM is shown in Figure 8.

YOI:

The YOI is identified as follows in each GIS file:

- Hingham-Hull: Installati. There is no missing data.
- Millbury: Date_Inst (empty) and Installati (populated). 11 mains do not have any data. 8 are ABN. 3 ACT. 2 mains have a YOI of 2030 indicating that they are proposed. They were also removed.
- Oxford: InstallYea. 20 mains do not have any data.

The (post clean-up) distribution of Length based on System, MAT, and YOI is seen in Figure 9, Figure 10, Figure 11, and Figure 12.

3.1.3 Final Data after Clean up

After clean up we are left with a total of 2,282 mains for 285.7 mi.

In this Section we look at the length and length-weighted average age based on DIAM, MAT, System and YOI.

System:

The length of mains based on the System is shown in Figure 6 below.

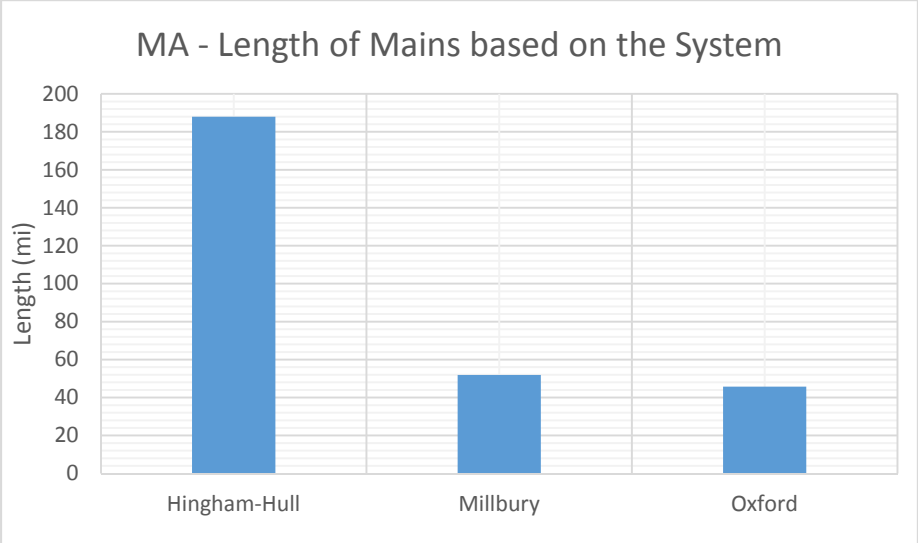


Figure 6 MA - Length of Mains based on the System - Post Clean up

The Hingham-Hull System is the largest with 188 mi; then come Millbury (51.9 mi.) and Oxford (45.8 mi.)

Length and Length-Weighted Average Age based on MAT and DIAM:

Figure 7, Figure 8, and Table 4 show the length of mains and the length-weighted average age based on System, MAT and DIAM.

The average age in MA is 61 years old, with Oxford being the youngest System (48.7; then comes Millbury (59.5), and the oldest is Hingham (64.4) as seen in Figure 7 below.

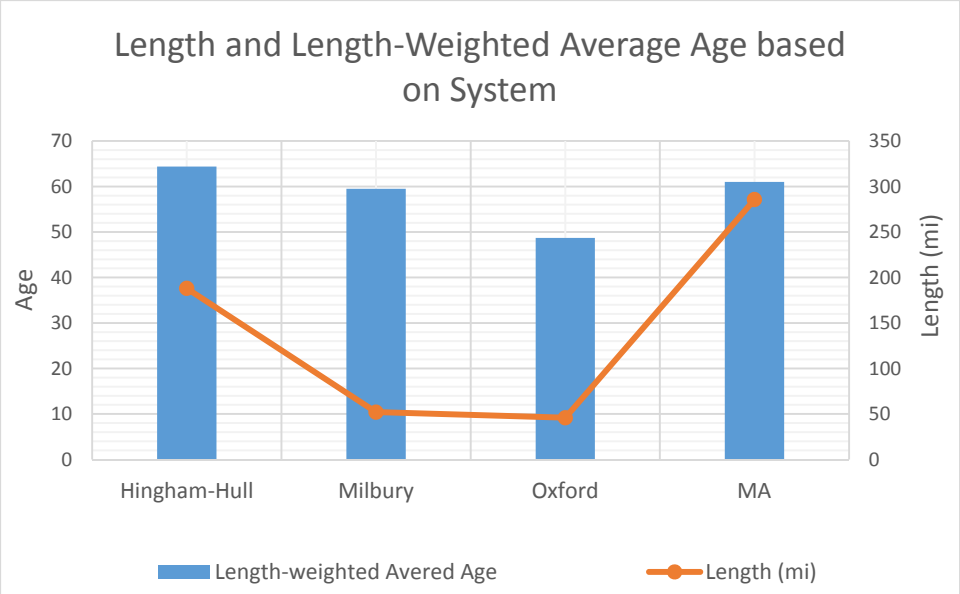


Figure 7 MA - Length and Length-Weighted Average Age based on System - Post Clean up

We now break down those results based on the MAT and DIAM.

	Hingham-Hull		Millbury		Oxford		MA	
	Length-weighted Averaged Age	Length (mi)	Length-weighted Averaged Age	Length (mi)	Length-weighted Averaged Age	Length (mi)	Length-weighted Averaged Age	Length (mi)
AC	62.2	27.4	70.3	0.8	62.2	8.9	62.4	37.2
DI_L	23.1	2.0	NA	NA	1.6	0.7	17.6	2.7
DI_S	25.6	43.8	23.0	15.8	23.1	19.0	24.5	78.6
ELSE	72.5	6.3	76.9	0.7	66.0	0.0	72.9	7.1
PCI_L	100.9	5.9	116.0	1.3	NA	NA	103.5	7.2
PCI_S	106.2	44.7	104.9	4.1	109.0	4.9	106.4	53.7
SCI_L	56.9	0.9	NA	NA	NA	NA	56.9	0.9
SCI_S	59.4	56.9	69.7	29.2	57.0	12.2	62.2	98.3
TOTAL	**64.4**	**188.0**	**59.5**	**51.9**	**48.7**	**45.8**	**61.0**	**285.7**

Table 4 MA - Length-Weighted Avg. Age and Length based on MAT, System, and DIAM - Post Clean up

There is no PCI Large main in Oxford; no SCI Large in Millbury and Oxford; no DI Large in Hingham-Hull

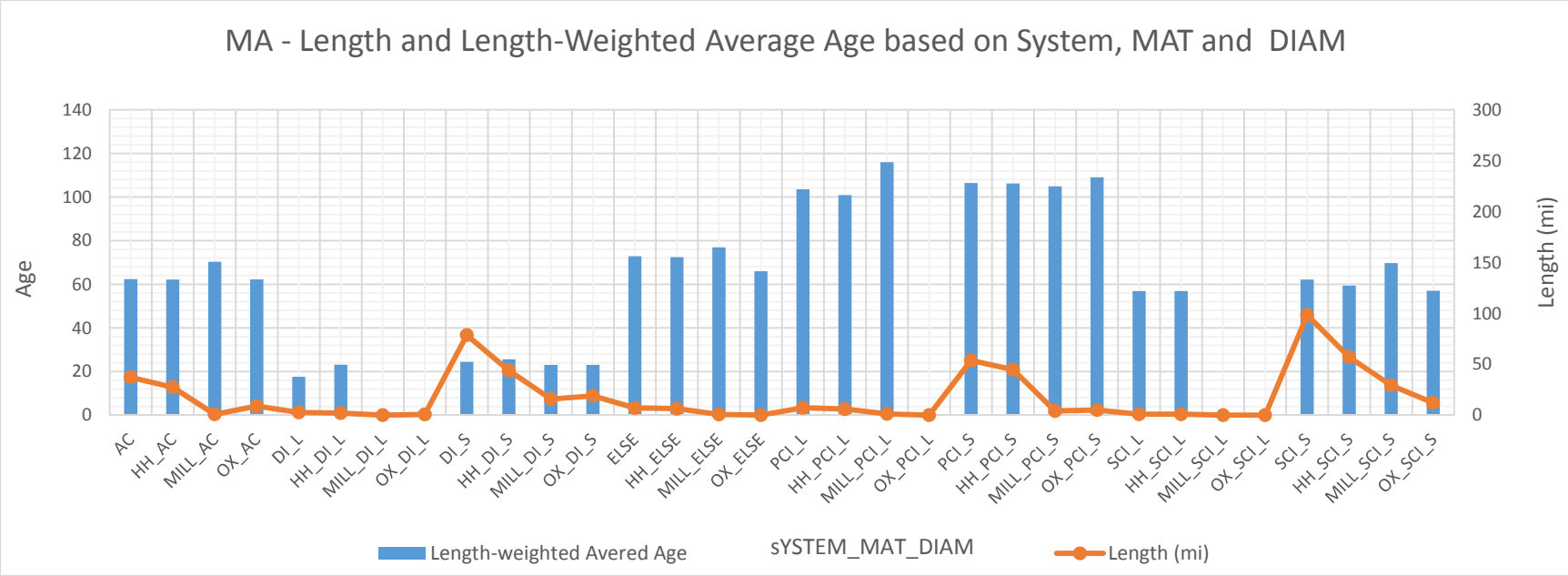


Figure 8 MA - Length and Length-Weighted Average Age of Mains based on System, MAT and DIAM - Post Clean up

Length of Mains based on System, MAT and YOI

The mains were installed starting in 1882 steadily until now (with a drop between 1930 and 1945). The peak in 1950 (mostly SCI mains in Millbury) should be investigated as it may be a default value.

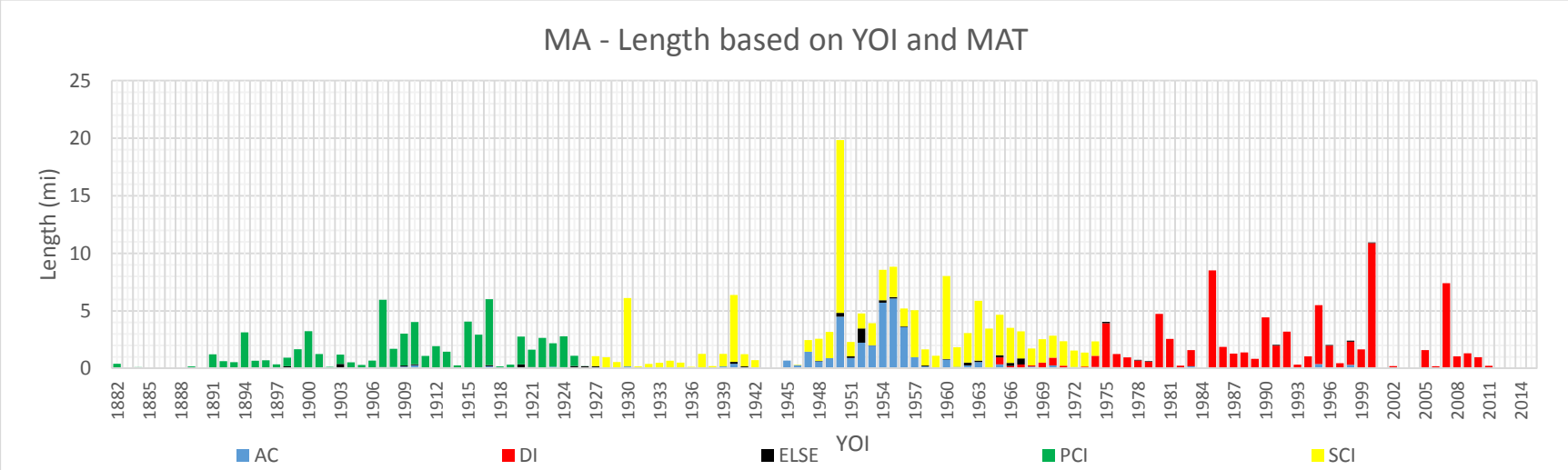


Figure 9 MA - Length of Mains based on YOI and MAT - Post Clean up

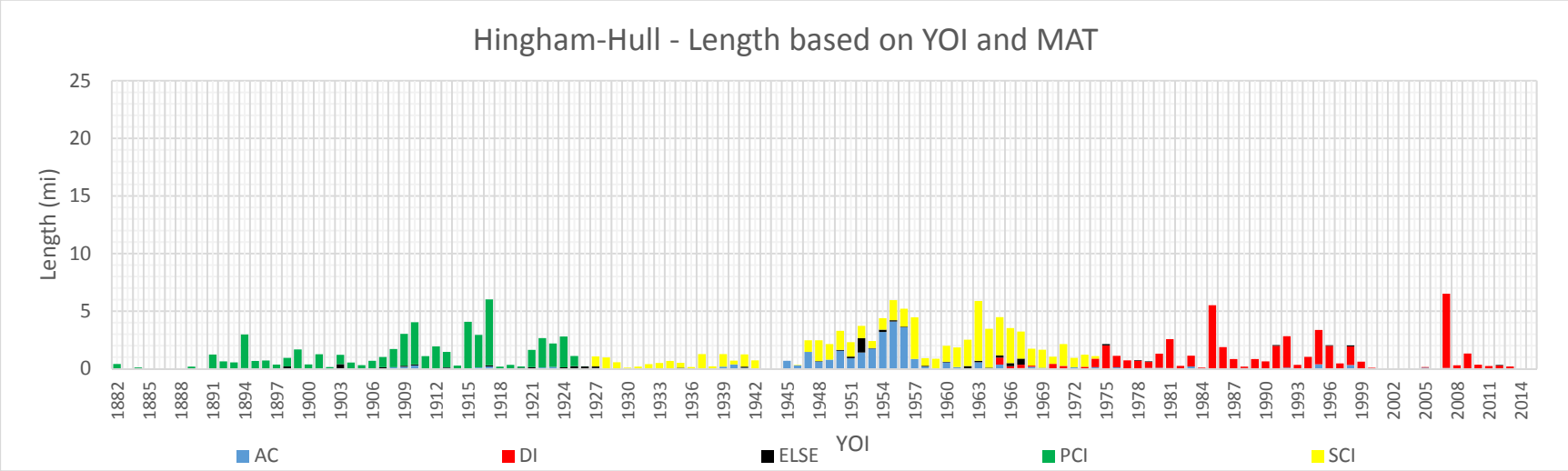


Figure 10 Hingham-Hull - Length of Mains based on MAT and MAT - Post Clean up

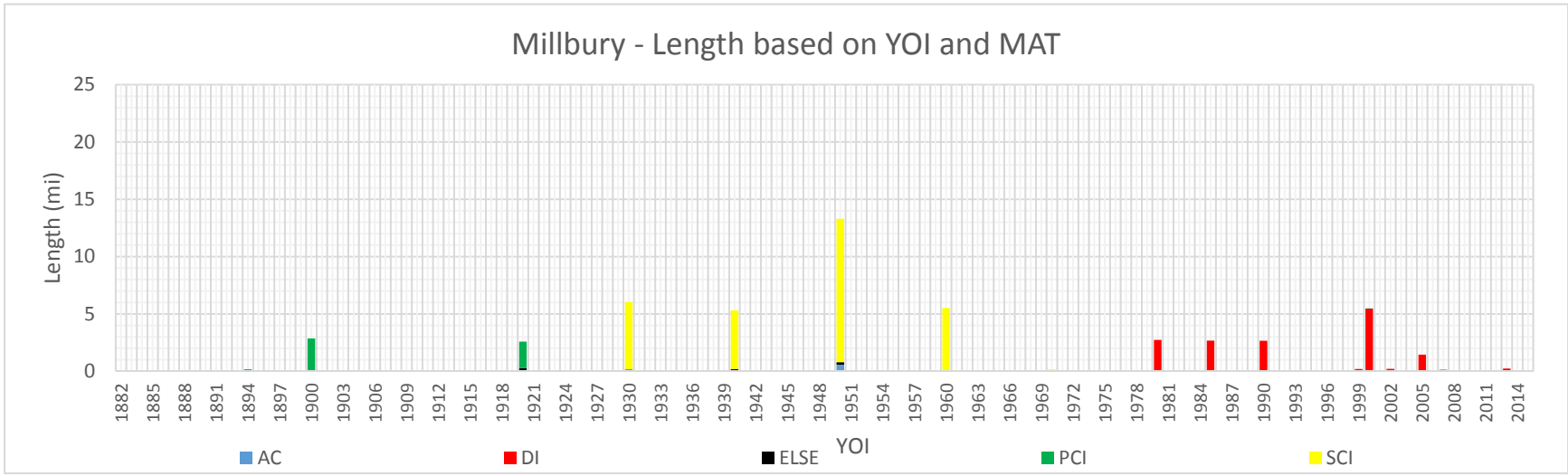


Figure 11 Millbury - Length of Mains based on MAT and YOI - Post Cleanup

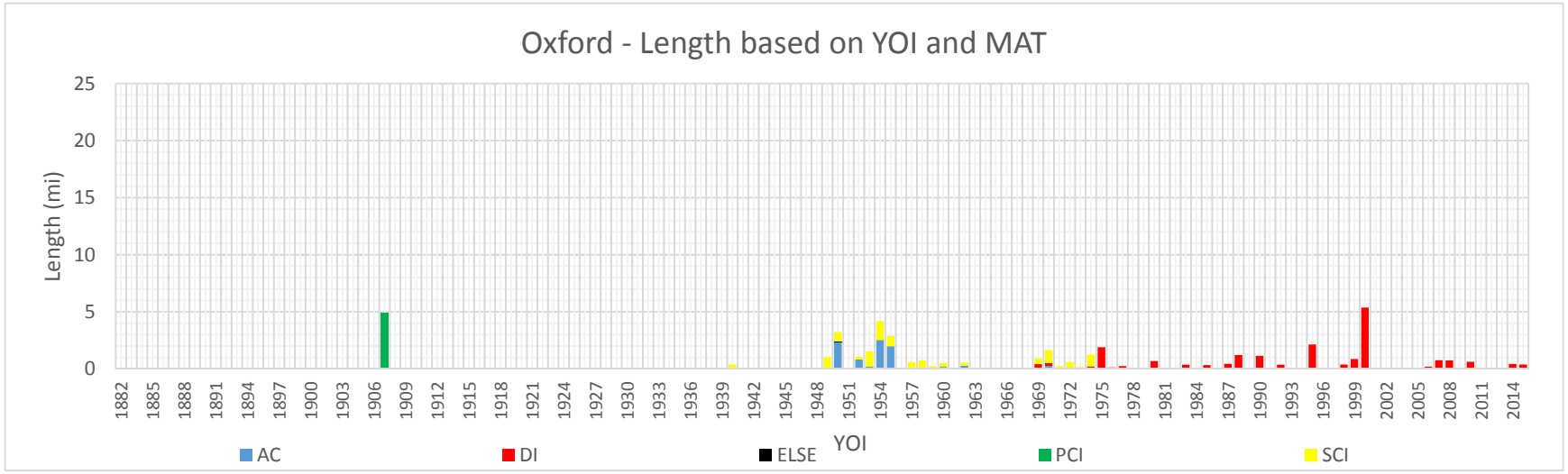


Figure 12 Oxford - Length of Mains based on YOI and MAT - Post Clean up

3.1.4 Recommendations - Mains

- Each main should be given a unique FeatureID.
- The nature of each main should be reported ("true" main, service, fire line, hydrant lines.) That attribute could also indicate whether a main is proposed "proposed main".
- Only one attribute pertaining to the YOI should be kept.
- Missing YOI should be investigated.
- The YOI peaks investigated as they may be a default value.
- Discrepancies between the CEP and the GIS Mains layer should be reconciled. The CEP should match the GIS as is at the date the CEP was produced.
- An ABN Mains layer should be initiated in the GIS (similar to the CT ABN Mains layer).
- A new main that replaces an ABN main should be given a new ID.
- The Date of Abandonment (DOA) should be reported.
- If an original main is split and one portion only is replaced, treatment of the main in GIS should be as shown in the example below:

GIS ACT mains prior to 2000

Feature ID	MAT	YOI	YOA	Length	Life Status
101	PCI	1910		500	ACT

200" are replaced in 2000.

After 2000 the ABN layer becomes:

Feature ID	MAT	YOI	YOA	Length	Life Status
101	PCI	1910	2000	200	ABN

And the ACT layer 2 new FeatureIDs are created:

Feature ID	MAT	YOI	YOA	Length	Life Status
102	PCI	1910		300	ACT
103	DI	2000		200	ACT

If a break occurred after 2000 it is to be assigned to the right section (PCI or DI). If a Break occurred prior to 2000 it was on PCI but it is difficult to know which part (the one that remains or the one that has been replaced). Since it was assigned to 101 (the only main that existed prior to 2000) we will keep it on the portion that keeps that FeatureID. Furthermore, the Break is most likely to have occurred on the piece that was removed. From the statistical standpoint, it will make little difference.

3.2 Breaks

3.2.1 Original Data

The source of information depends on the System as follows:

Hingham-Hull

- There was no break information in the GIS Mains layer (as is the case for the 2 other Systems)
- The CIP contains information about breaks in the form of an attribute called "No. of Breaks". 501 (out of 1,959) mains have experienced between 1 and 11 breaks for a total of 1,102 breaks. However, since there is no information regarding the timeframe for those breaks occurrences, we cannot calculate the Break Rate. Furthermore, as will be seen in the other source of break data, it is important to understand the nature of the event that has been reported as a break. A lot of those so-called breaks may actually be leaks.

Number of Breaks	Number of Mains having experienced that number of Breaks	Total Number of Breaks
0	1,458	0
1	286 (mains have broken once)	286
2	105 (mains have broken twice)	210
3	30	90
4	41	164
5	4	20
6	1	6
7	2	14
8	10	80
9	5	45
11	17	187
Grand Total	1,959	1,102

- 3 "Leak" spreadsheets ("AWC Master Leak Spreadsheet 2016 V3"; "AWC Master Leak Spreadsheet V3 (1)"; and "AWC Master Leak Spreadsheet V3"). Those 3 Leak spreadsheets contain information regarding 303 leaks that have occurred between January 1, 2013, and April 16, 2016, as well as some analysis about those leaks. Some attributes need to be better defined and populated so that we can decide which entry is relevant for this analysis (we want real event that show signs of physical degradation on the mains for which R&R is being budgeted; leaks are not to be included):
    - Leak Location: All the options are shown in the Table below. Main is assumed to be the only entry suitable for this analysis.

Leak Location	Total		Leak Location	Total
Abn service	1		Pulled Service	1
Corp	3		RW Main	2
Curb Box	1		Service	123
Hydrant	51		Stop leak	2
Main	111		Tee	1
Main/Hydrant	1		UNK	1
New Tap	1		Valve	4
Grand Total				303

- Type/Cause of Break. All the options are listed in the Table below. The options that are assumed to be suitable for this analysis have been highlighted in yellow.

Type/Cause of Break	Total		Type/Cause of Break	Total		Type/Cause of Break	Total
*	1		Dresser Break	1		Packing Leak	3
ABN SERVICE	1		Flare	1		Pin holes in copper	1
Blow out	4		Hit	1		Relay	5
Cir Crack	2		Hit by Contractor	1		Repair	9
Circumfrential	7		HOLE	59		Repaired leak	1
Contractor	1		Hole- contractor hit	1		Replaced curb stop	1
Contractor Hit	2		Hydrant	1		Replaced Service	2
Corp	1		Hydrant on 3 turns	1		RW LINE	2
Corrosion	3		Hydrant Valve	1		Service	1
Corrosion Holes	1		Joint	1		Split	1
CRACK	79		Leak At corp	2		Stop Leak	1
Crack @ Tap	1		Longitudinal	1		TBD	13
Curb Box Replacement	1		No Leak	1		TEE	1
Curb Stop	4		No leak Found	1		UNK	72
						Valve	9
Grand Total							303

- Additional Comments. The options appear in the Table below. Those highlighted in grew do not appear to be suitable for this analysis.

Additional Comments	Total
345001518	1
345001519	1
345003304	1
Based on Tank Drop	3
Contractor Hit Main	1
Contractor made three attempts to locate leak before found.	1
Curb Stop	2
Hit by Gas Co.	1
Hit By Light Co	2
Leak Detectiion	1
Leak Detection	90
Shut off at controling valve. Chief Russo notified. Hydrant replaced 2/2/16	1
Shut off at curb on hose.	1
UNK	196
Water loss based on customer comments of collapsed basin on 3/18/2015	1
Grand Total	303

Once the above considerations have been taken into account (what to keep or not) only 100 leaks (out of the original 303) were found to be acceptable. The distribution based on YOB and MAT is as follows.

YOB	AC	CI	GALV	PLASTIC	UNK	TOTAL
2013	3	20	4	3		30
2014	3	11	10		2	26
2015	2	16	18	3		39
2016		4	1			5
TOTAL	8	51	33	6	2	100

While we do not know over how many years the 1,102 breaks recorded in the CEP occurred (it is most likely more than 2013-2016), it looks like the CEP and the "leaks spreadsheets" are not reporting the same thing.

There is a need to report the breaks in a reliable way (see Recommendations.)

Millbury

The only document that contains information about the breaks is the CEP. It is reported by Break per 1,000 feet. However, the length of a main is not provided in that document and there is no information either about the timeframe (is the rate reported per year?). Furthermore, even though we reported in 3.1.1 the fact that the CEP and the GIS mains (where the length is reported) do not completely match, we attempted to partially join the CEP (and the Break Rate) and the GIS Mains layer (length) based on the Label. We obtained a number of Breaks for each main between 0 and 5. Again, the timeframe is not known making that number of breaks of limited interest. Furthermore, similarly to what we saw for Hingham-Hull, it is also necessary to know what constitutes a Break.

Oxford

Information about breaks appears solely in the CEP in the form of an attribute called "Break History?" with Yes/No modalities. 324 out of the 369 mains in the CEP are "No" (not broken). There is no information about the timeframe.

3.2.2 Recommendations - Breaks

- The breaks should be reported in one source, preferably the Breaks layer of the GIS. Reporting Breaks in the Mains layer does not allow to properly report the YOB.
- Each break should be assigned to its main. This is to be done after each main has been given a unique FeatureID.
- The type of break should be properly identified. Leaks should not be included in the computation of the Break Rate.
- Breaks that occurred on ABN mains should be kept in the GIS Breaks layer.

Because the break data is not adequate we cannot generate aging curves specific to each cohort of the MA Systems, nor can we, subsequently generate utility-specific EULs. We will use the aging curves and EULs of the CT System. For each cohort, we will compute the 2016 Break

Rate by reading the Break Rate on the aging curve at the current average age. See the example described in details for the AC mains in Section 4.1.

We now show the CT aging curve of each cohort.

4 Aging Curves

4.1 AC

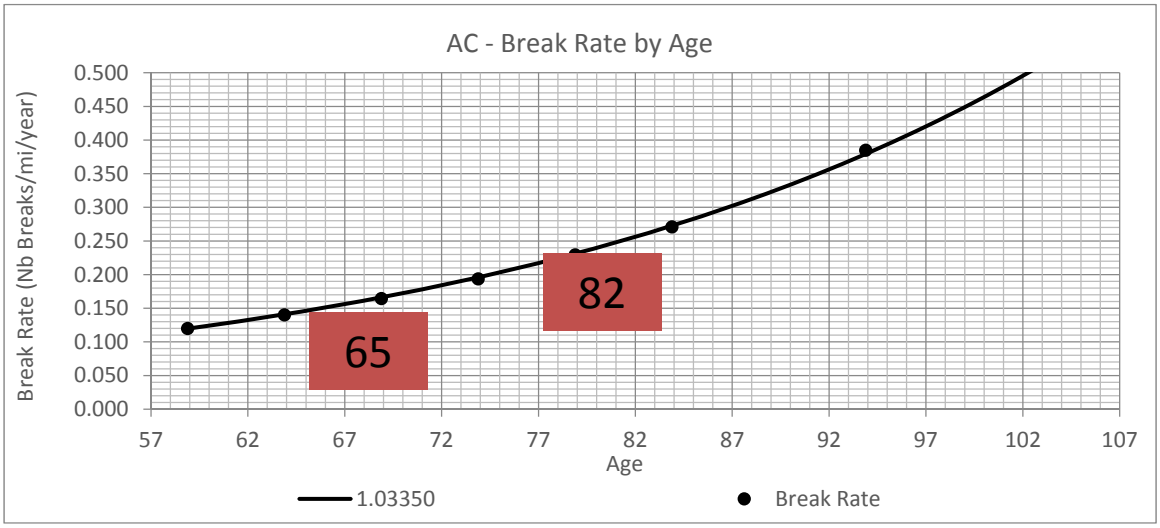


Figure 13 AC - Break Rate by Age

We call f the aging factor that defines the aging curve. It corresponds to the value that allows plotting the Break Rate based on the following geometric series:

BR at year i+1 = Break Rate at year i x f (f is the compounding factor)

For the AC aging curve we have f = 1.034 or 3.4%.

The EUL is based on the Maximum Break Rate. It is 65 for a MBR of 0.15 Breaks/mi./yr., and 82 for a MBR of 0.25 Breaks/mi./yr.

The starting Break Rate (Breaks/mi./yr.) is also read on the curve based on the average age of each cohort. It is 0.13 for AC mains in Hingham-Hull and Oxford, that have an average age close to the average age and Break Rate of the AWC System (59 years old; 0.12 Breaks/mi./yr.). It is 0,17 for Millbury that has an average age of 70.3.

AC	Hingham-Hull	Millbury	Oxford	AWC
Age	62.2	70.3	62.2	59
Break Rate (2016)	0.13	0.17	0.13	0.12

A similar approach is adopted for the other cohorts.

4.2 DI

4.2.1 DI Large

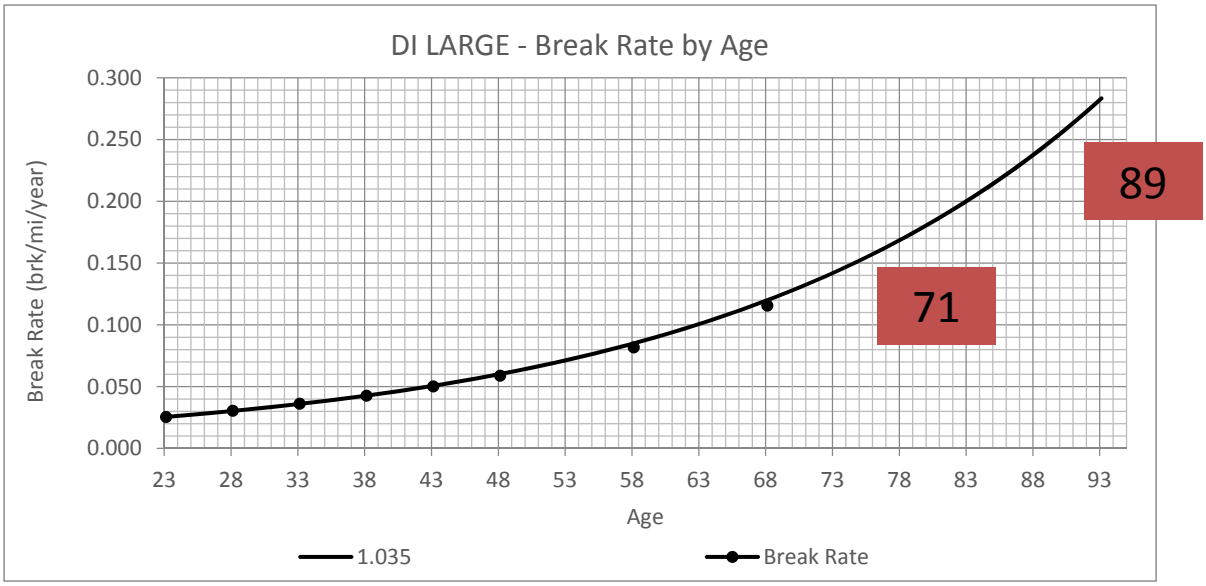


Figure 14 DI Large - Break Rate by Age

EUL (0.15) = 71; EUL (0.25) = 89; f = 3.4%

DI_L	Hingham-Hull	Millbury	Oxford	AWC
Age	23.1	NA	1.6	21.9
Break Rate (2016)	0.025	NA	0.01	0.02

4.2.2 DI Small

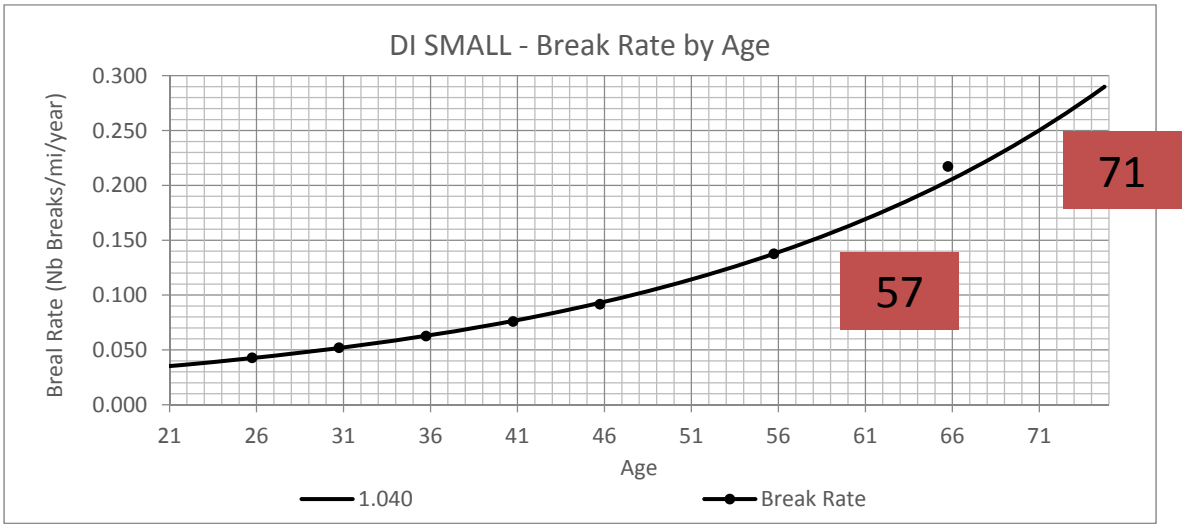


Figure 15 DI Small - Break Rate by Age

EUL (0.15) = 57; EUL (0.25) = 71; f = 4%

DI_S	Hingham-Hull	Millbury	Oxford	AWC
Age	25.5	23	23.1	21
Break Rate (2016)	0.04	0.035	0.035	0.03

4.3 PCI

4.3.1 PCI Large

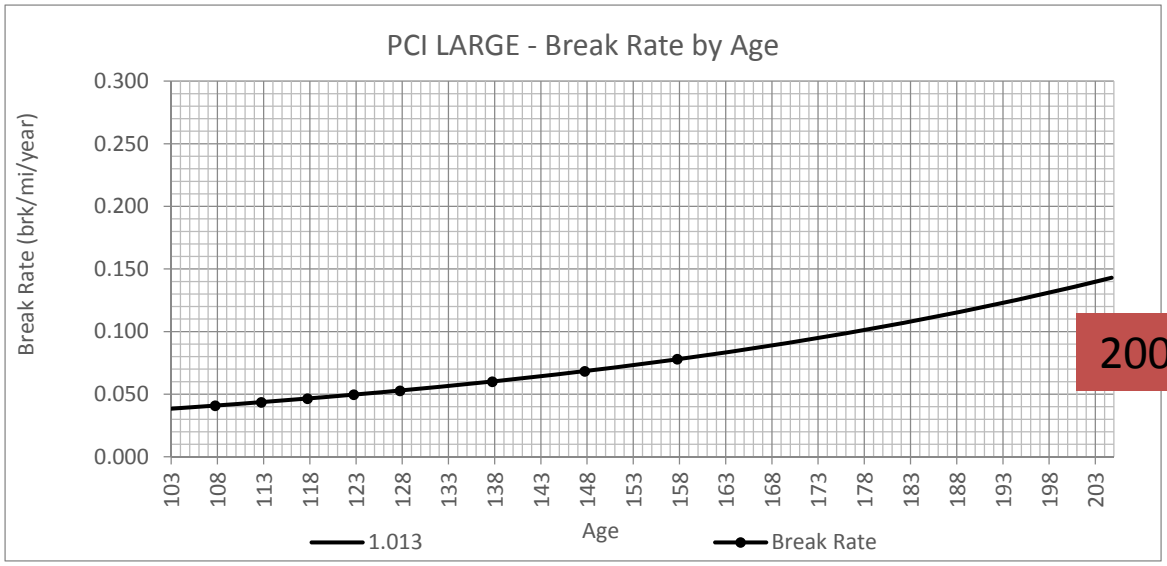
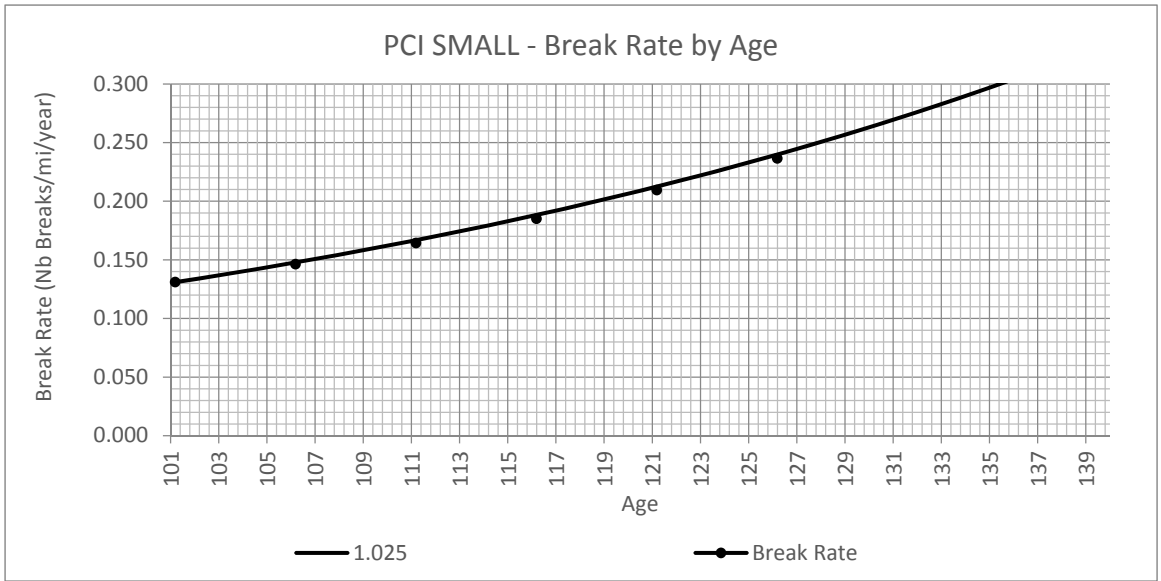


Figure 16 PCI Large - Break Rate by Age

EUL (0.15 and 0.25) = 200; f = 1.3%

PCI_L	Hingham-Hull	Millbury	Oxford	AWC
Age	100.9	116	NA	103
Break Rate (2016)	0.038	0.045	NA	0.04



4.3.2 PCI Small

107

Figure 17 PCI Small - Break Rate by Age

EUL (0.15) = 107; EUL (0.25) = 129; f = 2.5%

PCI_S	Hingham-Hull	Millbury	Oxford	AWC
Age	106.5	105	109	101
Break Rate (2016)	0.15	0.14	0.16	0.13

4.4 SCI

4.4.1 SCI Large

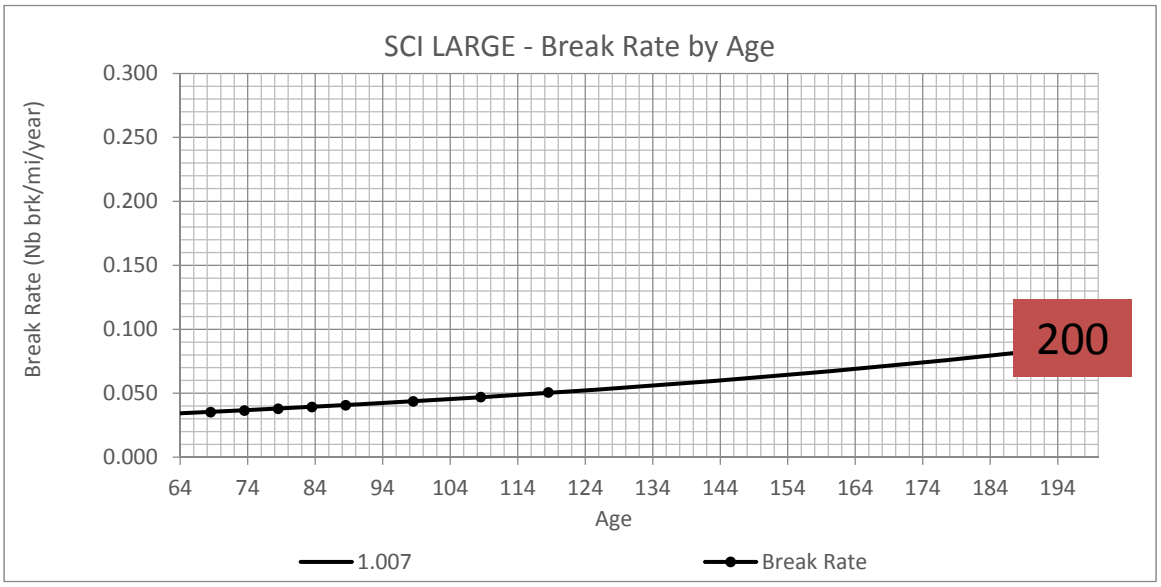


Figure 18 SCI Large - Break Rate by Age

EUL (0.15 and 0.25) = 200; f = 0.7%

SCI_L	Hingham-Hull	Millbury	Oxford	AWC
Age	56.9	NA	NA	64
Break Rate (2016)	0.025	NA	NA	0.035

4.4.2 SCI Small

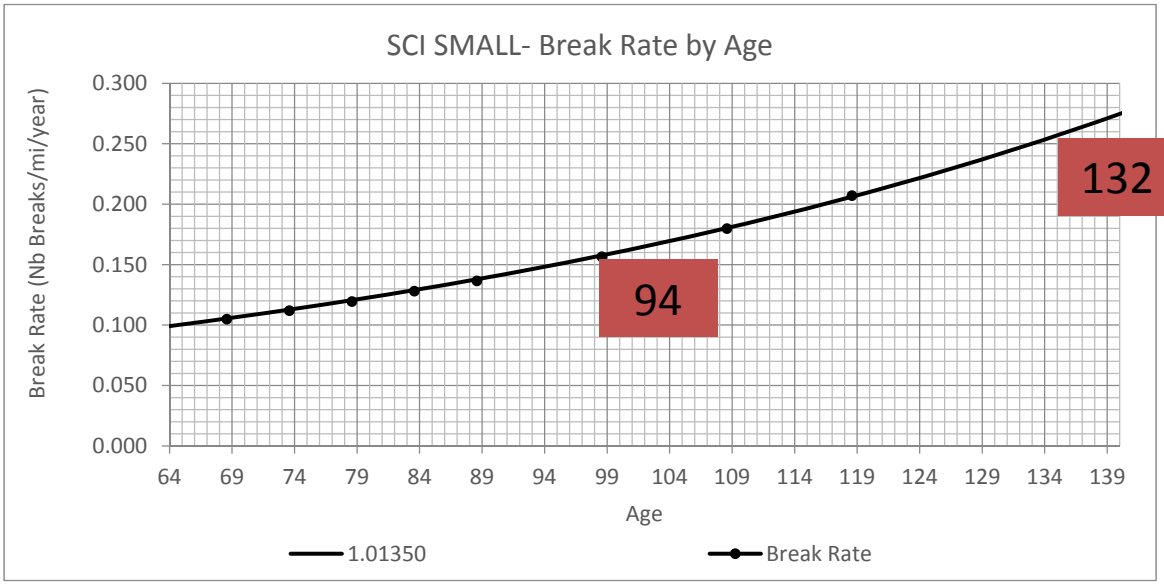


Figure 19 SCI Small - Break Rate by Age

EUL (0.15) = 94; EUL (0.25) = 132; f = 1.35%

SCI_S	Hingham-Hull	Millbury	Oxford	AWC
Age	58.3	70	56	64
Break Rate (2016)	0.08	0.11	0.07	0.1

5 KANEW Input Values and Methodology

5.1 KANEW Input Values

5.1.1 Aging

The KANEW input values for each cohort are shown in Table 5.

The 9 first values pertain to the EULs. The 50% Medium value (in red) corresponds to the 0.25 MBR threshold read on the aging curve in the previous Section. We only show the values that correspond to that MBR threshold because they are the ones used in the Scenarios that are shown in this report.

The other values (100% and 10%) illustrate the fact that not all mains will reach their EUL at the 50% value; for some it will be sooner; for others, later. By the 10% EUL value (for example 114 years old for the AC cohort medium EUL values), 10% of the mains will still be in service; no main is to be replaced before the 100% EUL age (50 years old for AC) which, when possible (there are exceptions) is chosen as the current average age as there has been little replacement so far.

The pessimistic and optimistic series of values allow for additional sensitivity analysis. While the 100% values are the same, the 50% values are typically the medium values + or – 5, 10 or 20 years depending how big the 50% value is.

The other values include, for each cohort, the 2016 Break Rate, the aging factor, and as a reference, the length of mains (not an input value). The Very Small (VS) cohorts have the same values as the Small ones. They are not shown in the Table.

	Pessimistic EUL Values (Short Lives)			Medium EUL Values			Pessimistic EUL Values (Long Lives)			2016 Break Rate	Aging Factor	Length
	100%-	50%-	10%-	100%	50%	10%	100%+	50%+	10%+			(mi)
HH_AC	50	72	94	50	82	114	50	92	134	0.13	3.35	27.4
HH_DI_L	22	79	136	22	89	156	22	99	176	0.025	3.5	2.0
HH_DI_S	20	61	102	20	71	122	20	81	142	0.04	4	43.1
HH_ELSE	57	61	65	57	71	85	57	81	105	0.096	3.4	6.3
HH_PCI_L	102	180	258	102	200	298	102	220	338	0.038	1.3	5.9
HH_PCI_S	80	109	138	80	129	178	80	149	218	0.15	2.5	42.9
HH_SCI_L	63	180	297	63	200	337	63	220	377	0.025	0.7	0.9
HH_SCI_S	63	112	161	63	132	201	63	152	241	0.08	1.35	49.6
MILL_AC	50	72	94	50	82	114	50	92	134	0.17	3.35	0.8
MILL_DI_S	20	61	102	20	71	122	20	81	142	0.035	4	15.8
MILL_ELSE	57	61	65	57	71	85	57	81	105	0.096	3.4	0.7
MILL_PCI_L	102	180	258	102	200	298	102	220	338	0.045	1.3	1.3
MILL_PCI_S	80	109	138	80	129	178	80	149	218	0.14	2.5	4.0
MILL_SCI_S	63	112	161	63	132	201	63	152	241	0.11	1.35	26.8
OX_AC	50	72	94	50	82	114	50	92	134	1	3.35	8.9
OX_DI_L	22	79	136	22	89	156	22	99	176	0.01	3.5	0.7
OX_DI_S	20	61	102	20	71	122	20	81	142	0.035	4	19.0
OX_ELSE	57	61	65	57	71	85	57	81	105	0.096	3.4	0.0
OX_PCI_S	80	109	138	80	129	178	80	149	218	0.16	2.5	4.9
OX_SCI_S	63	112	161	63	132	201	63	152	241	0.07	1.35	10.2
REHAB	50	70	90	50	80	110	50	90	130	0.01	4.2	NA

Table 5 MA - KANEW Input Values

5.1.2 EF factor

There are various reasons why a main is replaced; not all of them are due to its physical condition. The KANEW model takes into account the efficiency of targeting certain mains for R&R by using an Efficiency Factor (EF). An Efficiency Factor of 1 means that replaced mains, if not replaced, would have a Break Rate in the same range as the average Break Rate of the whole cohort or network. An Efficiency Factor of EF=x and greater than 1 means that replaced mains would have a Break Rate which is x times higher than the average Break Rate of the cohort. As a starting point the EF is kept at 1. In subsequent Scenarios, the EF can be increased to 2.

5.1.3 Cost

AWC provided the following unit costs for the R&R MAT based on the DIAM:

- DIAM 1-12”: $275/ft.
- DIAM >=16”: $300/ft.

We computed a length-weighted average cost of $277.

Currently the budget is projected at between $1.5 M and $2.0 M per year (we use $1.75 M for this study). That budget was distributed over all three MA Systems proportionally to their respective length, as follows, Hingham-Hull: $1.15 M; Millbury: $0.32 M; and Oxford: $0.28 M.

5.2 KANEW Methodology

A KANEW Scenario consists in (except for Scenario 1: R&R Needs; see Section 6) choosing an analysis period of time (for example 2016-2100) and imposing a certain length of R&R (for example, planning horizon) during that whole period or part of it (for example, 2016-2050 selected by AWC). Typical output results are:

- R&R length for each year during the overall analysis period
- R&R length right after the planning horizon if different from the period of analysis
- Future Break Rate
- Future Investment Cost

Comment about terminology: the KANEW software calls the Figure that shows the first output results mentioned above, R&R length, "Future rehabilitation *needs* per asset type" regardless of whether we are in the "Needs" Scenario or in a constrained Scenario (Scenario 2 or 4).

We had 2 sets of EULs at our disposal: one that represents the age at which the mains of various cohorts reach the MBR of 0.15 Breaks/mi./yr. (aiming for a System-wide Break Rate of approximately 0.1) and 0.25 Breaks/mi./yr. (allowing for a System-wide Break Rate around 0.12). We also have the choice between an EF of 1 or 2.

We first looked at the Needs with the EULs corresponding to a MBR of 0.15 and an EF of 1, and then 2. The resulting backlog after 2050 and the Break Rates were too high. We then created Scenarios (1, 2 and 4) solely with the EULs corresponding to a MBR of 0.25 (which are shown in Table 5) and an EF of 2.

Scenario 1 Needs merely translates the inventory and the EULs. We also show the resulting average Break Rate for the overall System.

In order to create an "optimal" Scenario (Scenario 2) we conducted a study at the cohort level. The methodology consists in first examining the Break Rate for each cohort as if we were to follow the Needs (those results can be regarded as Scenario 1 at the cohort level) and, then, optimizing the necessary length of R&R accordingly. The guiding principle is to try to do less R&R if the Break Rate remains low in the Scenario Needs; more if the Break Rate is too high.

Scenario 2 is created by adding all the optimal levels identified previously at the cohort level. As an example, we show the work done with cohort DI_S.

Scenario 4 CIP consists in simulating the budgeted levels of R&R are simulated until 2100. We looked at what happens after 2100 including backlog and Break Rate.

Results are shown solely for Scenarios 1, 2 and 4.

For Scenarios 1 Needs and Scenario 4 we show R&R lengths (Future rehabilitation needs) solely for the medium EULs. One graph is produced for the other results (Break Rate and Cost); for those, the pessimistic, medium and optimistic results are shown in the same Figure with a different color.

For Scenario 4 we show results with the medium EULs as well as with pessimistic (short), and optimistic (long) EULS.

During the period of time when the length is constrained by the analyst, only medium values are at play. After that period results are produced for medium, pessimistic and optimistic EULs.

Analyses and Results are produced at the System level (including optimization at the cohort level), and then for the whole MA System.

6 KANEW Results

6.1 Hingham-Hull

6.1.1 Hingham-Hull Needs

Scenario 1 Needs merely translates the inventory and the EULs. We also show the resulting average Break Rate for the overall System. Scenario 1 is obtained with an MBR of 0.25 Breaks/mi./yr., and an EF of 2. We show the Length of R&R, Break Rate and Cost.

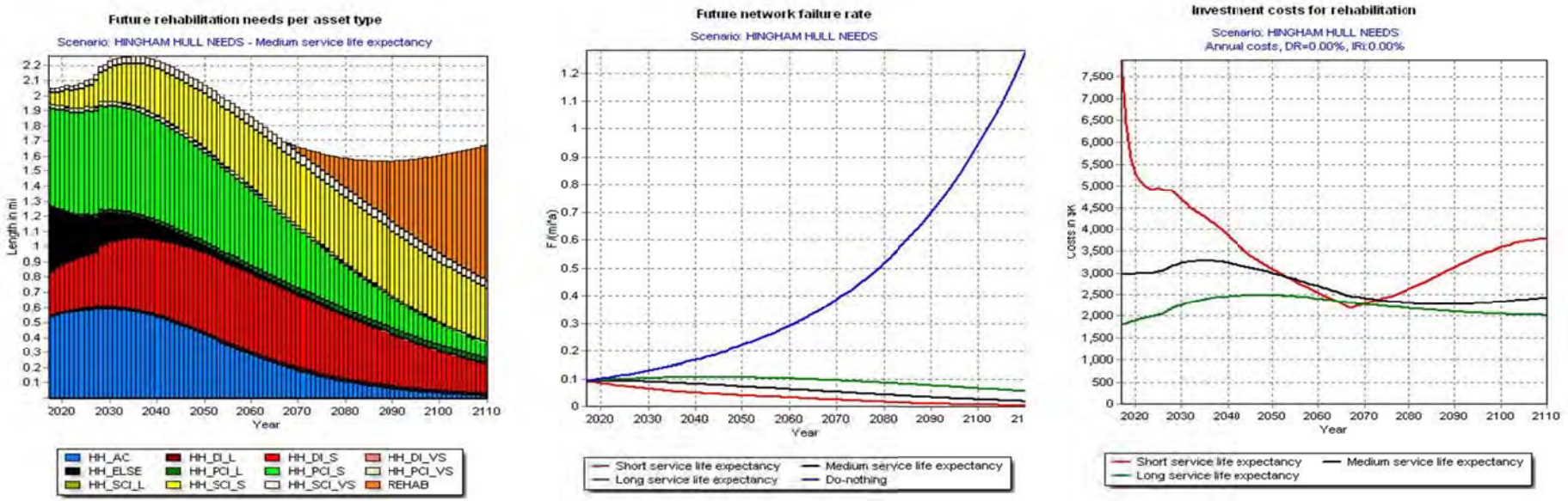
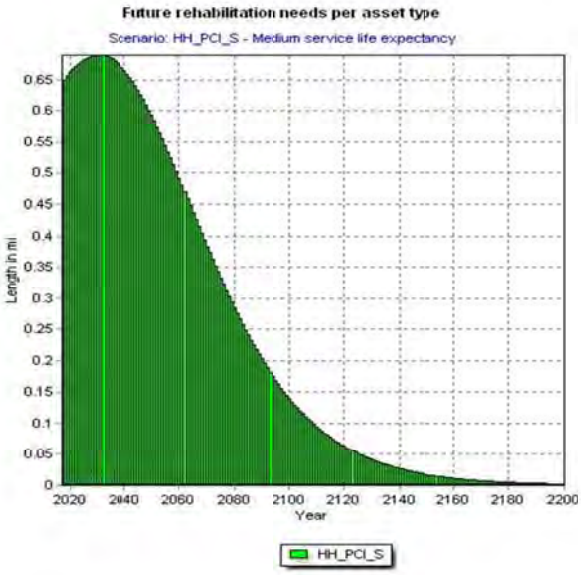


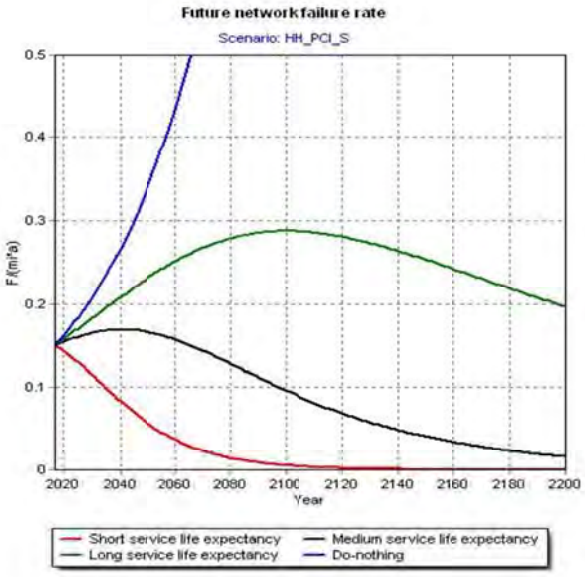
Figure 20 Hingham-Hull Needs Scenario 1 - R&R Length, Break Rate and Investment Cost

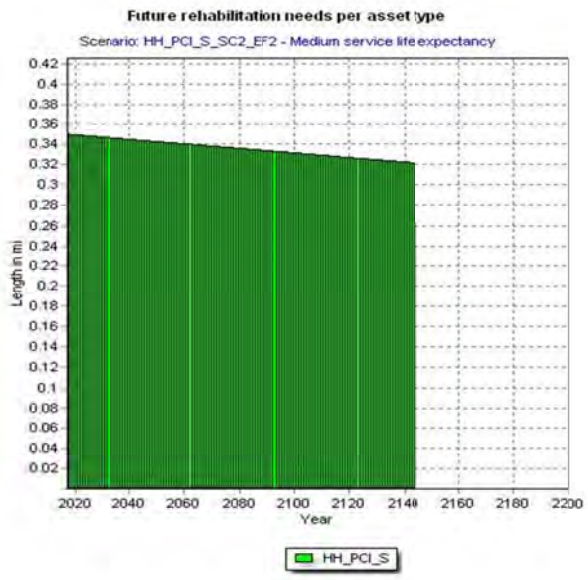
The cost is higher than what has been budgeted ($1.15 M/yr.) while the Break Rate is lower than needs to be. We therefore look at building a new Scenario, Scenario 2, where lengths are reduced at the cohort level.

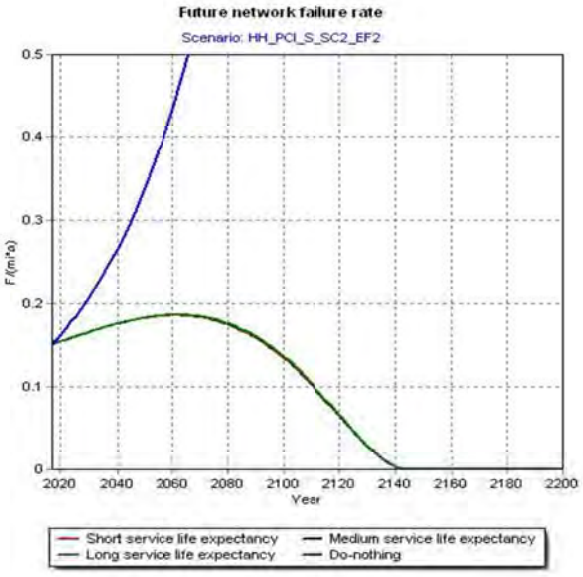
6.1.2 Hingham-Hull Scenario 2

To illustrate the work done at the cohort level, we show HH_PCI_S which is the largest cohort, therefore where the most gain can be achieved. The Needs showed a peak of R&R in the immediate future around 0.65 mi/year going down steadily after that. We are able to stretch the HH_PCI_S R&R level from 0.35 mi in 2017 to 0.3 by 2140 while keeping a Break Rate below 0.2 Breaks/mi./yr. We show results up to 2200 to demonstrate that reducing the levels of RR&R does not create a backlog after 2100. Scenario 2 results in all PCI_S mains having been replaced by 2144 while controlling the Break Rate at an acceptable level.



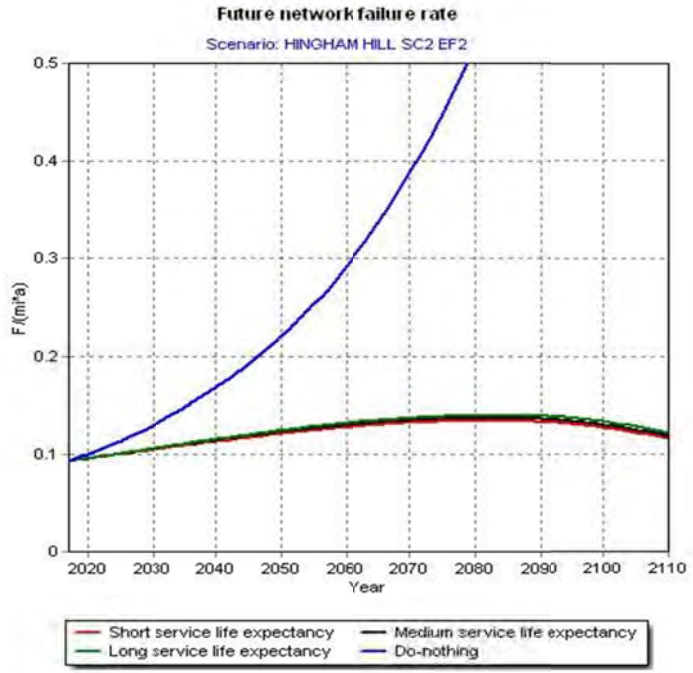






Scenario 2 consists in adding the optimized length obtained at the cohort level for AC, DI_S, ELSE, PCI_S and SCI_S and the Needs for the other cohorts. The lengths are seen in Figure 22. The Break Rate and Cost are seen in Figure 21.

We are not able to lower the cost to $1.15 M while keeping a Break Rate and a backlog that are acceptable.
The minimum investment that is projected is $1.8 M that could be maintained up to 2070 but, then, would need to be ramped up to $2 M by 2100 (including the new mains).



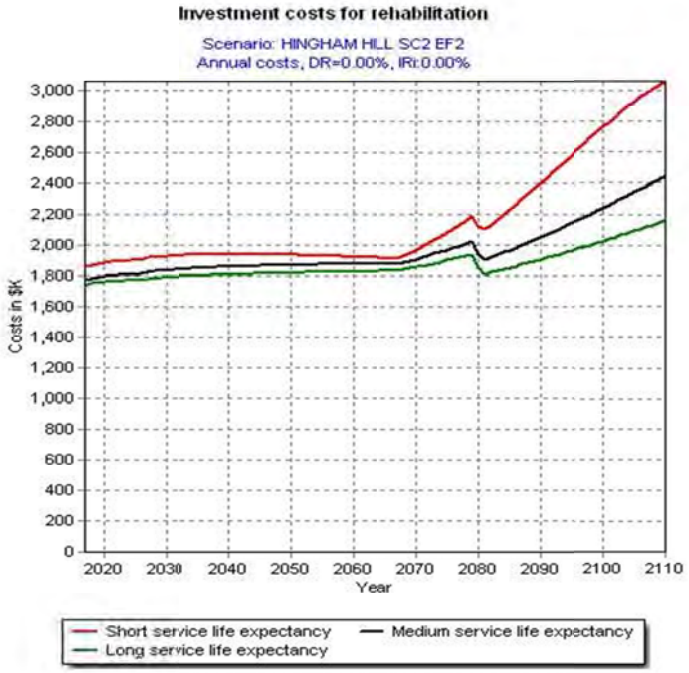


Figure 21 Hingham-Hull Scenario 2 - Break Rate and Investment Cost

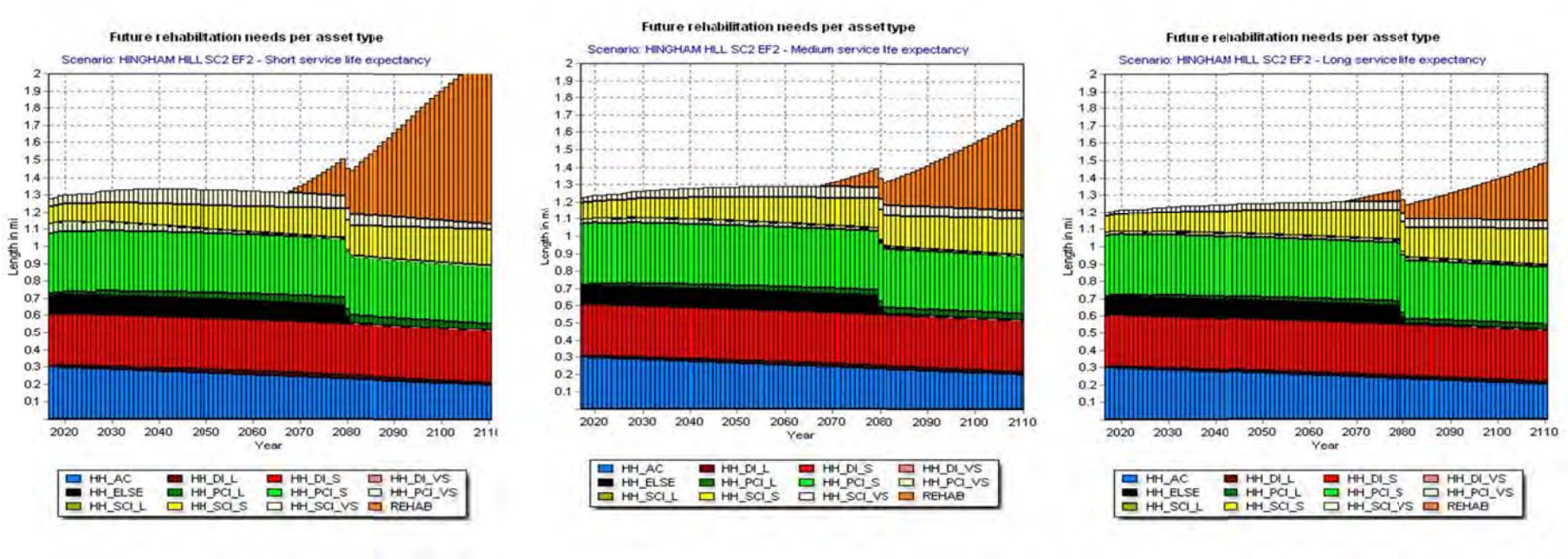


Figure 22 Hingham-Hull Scenario 2 - R&R Length

6.1.3 Hingham-Hull Scenario 4

Scenario 4 was created to see what would happen if we were to maintain the currently projected budget ($1.15 M per year) until 2100, (and to justify the need for a larger budget.) As done previously, we used the EULs that correspond to the MBR of 0.25 Breaks/mi./yr. threshold and an EF of 2.

$1.15 M/yr. @ $275/ft. or $1.452M/mi. ➔ 0.8 mi./yr. We distribute that amount to each cohort proportionally to the relative length of R&R in the Needs Scenario. Figure 23 and Figure 24 show that Scenario 4 would result in a steep backlog (close to 4 miles in 2101) and a cost of $13 M in 2101. Figure 24 also shows that the Break Rate would climb to 0.4 Breaks/mi./yr.

2100 2110

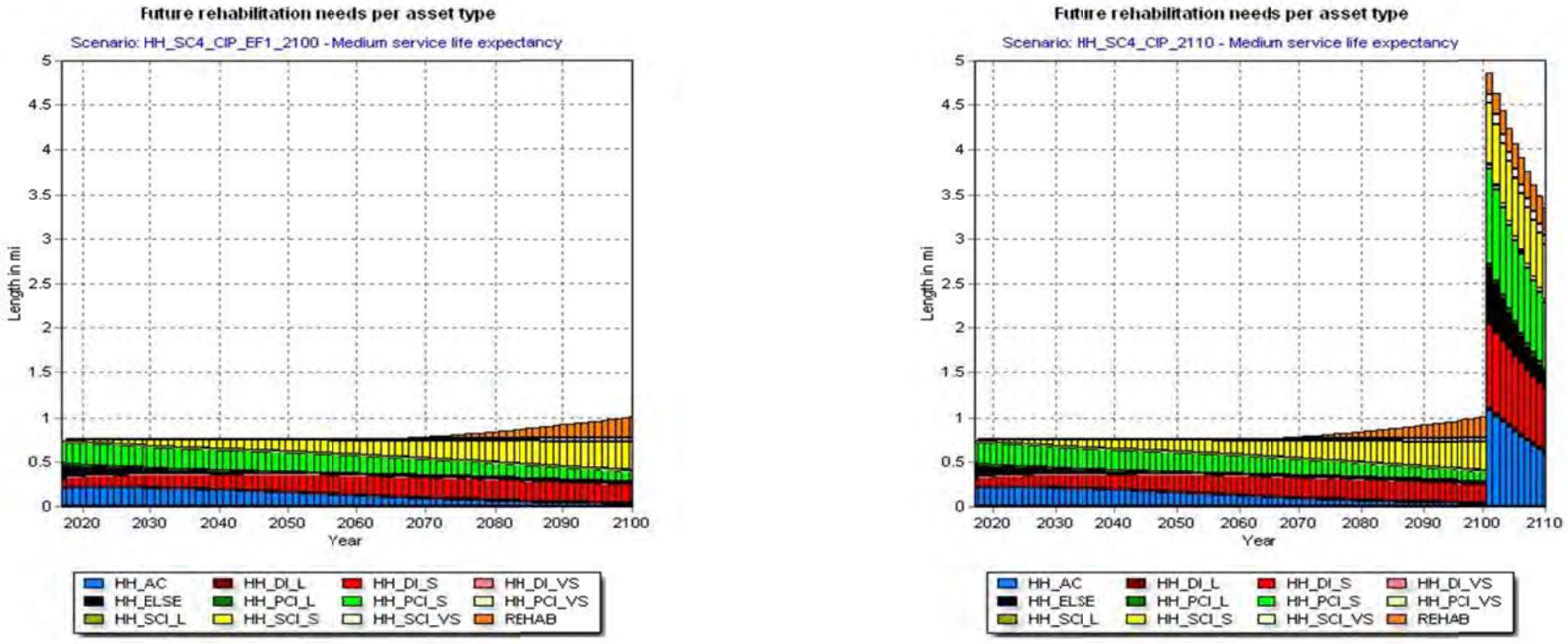


Figure 23 Hingham-Hull Scenario 4 - R&R Length

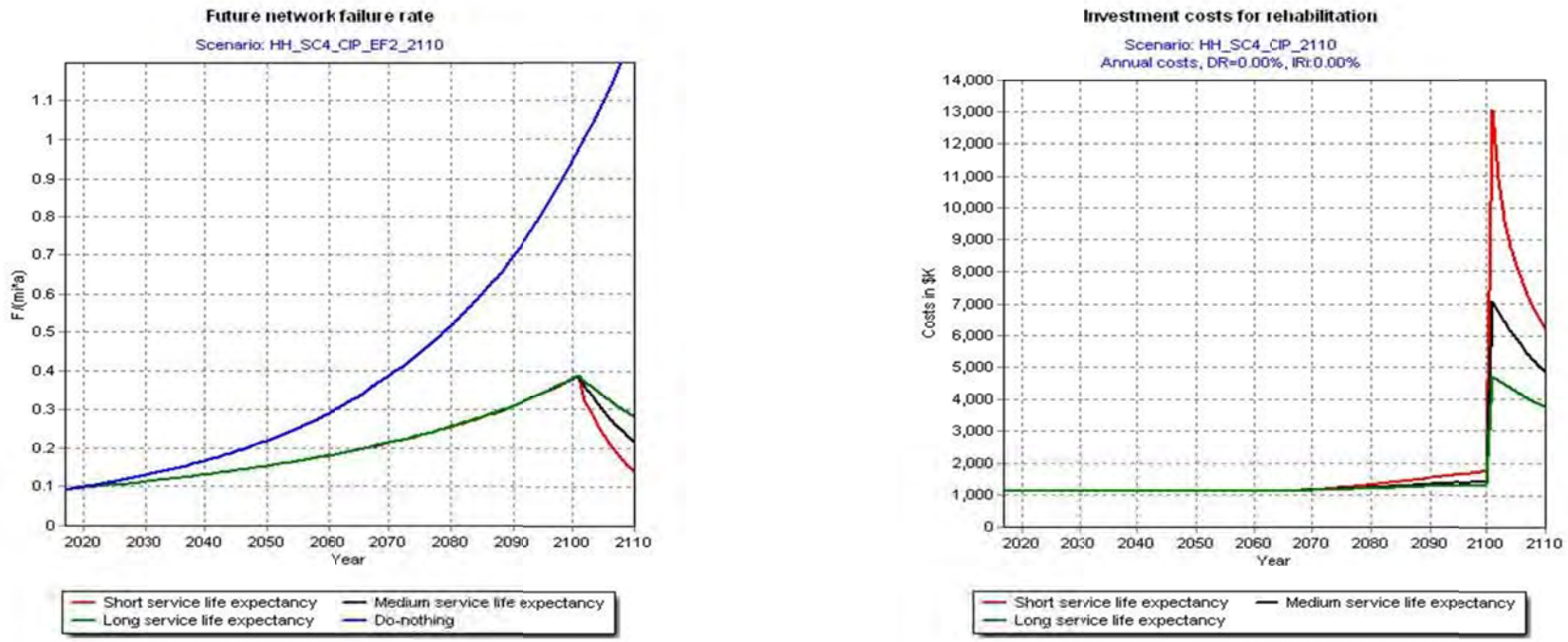


Figure 24 Hingham-Hull Scenario 4 - Break Rate and Investment Cost

6.2 Millbury

6.2.1 Millbury Needs

Scenario 1 Needs merely translates the inventory and the EULs. We also show the resulting average Break Rate for the overall System. Scenario 1 is obtained with an MBR of 0.25 Breaks/mi./yr., and an EF of 2. We show the Length of R&R, Break Rate and Cost in Figure 25.

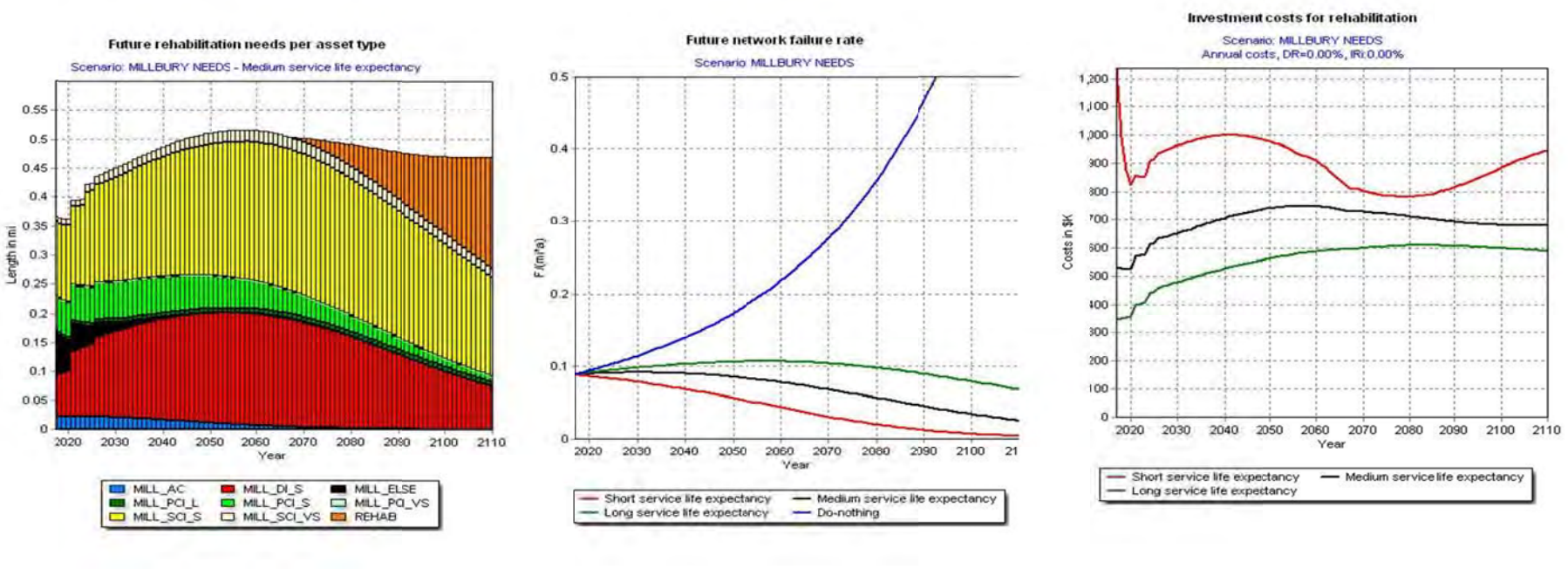


Figure 25 Millbury Needs Scenario 1 - R&R Length, Break Rate and Investment Cost

The cost starts at $0.53 M, and then goes up, peaking at $0.75 M by 2055. This is higher than what has been budgeted ($0.32 M/yr.) while the Break Rate is lower than needs to be. We therefore look at building a new Scenario, Scenario 2, where, when possible, lengths are reduced at the cohort level. An example was shown for Hingham-Hull in Section 6.1.2.

6.2.2 Millbury Scenario 2

For Millbury, we were able to optimize the R&R lengths for the DI_S and SCI_S cohorts. The resulting Scenario 2 consists in adding the optimized lengths and, for the other cohorts, the Needs. The resulting R&R lengths are seen in Figure 27.

While the lengths of R&R and cost went down, we were not able to bring the cost to $0.32 M while keeping a backlog that is acceptable.

Figure 27 shows that the minimum investment projected is $0.55 M. It then goes down to $0.4 M by 2070, then goes up again (including the new mains). The Break Rate is acceptable.

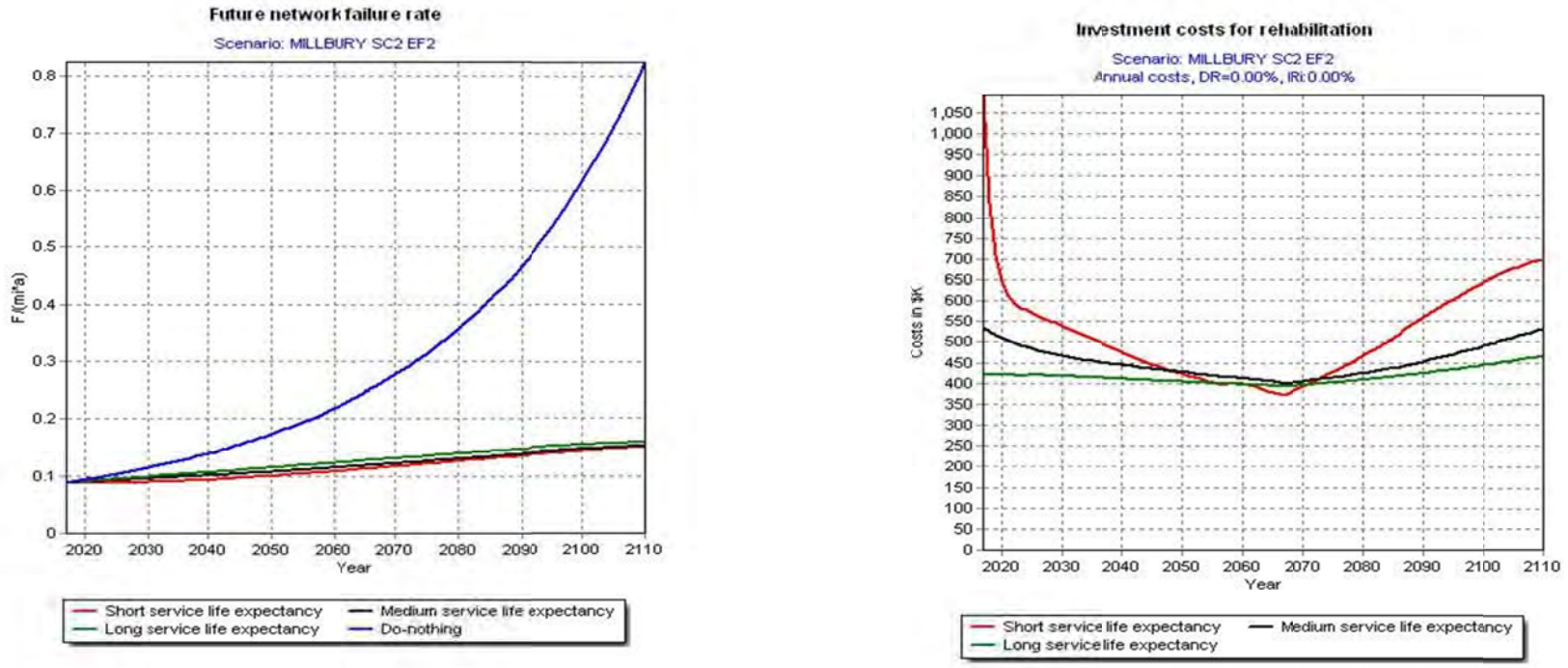


Figure 26 Millbury Scenario 2 - Break Rate and Investment Cost

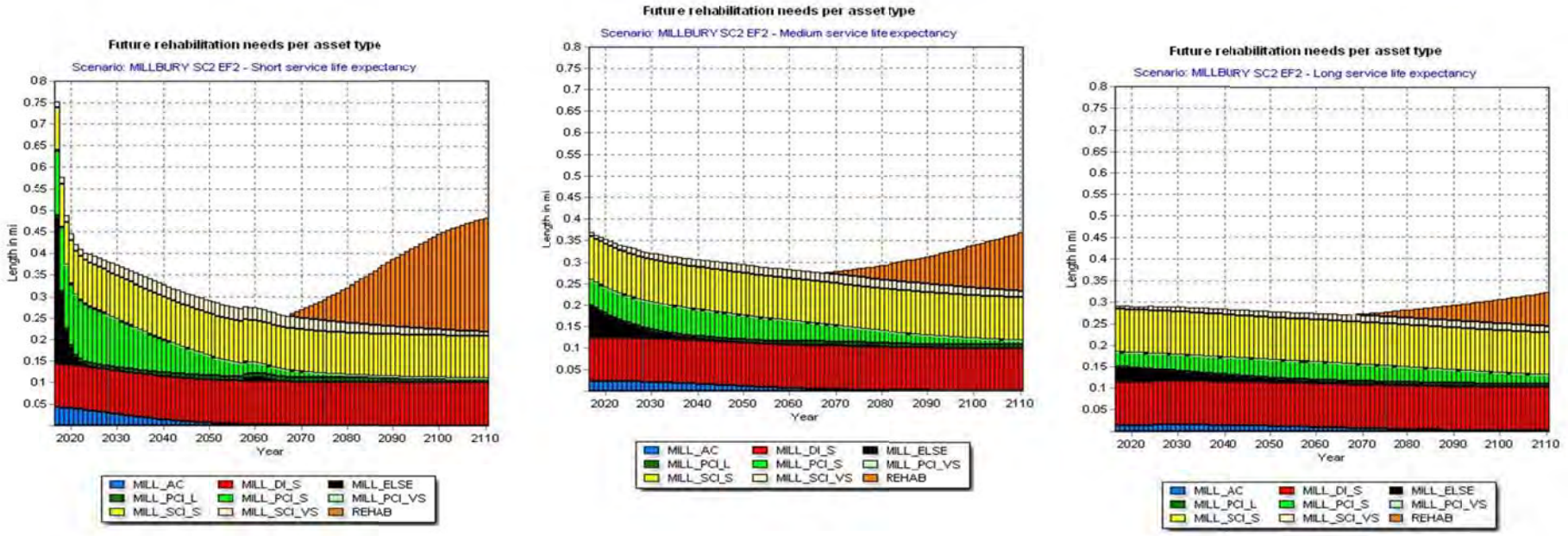


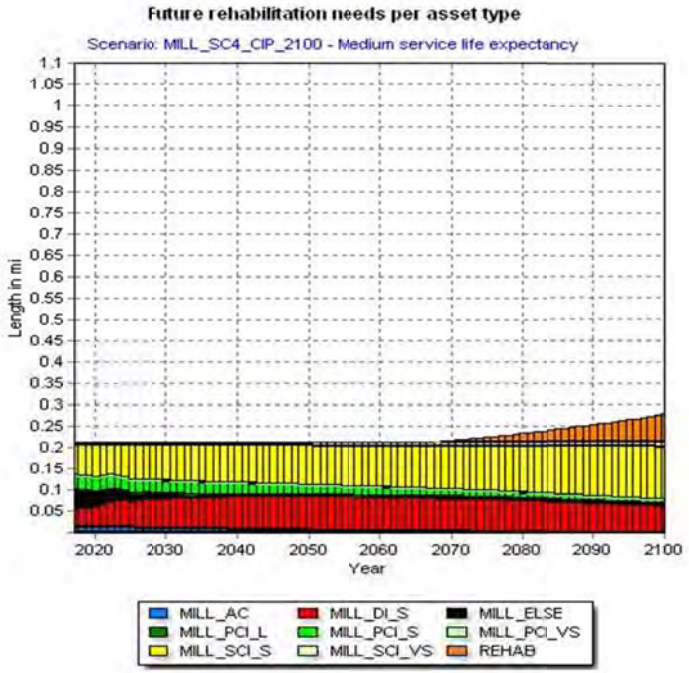
Figure 27 Millbury Scenario 2 - R&R Length

6.2.3 Millbury Scenario 4

Scenario 4 was created to see what would happen if we were to maintain the currently projected budget ($0.32 M per year) until 2100, and to justify the need for a larger budget. As previously we used the EULs that correspond to the MBR of 0.25 Breaks/mi./yr. threshold and an EF of 2.

$0.32 M/yr. @ $275/ft. or $1.452M/mi. ➔ 0.22 mi./yr. We distribute that amount to each cohort proportionally to the relative length of R&R in the Needs Scenario. The right-hand Figure 28 shows the steep backlog (close to 1 mile in 2101) that would result for that Scenario. This results in a cost of $1.4 M in 2101 (see next page). The Break Rate would also climb to 0.3 Breaks/mi./yr. (see Figure 29).

2100



2110

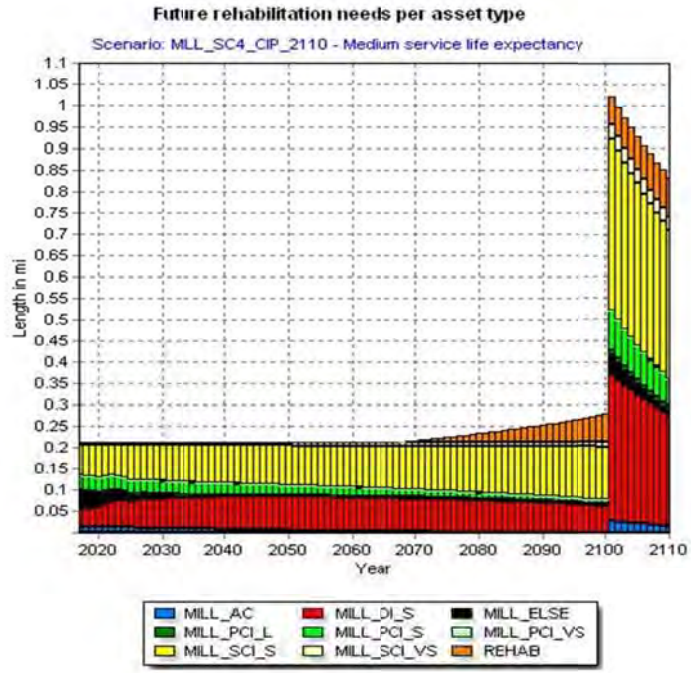


Figure 28 Millbury Scenario 4 - R&R Length

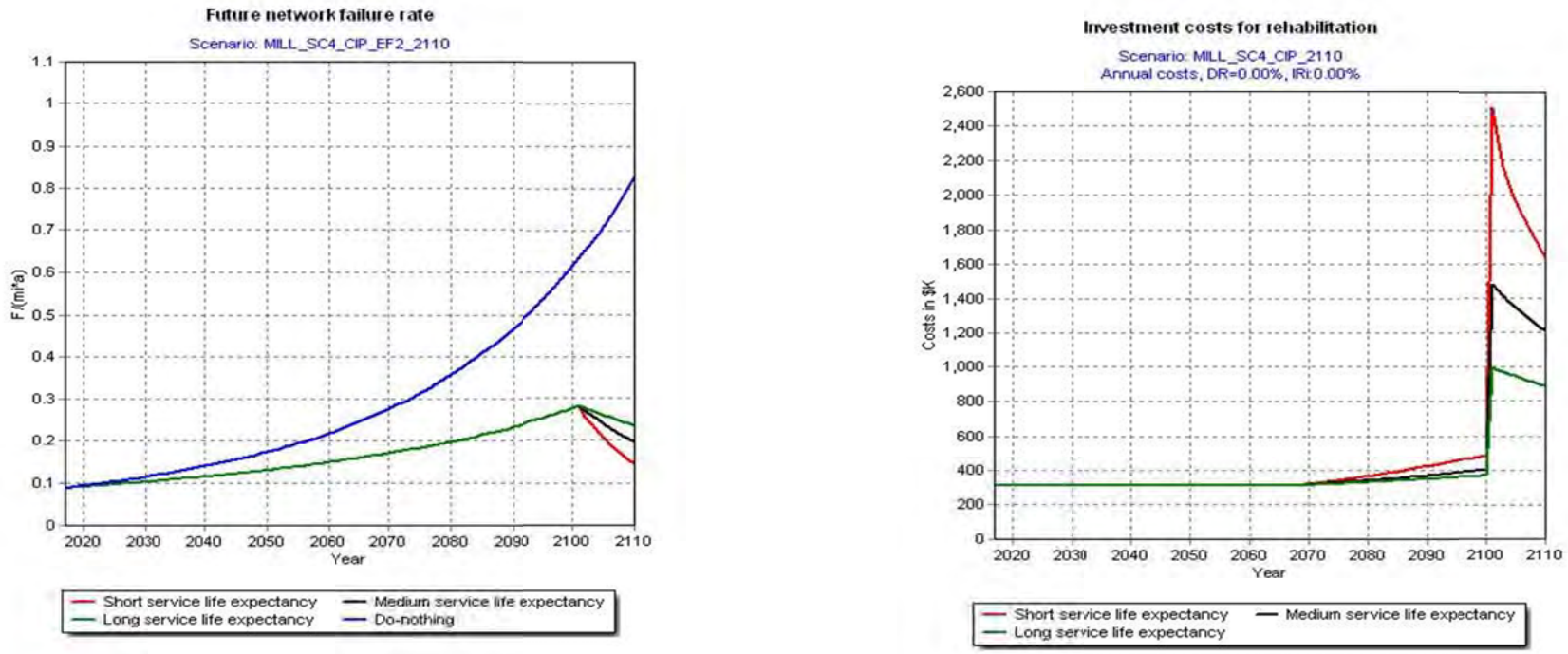


Figure 29 Millbury Scenario 4 - Break Rate and Investment Cost

6.3 Oxford

6.3.1 Oxford Needs

Scenario 1 Needs merely translates the inventory and the EULs. We also show the resulting average Break Rate for the overall System. Scenario 1 is obtained with an MBR of 0.25 Breaks/mi./yr., and an EF of 2. We show the Length of R&R, Break Rate and Cost in Figure 30.

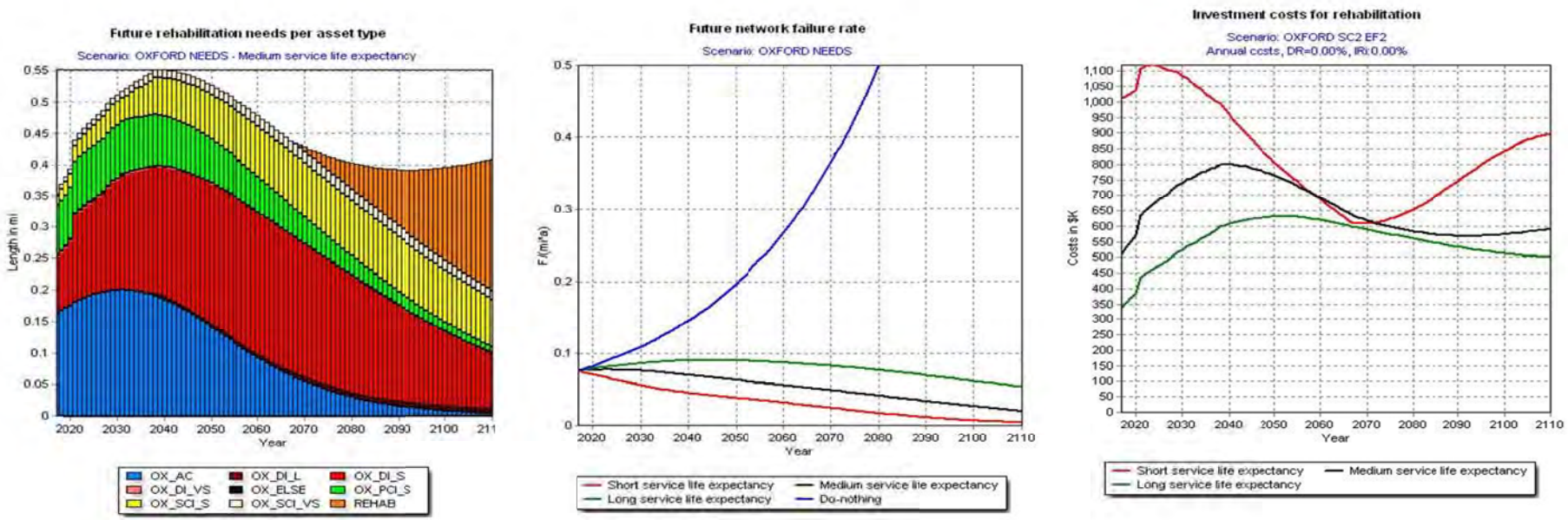


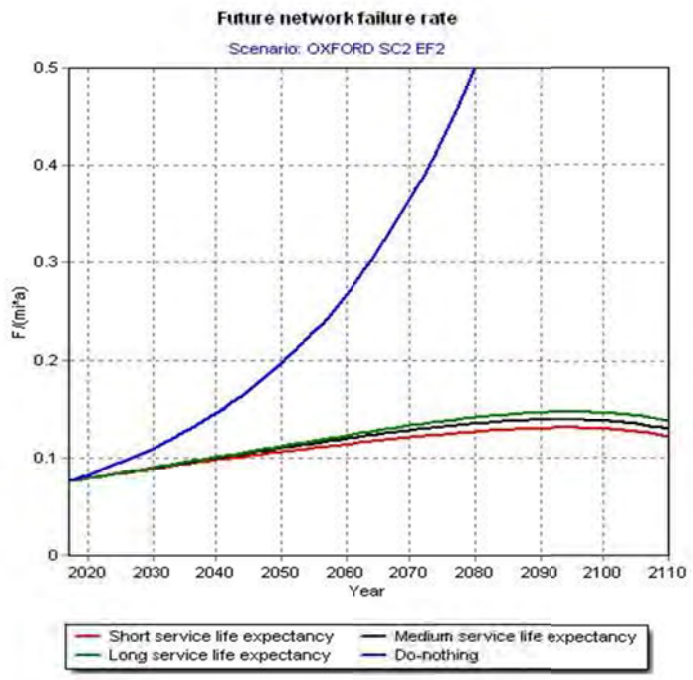
Figure 30 Oxford Needs Scenario 1 - R&R Length, Break Rate and Investment Cost

The cost is higher than what has been budgeted ($0.28 M/yr.) while the Break Rate is lower than needs to be. We therefore look at building a new Scenario, Scenario 2, where lengths are reduced at the cohort level. An example was shown in The Hingham-Hull Section.

6.3.2 Oxford Scenario 2

We were able to optimize the AC, DI_S, and PCI_S cohorts.
Scenario 2 consists in adding the optimized length obtained at the cohort level for AC, DI_S, and PCI_S, as well as the Needs for the other cohorts. The resulting R&R lengths are seen in Figure 32.
As seen in Figure 31 we are not able to lower the cost to $0.28 M while keeping a Break Rate and a backlog that are acceptable.

The minimum investment that is projected is $0.37 M going steadily up to reach $0.67 M (including the new mains). The Break Rate remains at an acceptable level.



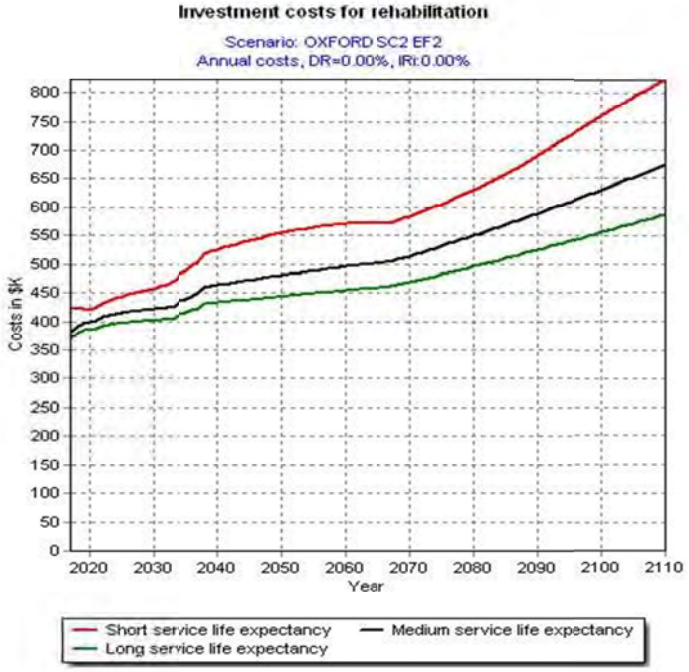


Figure 31 Oxford Scenario 2 - Break Rate and Investment Cost

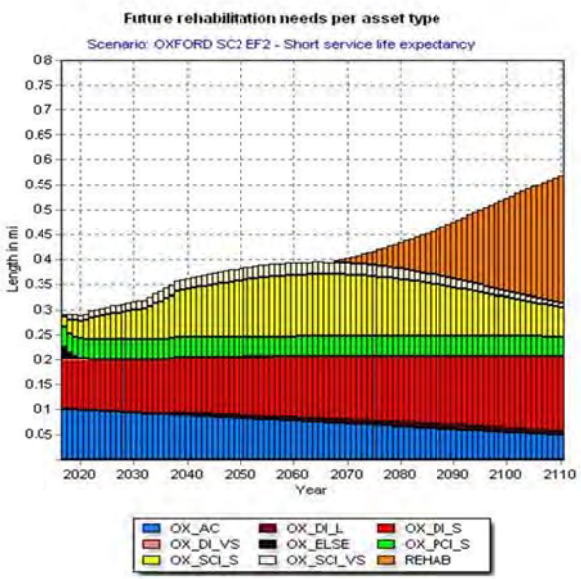
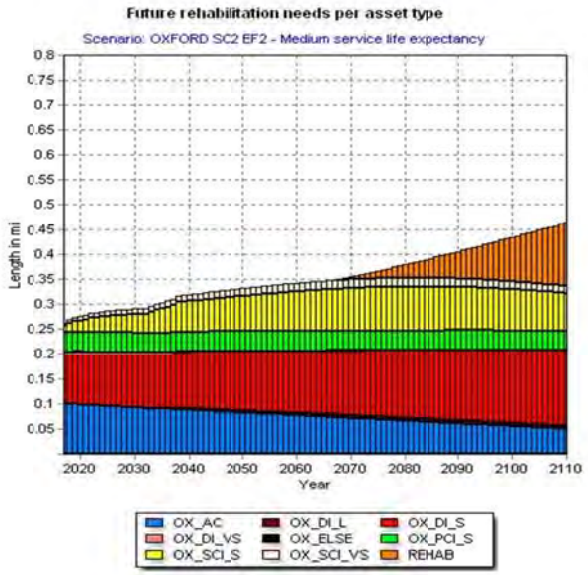


Figure 32 Oxford Scenario 2 - R&R Length



6.3.3 Oxford Scenario 4

Scenario 4 was created to see what would happen if we were to maintain the currently projected budget ($0.28 M per year) until 2100, and to justify the need for a larger budget. As previously we used the EULs that correspond to the MBR of 0.25 Breaks/mi./yr. threshold and an EF of 2.

$0.28 M/yr. @ $275/ft. or $1.452M/mi. ➔ 0.19 mi./yr. We distribute that amount to each cohort proportionally to the relative length of R&R in the Needs Scenario. The right-hand Figure 33 shows the steep backlog (close to 1.1 miles in 2101) that would result for that Scenario. It corresponds to a cost of $1.6 M in 2101 (see Figure 34). The Break Rate would also climb to 0.6 Breaks/mi./yr. (see Figure 34 as well).

2100 2110

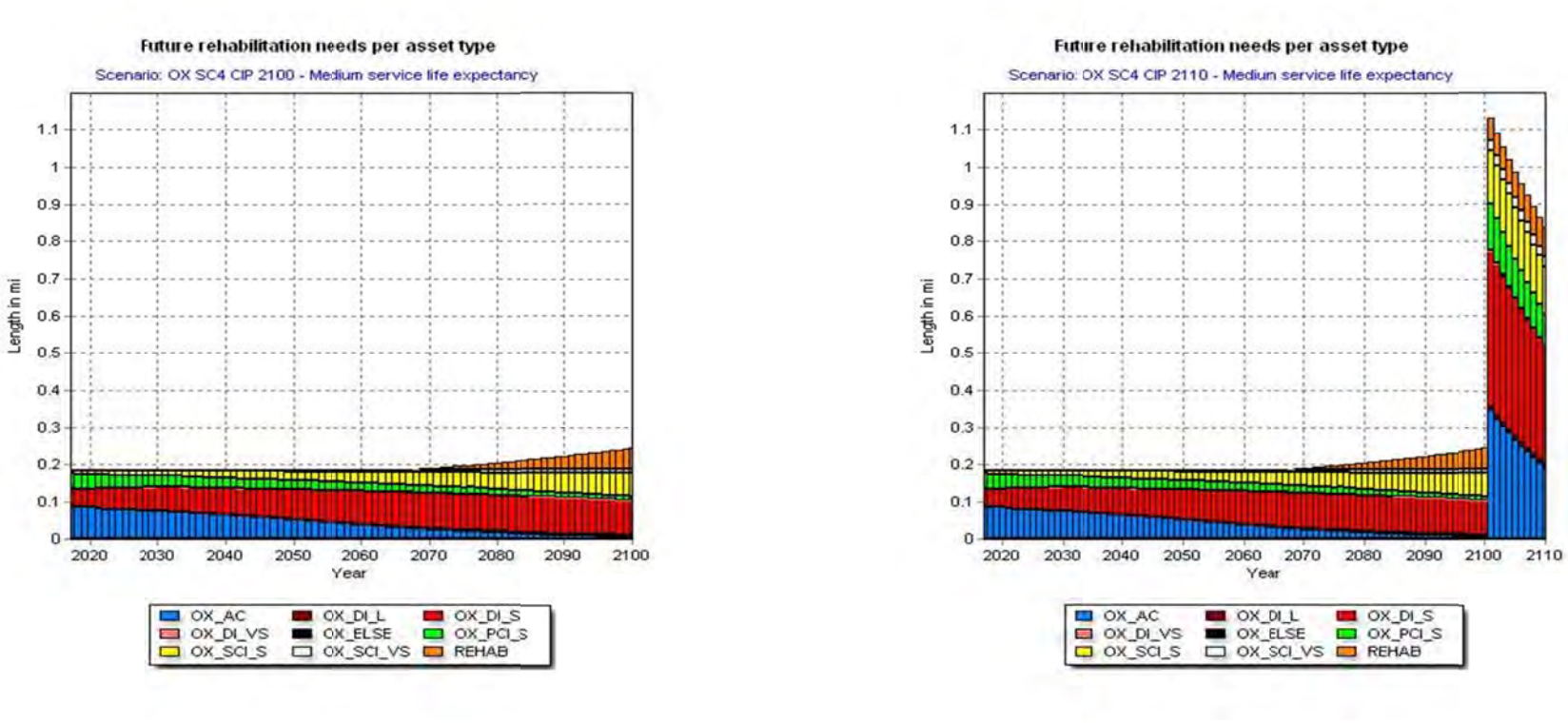


Figure 33 Oxford Scenario 4 - R&R Length

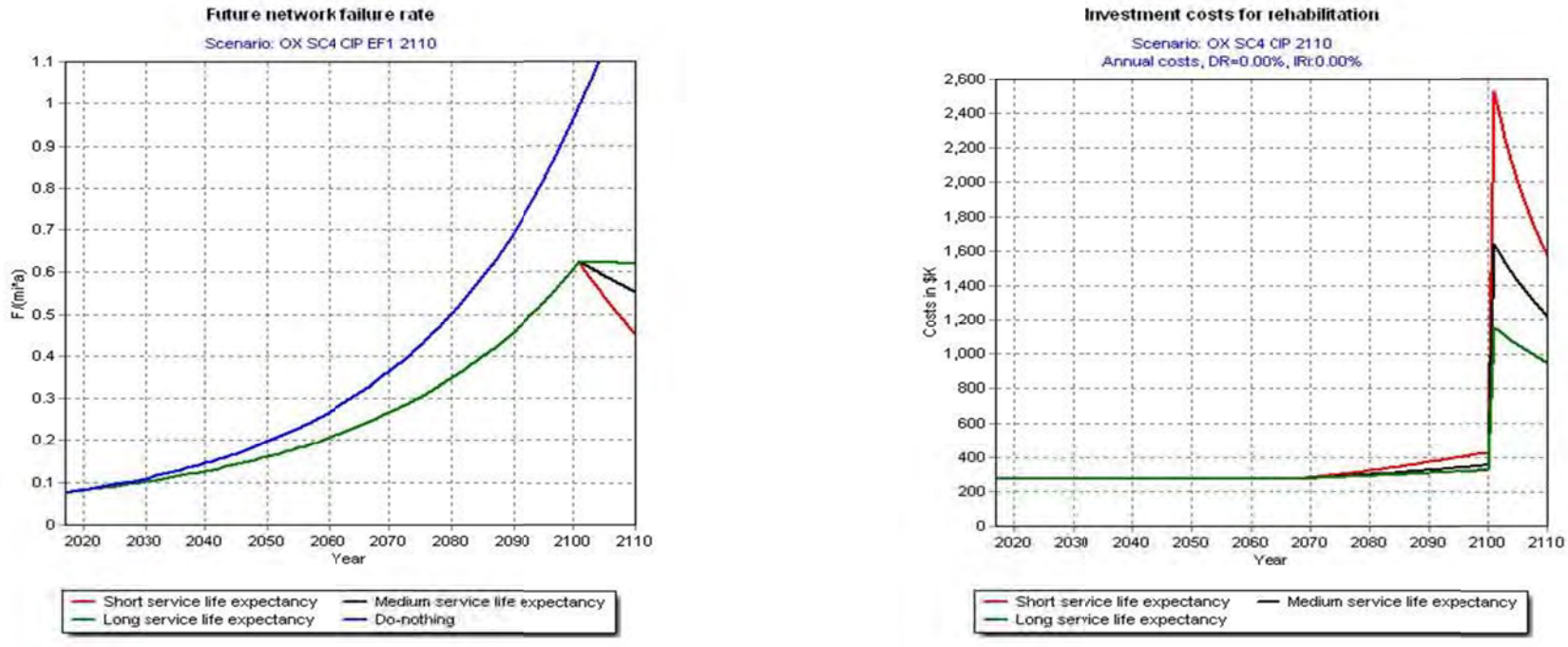


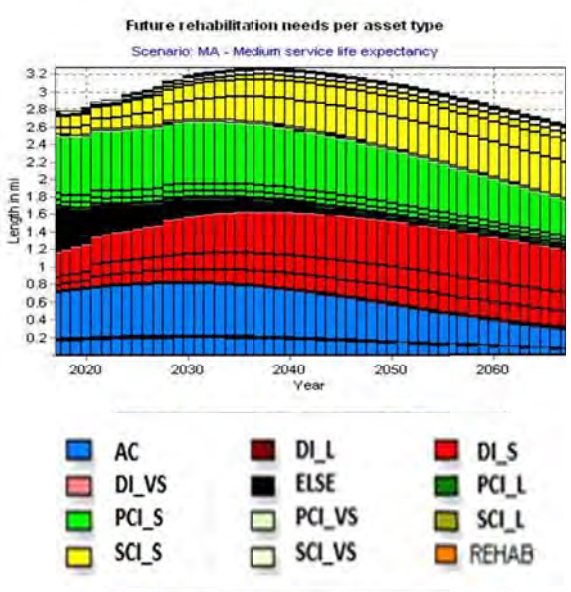
Figure 34 Oxford Scenario 4 - Break Rate and Investment Cost

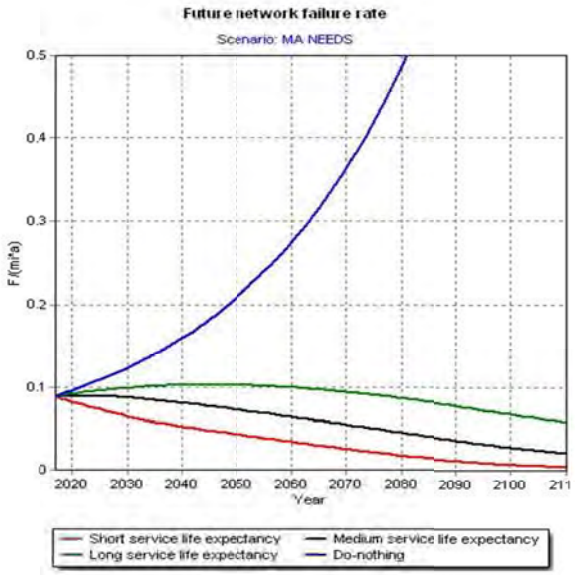
6.4 MA - 3 Systems

6.4.1 MA Needs

Scenario 1 Needs merely translates the inventory and the EULs. We also show the resulting average Break Rate for the overall

System. Scenario 1 is obtained with an MBR of 0.25 Breaks/mi./yr., and an EF of 2. We show the Length of R&R, Break Rate and Cost in Figure 35.


Future rehabilitation needs per asset type
Scenario: MA - Medium service life expectancy
Length in mi
Year
AC
DI_L
DI_S
DI_VS
ELSE
PCI_L
PCI_S
PCI_VS
SCI_L
SCI_S
SCI_VS
REHAB


Future network failure rate
Scenario: MA NEEDS
F (mi*a)
Year
Short service life expectancy
Medium service life expectancy
Long service life expectancy
Do-nothing

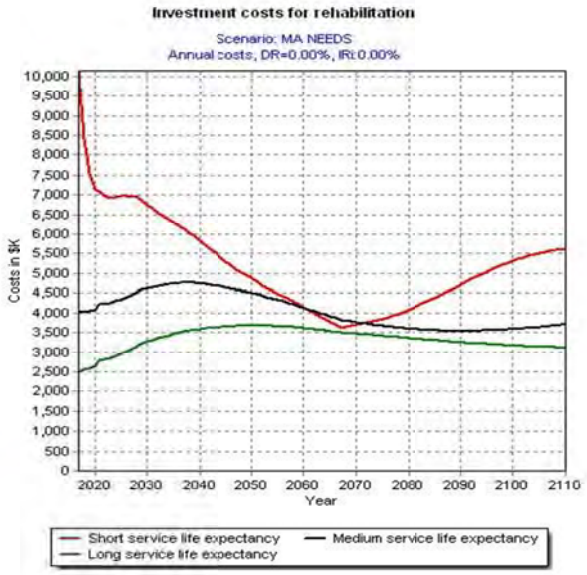
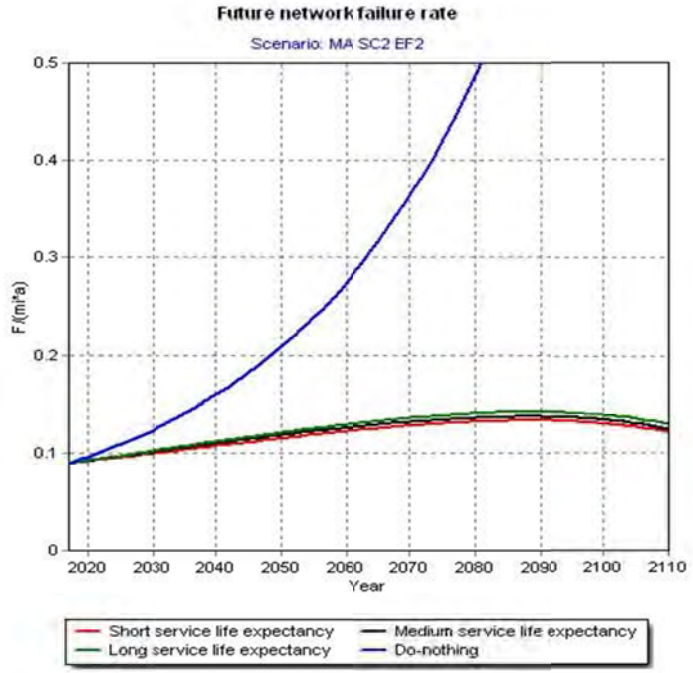

Investment costs for rehabilitation
Scenario: MA NEEDS
Annual costs, DR=0.00%, IR=0.00%
Costs in $K
Year
Short service life expectancy
Medium service life expectancy
Long service life expectancy

Figure 35 MA Needs Scenario 1 - R&R Length, Break Rate and Investment Cost

The cost ($4 M - $5 M) is seen in Figure 35. It is higher than what has been budgeted ($1.75 M/yr.) while the Break Rate (Figure 35 is lower than needs to be. We built Scenario 2 for each System, by optimizing each cohort in each System (when possible) which was done in Sections 6.1, 6.2, and 6.3. We are adding the length from each cohort in the 3 Systems. The results are shown in the Section 6.4.2.

6.4.2 MA Scenario 2

The R&R lengths are seen in Figure 37. As seen in Figure 36 we are not able to lower the cost to $1.5 - $2 M while keeping a Break Rate and a backlog that are acceptable.
The minimum investment that is projected is $2.6 M that has to slightly increase to $2.8 M by 2070 but, then, would need to be ramped up to $3.8 M by 2100 (including the new mains). See Figure 36.



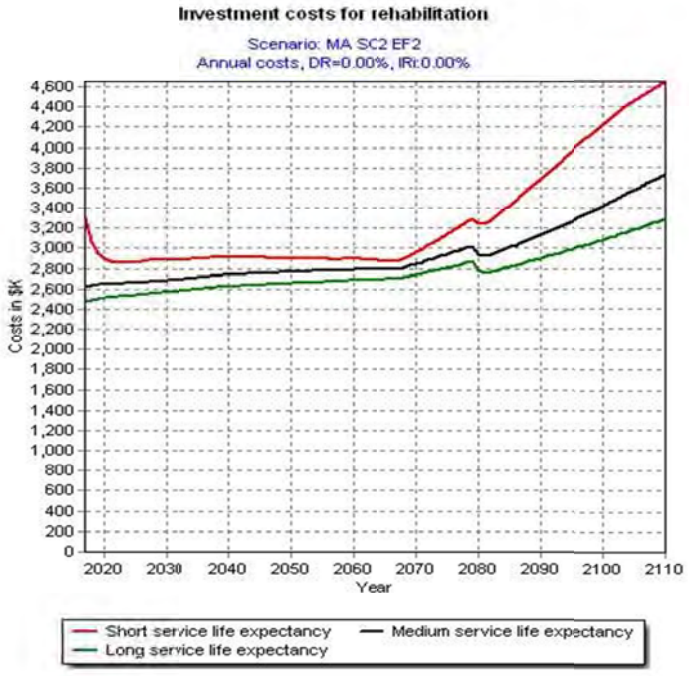


Figure 36 MA Scenario 2 - Break Rate and Investment Cost

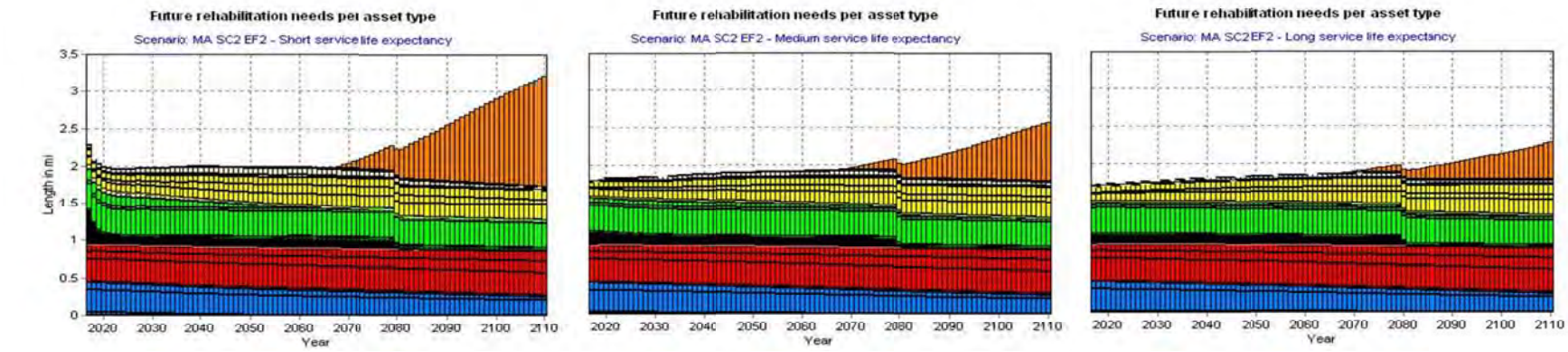


Figure 37 MA Scenario 2 - R&R Length

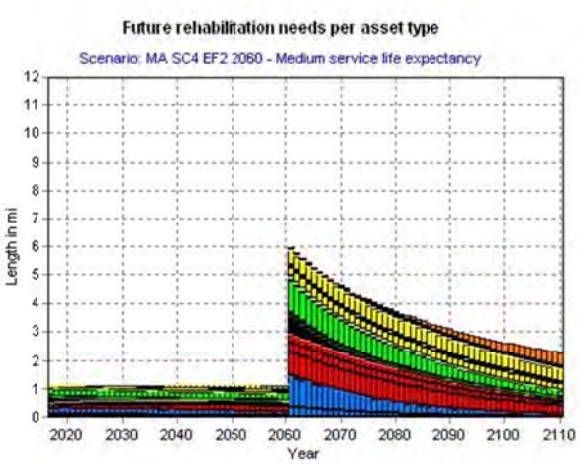
6.4.3 MA Scenario 4

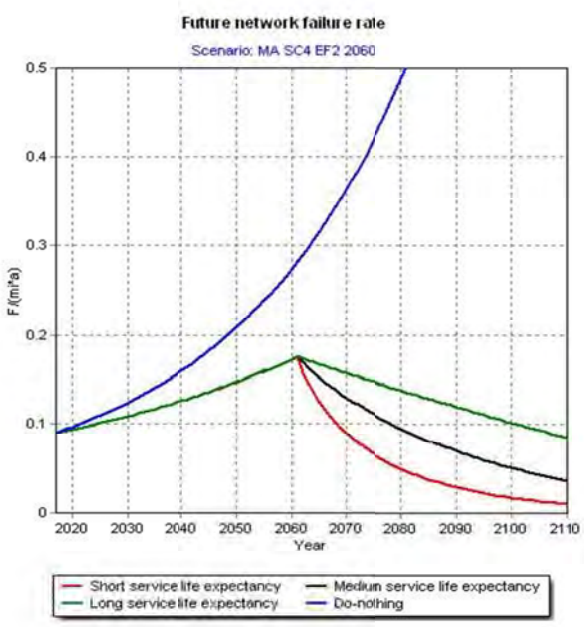
Scenario 4 was created to see what would happen if we were to maintain the currently projected budget ($1.75 M per year) until 2100, and to justify the need for a larger budget. As previously we used the EULs that correspond to the MBR of 0.25 Breaks/mi./yr. threshold and an EF of 2.

$1.75 M/yr. @ $275/ft. or $1.452M/mi. ➔ 1.2 mi./yr. We distribute that amount to each cohort proportionally to the relative length of R&R in the Needs Scenario. Because of the number of cohorts (27) the software was not able to process a 100-yr. scenario. We had to stop at year 2060. The left-hand part of

Figure 38 shows the steep backlog (close to 6 miles in 2061) that would result with that Scenario. This results in a cost of $8.5 M in 2061 (right-hand

Figure 38). The Break Rate would only climb to 0.17 Breaks/mi./yr. which is acceptable. The issue with this Scenario is managing the backlog. If we had been able to build a Scenario up to 2100, we would show an even higher backlog (similar to the sum of the backlogs seen for each system). The Break Rate wouldalso be much higher.


Future rehabilitation needs per asset type
Scenario: MA SC4 EF2 2060 - Medium service life expectancy
Length in mi
Year


Future network failure rate
Scenario: MA SC4 EF2 2060
F (mi/a)
Year
Short service life expectancy
Medium service life expectancy
Long service life expectancy
Do-nothing

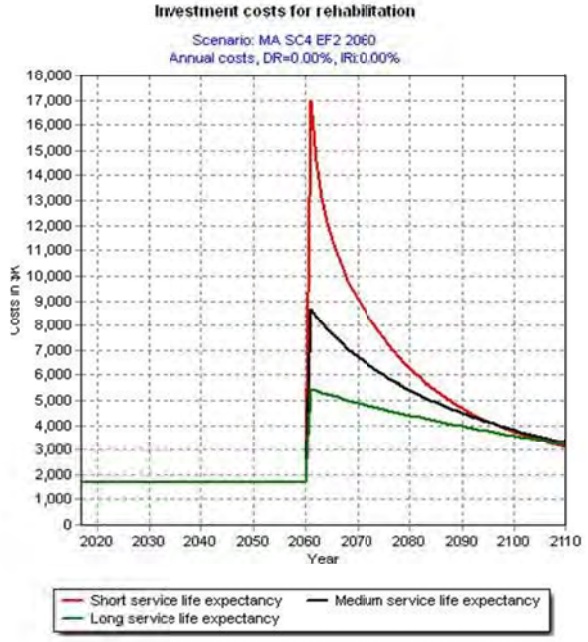

Investment costs for rehabilitation
Scenario: MA SC4 EF2 2060
Annual costs, DR=0.00%, IR=0.00%
Year
Short service life expectancy
Medium service life expectancy
Long service life expectancy

Figure 38 MA Scenario 4 – R&R Length, Break Rate and Investment Cost

Aquarion Water Company of Massachusetts
DPU 17-90

List of Revisions to Exhibits 2, 3, 5 and 6

Exhibit / Schedule	Schedule Title	Description of Revision	Impact in $	Data Request References
Exh 2 Sch 1	Statement of Income at Present and Proposed Rates	Amounts revised automatically due to changes in other schedules in Exhibits 2, 3, 5 and 6	-	
Exh 2 Sch 2	Summary of Pro Forma Adjustments to Operating Expenses	Amounts revised automatically due to changes in other schedules in Exhibit 2	(190,666)	
Exh 2 Sch 3	Salaries and Wages	Current annualized wages revised to reflect known changes	83,000	AG-4-12;
Exh 2 Sch 4	Group Medical, Life and Disability	Pro Forma amounts reflect the most recent known updates on premiums and employee contributions	31,900	AG-6-9 and Attachment; AG-4-7
Exh 2 Sch 5	Post Retirement Healthcare & Pension	Revised cash contributions for Pension and OPEB	(229,042)	AG-6-11 and Attachment; AG-4-16
Exh 2 Sch 6	Amortization of Deferred Expenses	Updated deferred pension and OPEB for 2017	(69,068)	AG-4-18
Exh 2 Sch 7	Outside Services-Communications	No change	-	
Exh 2 Sch 8	Chemicals (2 pages)	No change	-	AG-4-1
Exh 2 Sch 9	Purchased Electric (3 pages)	Purchased electric amounts revised to reflect the most recent known changes	(22,098)	AG-4-6; AG-4-22
Exh 2 Sch 10	Rate Case Expense & Cost of Service Study	Amount increased to reflect fee for Attorney General consultant	7,260	DPU-5-11; DPU-5-12 and Attachment A
Exh 2 Sch 11	Corporate Insurance	Updated insurance premium for the 12 months ending December 31, 2018	20,976	DPU-6-23 and Attachment; AG-4-4
Exh 2 Sch 12	Corporate Expenses (2 pages)	Corporate savings of $3,000	(3,000)	DPU-2-16
Exh 2 Sch 13	Shared IT Services	Amount of software maintenance revised; Customer counts used to allocate such costs revised and are consistent with Exhibit 2 Schedule 12	(13,329)	DPU-2-16; AG-5-10; AG-5-21; DPU-2-9
Exh 2 Sch 14	Shared Customer Services	Total shared labor amount revised to reflect 2017 actual; Customer counts used to allocate such costs revised and are consistent with Exhibit 2 Schedule 12	(12,642)	DPU-2-16
Exh 2 Sch 15	Shared Office Costs	Amounts revised automatically due to revisions in allocated building labor (IT/CS) linked from Exh 2 Sch 13&14	(2,817)	
Exh 2 Sch 16	Payroll & Benefit Allocations	Amounts revised automatically due to revisions in allocated customer service/collections and allocated IT linked from Exh 2 Sch 13&14	(7,575)	DPU-2-14; AG-5-11
Exh 2 Sch 17	Goodwill Fire Charge Credits	No change	-	
Exh 2 Sch 18	Purchased Water	To reflect the current price per CCF	15,039	AG-4-24; AG-5-12; AG-7-10; AG-7-11
Exh 2 Sch 19	Tangible Property Regulation Credit	No changes	-	
Exh 2 Sch 20	Legal Expense	Pro Forma amount reduced by $14,000 to reflect savings from using new parent resource	(14,000)	DPU-7-2;
Exh 2 Sch 21	Rent Expense	No change	-	
Exh 2 Sch 22	Uncollectibles	Amounts revised automatically due to revisions in revenue increase from Exh 2 Sch 1	(386)	
Exh 2 Sch 23	Unadjusted Test Year Expenses	GDP Chained Price Index for rate year revised due to abeyance	25,116	DPU-6-19 and Attachment;
Exh 2 Sch 24	Depreciation (2 pages)	Amounts revised automatically due to revision in Exh 5 Sch 2 for the Charlton Street, Oxford main replacement project cost being finalized	3,814	
Exh 2 Sch 25	Property Taxes (3 pages)	No change	-	

Aquarion Water Company of Massachusetts
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List of Revisions to Exhibits 2, 3, 5 and 6

Exhibit / Schedule	Schedule Title	Description of Revision	Impact in $	Data Request References
Exh 2 Sch 26	Sewer Usage Charge (2 pages)	No change	-	
Exh 2 Sch 27	Payroll Taxes	Amounts revised automatically due to revisions in Exh 2 Sch 3 Salaries and Wages	5,339	
Exh 2 Sch 28	State Income Taxes	Amounts revised automatically due to revisions in other worksheets	(2,777)	
Exh 2 Sch 29	Federal Income Taxes	Amounts revised automatically due revisions in other worksheets and change of federal rate from 34% to 21%,	(117,323)	AG-5-17;
Exh 3 Sch 1	Treatment Plant Operating Lease	Amounts revised automatically due to changes in WACC, gross up factor and tax rate	(3,438)	
Exh 3 Sch 2	Treatment Plant Operating Costs	Page 1 of 6: Summary of Operating Costs - Amounts revised automatically due to changes on pages 3 and 6 in the same schedule	(32,793)	
		Page 2 of 6: Property Tax - No change	-	
		Page 3 of 6: Heating Expense - data replaced with 2017 actuals	12,403	AG-4-3 and Attachment
		Page 4 of 6: Waste Disposal - No change	-	
		Page 5 of 6: Chemicals - No change	-	
		Page 6 of 6: Power - heading "Exhibit No. 3, Schedule 6" revised to "Exhibit No. 3, Schedule 2"; data replaced with 2017 actuals	(44,000)	AG-6-6 and Attachment; AG-4-2; AG-6-6
Exh 5 Sch 1	Rate Base	Amounts revised automatically due to changes in other worksheets	244,605	
Exh 5 Sch 2	Rate Base	Amount for Charlton Street, Oxford Main Replacement was revised to reflect final cost; amount for Pro forma O&M expenses was revised automatically due to revisions in other worksheets	244,605	
Exh 6 Sch 1	Capital Structure and Cost of Capital	S/T debt excluded from the capital structure resulting in an increase of 24 bps in weighted cost of capital	0.24%	AG-6-4;

Statement of Income at Present and Proposed Rates

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 1
Page 1 of 1

Line No.	Schedule Reference No.	Schedule Title	Test Year Ended 12/31/2016	Adjustment	Present Rates	Pro Forma Adjustment	Pro Forma
1							
2	Exh4 Sch 1	Operating Revenues	$ 16,054,888	$ (93,994)	$ 15,960,894	$ 2,121,117	$ 18,082,012
3							
4	Exh 2 Sch 2	Operating Expenses	$ 8,209,229	$ (196,724)	$ 8,012,505	$ 3,636	$ 8,016,141
5	Exh 3 Sch 1&2	Operating Expenses-Plant	3,567,602	5,259	3,572,861		3,572,861
6		Merchandising & Jobbing Income	(56,854)	$0	($56,854)		(56,854)
7							
8	Exh 2 Sch 24	Depreciation	1,821,208	186,265	2,007,473		2,007,473
9							
10		Taxes:					
11	Exh 2 Sch 25,26	Property	465,813	38,191	504,004		504,004
12	Exh 3 Sch 2	Property-Plant	606,104	(1,702)	604,402		604,402
13	Exh 2 Sch 16, 27	Payroll	177,249	15,569	192,818		192,818
14							
15	Exh 2 Sch 28	State Income Tax	(410,589)	281,465	(129,124)	169,399	40,275
16	Exh 2 Sch 28	Deferred State Income Tax	323,725	(301,457)	22,268	-	22,268
17	Exh 2 Sch 29	Federal Income Tax	(1,989,019)	1,474,494	(514,525)	409,098	(105,426)
18	Exh 2 Sch 29	Deferred Federal Income Tax	1,633,973	(1,383,776)	250,197	-	250,197
19							
20							
21		Total Revenue Deductions	$ 14,348,441	$ 117,584	$ 14,466,025	$ 582,133	$ 15,048,158
22							
23		Utility Operating Income	$ 1,706,447	$ (211,578)	$ 1,494,869	$ 1,538,984	$ 3,033,853
24							
25		Non-Operating Income					
26		Other Non-Operating Income	$ (102,986)	$ 28,851	$ (74,135)		$ (74,135)
27		AFUDC	(90,723)	90,723	-		-
28							
29		Total Non-Operating Income	$ (193,709)	$ 119,574	$ (74,135)	$ -	$ (74,135)
30							
31		Gross Income	$ 1,900,156	$ (331,152)	$ 1,569,004	$ 1,538,984	$ 3,107,988
32							
33		Deductions from Gross Income					
34		Interest on Long Term Debt	$ 1,105,561	$ 94,795	$ 1,200,356		$ 1,200,356
35		Misc Income Deductions	36,868	(36,868)	-		-
36		Amortization of Debt Discount & Expense	25,391	(25,391)	-		-
37							
38		Total Deductions from Gross Income	$ 1,167,820	$ 32,536	$ 1,200,356	$ -	$ 1,200,356
39							
40		Net Income	$ 732,336	$ (363,688)	$ 368,648	$ 1,538,984	$ 1,907,632

Summary of Pro Forma Adjustments to Operating Expenses

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 2
Page 1 of 1

Line No.	Adjustment Title	Supporting Schedule	Test Year Amounts	Adjustment Amounts	Pro Forma Amounts
1					
2	Salaries & Wages	3	$ 1,607,990	$ 263,584	$ 1,871,574
3					
4	Group Medical, Life and Disability	4	386,730	80,687	467,417
5					
6	Post Retirement Healthcare & Pension	5	344,235	(35,193)	309,042
7					
8	Amortization of Deferred Expenses	6	52,171	137,237	189,408
9					
10	Outside Services-Communications	7	418,521	(334,521)	84,000
11					
12	Chemicals	8	102,574	(6,470)	96,104
13					
14	Purchased Electric	9	452,065	(29,475)	422,590
15					
16	Rate Case Expense & Cost of Service Study	10	19,877	65,983	85,860
17					
18	Corporate Insurance	11	271,515	27,393	298,908
19					
20	Corporate Expenses	12	115,184	(3,543)	111,641
21					
22	Shared IT Services	13	518,229	(8,453)	509,776
23					
24	Shared Customer Services	14	195,035	13,256	208,291
25					
26	Shared Office Costs	15	98,725	(935)	97,790
27					
28	Payroll & Benefit Allocations	16	616,502	(33,381)	583,121
29					
30	Goodwill Fire Charge Credits	17	23,553	(23,553)	-
31					
32	Purchased Water	18	496,922	(260,508)	236,414
33					
34	Tangible Property Regulation Credit	19	-	(6,722)	(6,722)
35					
36	Legal Expense	20	205,395	(184,323)	21,072
37					
38	Rent Expense	21	51,496	1,654	53,150
39					
40	Uncollectibles	22	12,169	15,191	27,360
41					
42	Unadjusted Test Year Expenses	23	2,220,341	125,368	2,345,709
43					
44	Total Pro Forma Adjustments		$ 8,209,229	$ (196,724)	$ 8,012,505
45					
46	Uncollectibles	22		3,636	
47					
48	Total Pro Forma Adjustments at Proposed Rates			$ (193,088)	

Salaries & Wages

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 3
Page 1 of 1

Line No.	Description	Current Annualized Wages	Increase	Pro forma Wages
1				
2				
3	**Purpose and Description:** The Company's payroll includes 20 full time employees. Pro forma payroll reflects ~~current~~ wages as of ~~April~~ December 2017~~,~~ ~~increased by 3% for Millbury union employees effective August 1, 2017~~ and a 3% increase for employees effective April 1, 2018 (August 1, 2018 for Millbury union employees). Pro forma overtime is test year overtime increased by 3% for April 2017 and 3% for April 2018. ~~Test year overtime is increased by 3% for the associated increases~~.			
4				
5				
6				
7				
8	Non union wages	$ 501,187	3% (Apr '18)	$ 516,223
9				
10	Union Wages - Hingham	878,509	3% (Apr '18)	904,864
11				
12	Union Wages - Millbury	280,176	~~3% (Aug '17)~~ 3% (Aug '18)	288,581
13				
14	Overtime, Shift Differential	251,541	3% (Apr '17) 3% (Apr '18)	266,860
15				
16				
17				
18	Gross Payroll	$ 1,911,413		$ 1,976,528
19				
20	Amount charged to expense			94.69%
21				
22	Pro forma wages charged to expense			$ 1,871,574
23				
24	Amount charged to expense during the test year			1,607,990
25				
26	Pro Forma Adjustment			$ 263,584
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				

Group Medical, Life and Disability

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 4
Page 1 of 1

Line No.	Description	Pro Forma Expense	Test Year Expense	Adjustment Amount
1				
2				
3	**Purpose and Description:** The following adjustment calculates the annual insurance premiums effective January 1, ~~2017~~ 2018 for Tufts Medical ~~escalated by 6.7% consistent with assumed cost increases per the 2017 Segal Health Plan Cost Trend Study~~. CIGNA dental expense reflect test year levels. Life and Long Term Disability reflects premiums effective January 1, 201~~7~~8.			
4				
5				
6				
7				
8	**Group Medical and Dental**			
9				
10	Tufts Medical	$ 536,850		
11	Dental - CIGNA	22,631		
12		$ 559,481	$ 451,045	
13	Employee Contribution	(75,690)	(49,937)	
14		$ 483,791	$ 401,108	
15	Percent to Expense	94.69%	94.69%	
16	Total Group, Medical, Prescription and Dental	$ 458,102	$ 379,809	$ 78,293
17				
18				
19	**Life Insurance**			
20	Calculated Amount based on Wage Levels and Rates	$ 5,375	$ 3,884	
21	Percent to Expense	94.69%	94.69%	
22	Total Life Insurance	$ 5,090	$ 3,678	1,412
23				
24				
25	**Long Term Disability**			
26	Calculated Amount based on Wage Levels and Rates	$ 4,462	$ 3,425	
27	Percent to Expense	94.69%	94.69%	
28	Total Long Term Disability	$ 4,225	$ 3,243	982
29				
30				
31	**Total Pro Forma Adjustment**			$ 80,687
32				
33				
34				
35				
36				
37				
38				
39				
40				

Post Retirement Healthcare & Pension

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 5
Page 1 of 1

Purpose and Description: The Company is proposing to utilize a four-year average cash contribution for the post-retirement healthcare and pension expenses. In DPU 11-43, the Department derived the pension and post retirement healthcare expenses based on a five-year and four-year average cash contributions, respectively.

Line No.	Description	Pension	Post-Retirement	Total
10	Benefit Expenses	$ 275,674	$ 50,698	$ 326,372
12	Amount Charged to Expense	94.69%	94.69%	94.69%
14	Pro Forma Annual OPEB & Pension Expense	$ 261,036	$ 48,006	$ 309,042
16	Less: Amount Charged to expense during the test year	188,623	155,612	344,235
18	Total Pro Forma OPEB & Pension Adjustment	$ 72,413	$ (107,606)	$ (35,193)

Cash Contributions for the Previous 6-years

Years	Pension	Post-Retirement
2012	$ 789,242	$ 131,890
2013	479,976	140,536
2014	296,034	43,331
2015	-	50,173
2016	343,410	49,965
2017	463,253	59,323
6-Year Average Cash Contribution to Plans	**$ 395,319**	**$ 79,203**
	$ (78,785)	$ (10,537)
5-Year Average Cash Contribution to Plans	**$ 316,535**	**$ 68,666**
	$ (40,860)	$ (17,968)
4-Year Average Cash Contribution to Plans	**$ 275,674**	**$ 50,698**

Amortization of Deferred Expenses

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 6
Page 1 of 1

Purpose and Description: Per the order in DPU 11-43, the Company is permitted to defer the difference between actual pension and post-retirement healthcare expense and those permitted in rates in that proceeding. This adjustment captures the deferrals as of the test year end 12/31/16 as well as those anticipated based upon the average cash contributions to each plan reflected in expenses per Schedules 5. The Company requests a 4 year amortization to capture these costs in rates.

Line No.	Description	Balances as of December 31, 2016 Pension	Post-Retirement	Total
13	Deferred Pension Costs - FAS 87 (deferral in excess of $188,623)	$ 1,360,527	$ -	$ 1,360,527
14	Deferred Post Retirement Healthcare Costs - FAS 106 (deferral in excess of $155,612)		(552,781)	(552,781)
15	Deferred Pension Costs - FAS 87 (deferral in excess of $188,623) Additonal Deferral for 2017	$ 200,905		200,905
16	Deferred Post Retirement Healthcare Costs - FAS 106 (deferral in excess of $155,612) Additional Deferral for 2017		(230,974)	(230,974)
17	Additional 8 months of deferrals estimated based on 2017 activity.	133,937	(153,983)	(20,046)
18				
19	Subtotal	$ 1,695,369	$ (937,738)	$ 757,631
20				
21	Amortization Period	4	4	4
22				
23	Pro Forma Annual Amortization of Deferred Expense	423,842	(234,434)	189,408
24				
25	Less: Amount Charged to expense during the test year	20,556	31,615	52,171
26				
27	Pro Forma Expense	$ 403,286	$ (266,049)	$ 137,237

Purchased Electric

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 9
Page 1 of 3

Line No.	Description	Amount
1		
2		
3	**Purpose and Description:** AWC of Massachusetts has negotiated a lower generation rate for its Millbury and Oxford facilities with a third-party provider. The Company	
4	has adjusted its purchased electric expense to reflect the actual 2017 expense ~~negotiated rated based on test year energy usage~~. Further, the Company has adjusted the	
5	purchase electric expense from the Hingham Municipal Lighting Plant. The remainder of the electric expense is under the Hingham/Hull Treatment Plant (See Exhibit 3,	
6	Schedule 2).	
7		
8		
9	Purchased Electric - National Grid (Millbury & Oxford)	264,717
10	Purchased Electric - Hingham Municipal Light & Power	157,873
11	Total Purchased Electric	$ 422,590
12		
13	Less: Amount Charged to Expense During the Test Year	452,065
14		
15	Pro Forma Adjustment	$ (29,475)
16		
17		
18		
19		
20		
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Purchased Electric

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 9
Page 2 of 3

Line No.	Description												Amount
1													
2													
3	2016	# of Facilities	Customer Charger	Basic Service	kwH Rates < 2000 kwH	kwH > 2000 kwh	Demand Charges	Transition Charge	Transmission Charge	Energy Efficiency Charge	Renewable Energy Charge		
4													
5	G-1 Facilities	11	10.00	0.08550	0.04912	-	-	(0.00042)	0.02401	0.00875	0.00050		
6	G-2 Facilities	3	25.00	0.08550	0.01152	-	8.50	(0.00031)	0.02372	0.00875	0.00050		
7	G-3 Facilities	1	223.00	0.08550	0.01289	0.00536	5.75	(0.00023)	0.02161	0.00875	0.00050		
8													
9	2017	# of Facilities	Customer Charger	Basic Service	On Peak	Off Peak	Demand Charges	Transition Charge	Transmission Charge	Energy Efficiency Charge	Renewable Energy Charge		
10													
11	G-1 Facilities	10	10.00	0.08550	0.05340	-	-	0.00054	0.02297	0.00957	0.00050		
12	G-2 Facilities	4	25.00	0.08550	0.01756	-	8.50	0.00052	0.02211	0.00957	0.00050		
13	G-3 Facilities	1	223.00	0.08550	0.01617	0.00864	5.75	0.00058	0.02059	0.00957	0.00050		
14													
15													
16													
17	**Pro Forma**	**Jan-17**	**Feb-17**	**Mar-17**	**Apr-17**	**May-17**	**Jun-17**	**Jul-17**	**Aug-17**	**Sep-17**	**Oct-17**	**Nov-16**	**Dec-16**	**Totals**
18	**G-1 Facilities**													
19	Amount	3,430	2,956	4,088	6,469	7,197	2,529	2,152	4,895	6,981	6,723	4,917	6,591	**58,927**
20	Basic Service Charge	1,803	1,545	2,125	3,363	3,740	1,278	1,080	2,525	3,623	3,488	2,527	3,407	**30,503**
21	**Total Monthly kwh**	**19,842**	**17,009**	**23,390**	**37,017**	**41,166**	**14,070**	**11,892**	**27,793**	**39,886**	**38,391**	**27,816**	**37,505**	**335,777**
22	Customer Charge	100	100	100	100	100	100	100	100	100	100	110	110	**1,220**
23														
24	**G-2 Facilities**													
25	Amount	14,652	14,227	15,385	10,701	8,675	12,962	13,935	15,421	15,232	14,165	11,050	13,130	**159,534**
26	Basic Service Charge	4,644	4,893	4,836	4,139	3,825	3,630	4,244	4,875	5,079	4,229	6,449	7,836	**58,678**
27	**Total Monthly kwh**	**54,312**	**57,223**	**56,558**	**48,406**	**44,735**	**42,458**	**49,633**	**57,017**	**59,401**	**49,461**	**75,432**	**91,652**	**686,288**
28	**Total Monthly Demand**	**211**	**218**	**218**	**206**	**188**	**246**	**199**	**199**	**199**	**206**	**140**	**138**	**2,368**
29	Customer Charge	100	100	100	100	100	100	100	100	100	100	75	75	**1,150**
30														
31	**G-3 Facilities**													
32	Amount	3,793	4,196	4,000	1,086	3,236	8,191	6,098	3,990	2,578	2,587	2,935	3,567	**46,256**
33	Basic Service Charge	2,026	2,274	2,078	342	1,565	4,874	3,540	2,112	1,214	1,214	1,676	1,872	**24,786**
34	**Total Monthly Demand**	**107.1**	**113.4**	**117.9**	**61.2**	**114.3**	**115.2**	**108.0**	**99.0**	**90.0**	**90.0**	**102.6**	**105.3**	**1,224**
35	**On-Peak kwh**	**9,900**	**11,800**	**11,400**	**1,600**	**8,200**	**21,000**	**14,500**	**13,200**	**7,500**	**8,700**	**10,400**	**10,300**	**128,500**
36	**Off-Peak kwh**	**13,800**	**14,800**	**12,900**	**2,400**	**10,100**	**36,000**	**26,900**	**11,500**	**6,700**	**5,500**	**9,200**	**11,600**	**161,400**
37	**Total Monthly kwh**	**23,700**	**26,600**	**24,300**	**4,000**	**18,300**	**57,000**	**41,400**	**24,700**	**14,200**	**14,200**	**19,600**	**21,900**	**289,900**
38	Customer Charge	223	223	223	223	223	223	223	223	223	223	223	223	**2,676**
39														
40	**Total Month Charge**	**21,874**	**21,378**	**23,473**	**18,256**	**19,107**	**23,683**	**22,186**	**24,305**	**24,791**	**23,475**	**18,901**	**23,288**	**264,717**

Purchased Electric

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 9
Page 3 of 3

Line No.	Description							Amount
1								
2								
3	2016	# of Facilities	Customer Charger	PCA	Small General Service	Demand Charge	Consumption Charge	Transformer Credit
4								
5	G-1 Facilities	8	10.25	0.01500	0.15140	-	-	
6	G-2 Facilities	3	25.00	0.01500		9.00000	0.1220	(0.10000)
7								
8	2017	# of Facilities	Customer Charger	PCA/Energy Charge	Small General Service	Demand Charge	Consumption Charge	
9								
10	G-1 Facilities	7	10.94	0.03680	0.11559	-	-	
11	G-2 Facilities	4	36.86	0.03680		11.98000	0.06050	
12								
13								
14								

	Pro Forma	**Jan-17**	**Feb-17**	**Mar-17**	**Apr-17**	**May-17**	**Jun-17**	**Jul-17**	**Aug-17**	**Sep-17**	**Oct-17**	**Nov-16**	**Dec-16**	**Totals**
16	**G-1 Facilities**													
17	Billed Amount	1,509	1,607	1,390	1,447	983	1,501	2,125	3,600	2,930	1,617	2,036	2,037	**22,782**
18	Small General Service	1,445	1,544	1,327	1,384	919	1,438	1,688	2,898	2,348	1,271	1,973	1,974	**20,209**
19	KWH	**9,547**	**10,195**	**8,763**	**9,141**	**6,073**	**9,499**	**14,600**	**25,072**	**20,314**	**10,993**	**13,034**	**13,039**	**150,270**
20	Customer Charge	72	72	72	72	72	72	77	77	77	77	72	72	**880**
21	Demand Charge	-	-	-	-	-	-	-	-	-	-	-	-	**-**
22	PCA/Energy Charge	143	153	131	137	91	142	537	923	748	405	196	196	**3,801**
23	Prompt Payment Discount	(152)	(162)	(140)	(146)	(99)	(151)	(176)	(297)	(242)	(135)	(205)	(205)	**(2,109)**
24														
25														
26	**G-2 Facilities**													
27	Billed Amount	13,522	12,271	10,067	11,309	7,706	11,109	8,873	16,733	12,772	9,655	10,646	10,400	**135,091**
28	Consumption Charge	12,395	10,659	8,942	9,805	6,721	9,970	5,071	6,776	6,741	5,096	9,818	8,856	**100,848**
29	KWH	**101,151**	**86,879**	**73,133**	**77,048**	**55,088**	**81,724**	**83,818**	**111,994**	**111,415**	**84,228**	**80,474**	**72,592**	**1,019,544**
30	Demand	**93**	**158**	**103**	**153**	**92**	**102**	**102**	**175**	**230**	**171**	**63**	**154**	**1,595**
31	Customer Charge	100.00	100.00	100.00	100.00	100.00	100.00	147.44	147.44	147.44	147.44	100.00	100.00	**1,390**
32	Demand Charge	840	1,423	925	1,379	826	914	1,216	6,593	2,751	2,044	570	1,389	**20,870**
33	PCA/Energy Charge	1,524	1,310	1,100	1,156	826	1,226	3,085	4,121	4,100	3,100	1,207	1,089	**23,843**
34	Prompt Payment Discount	(1,333)	(1,218)	(997)	(1,128)	(765)	(1,098)	(643)	(902)	(964)	(729)	(1,049)	(1,035)	**(11,861)**
35	Transformer Credit	(3)	(3)	(3)	(3)	(2)	(3)	(3)	(3)	(3)	(3)			
36														
37	**Total Month Charge**	**15,030**	**13,877**	**11,457**	**12,756**	**8,689**	**12,610**	**10,998**	**20,333**	**15,702**	**11,272**	**12,682**	**12,437**	**157,873**
38									*					

39 * There was a demand charge adjustment from the previous six months for the Company's Free Street Facility of $4,499.23.
40

Rate Case Expense & Cost of Service Study

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 10
Page 1 of 1

Purpose and Description: The Company's proposed rate case expense is composed of ~~divided into three categories:~~Testimony & Exhibit preparation by the Rates & Regulation department from the Connecticut affiliate, Legal Fees, Cost of Service Study and Attorney General Consultants Expenses. The rate case expenses are normalized over a five year period, which coincides with the Company's average timespan between the Company's previous four rate cases including the current application.

Line No.	Description	Rate Case Expense
10	Preparation and Presentation of Revenue Requirement	
11	Testimony and Exhibits	$ 100,000
12	Legal Fees	233,000
13	Cost of Service Study	60,000
14	Attorney General Consultants - to date	16,300
15	Attorney General Consultants - estimated remaining	20,000
17	Total	$ 429,300
19	Normalization Period (Years)	5
21	Presentation & Legal Annual Normalization	$ 85,860
23	Less: Amount Charged to Expense During the Test Year	$ 19,877
25	Pro Forma Adjustment	$ 65,983

Average Rate Case Interval

Docket Number	Filing Date	Time Diff. (Years)
DPU 95-118	11/16/1995	
DTE 00-105	11/16/2000	5.01
DPU 08-27	5/14/2008	7.50
DPU 11-43	5/13/2010	2.00
DPU 17-90	4/7/2017	6.91
Average Rate Case Interval		**5.35**
Round to the nearest whole number - Use		**5.00**

Corporate Insurance

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 11
Page 1 of 1

Purpose and Description: To adjust Corporate Insurance amounts to reflect actual policy charges as of their respective renewal dates for the twelve months ending December 31, 2018~~7~~.

Line No.	Description	Allocation Method	Renewal Date	Amount
	Insurance Premiums:			
	Property	Insured Property	12/01/17	$ 14,282
	Fiduciary	Employee Count	12/01/17	1,575
	Business Travel	Employee Count	12/01/17	72
	Cyber Liability	Revenues	12/01/17	1,093
	Domestic Comprehensive General Liability	Per individual policy	12/01/17	163,817
	Automobile Insurance	Per individual policy	12/01/17	28,483
	Excess Liability	Gal. Production	12/01/17	31,897
	Administrative Fee	Combined policies	12/01/17	25,935
	Employee Practice Liability	Employee Count	12/01/17	869
	Worker's Compensation	Per individual policy	12/01/17	30,885
	Total Pro Forma Corporate Insurance Expense			$ 298,908
	Actual Test Year Expense			$ 271,515
	Pro Forma Adjustment			$ 27,393

Corporate Expenses

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 12
Page 1 of 2

Line No.	Description		Amount
1			
2			
3	**Purpose and Description:** Where the Company does not have its own dedicated, full-time corporate officers, it obtains shared management resources		
4	from Aquarion Company, the parent company to AWCMA. The allocation percentage for Aquarion Water Company of Massachusetts is based on "The		
5	Massachusetts Formula." This formula initially uses an initial allocation of charges between regulated and non-regulated Aquarion subsidiaries based upon		
6	Revenues, Gross Plant, and Wages. The utility share of costs is then allocated to the individual utilities based on the customer counts from the immediately		
7	preceding calendar year.		
8			
9			
10	**Charges from MUI**		
11	KPMG Internal Audit	$	170,000
12	Howard Woods Internal Audit		20,000
13	PWC Tax		100,000
14	PWC Financial Statement Audit		63,000
15	D&O Insurance		40,602
16	Legal		15,000
17	**Charges from Aquarion**		
18	Labor & Benefits/Taxes		651,034
19	Bank Fees		17,608
20	Outside Services - Audit/Pension/Tax/Insurance		194,659
21	Building Overhead		21,209
22	Miscellaneous		44,568
23			
24	Total Cost pool	$	1,337,680
25			
26	% allocation to AWC-MA (see page 2)		8.57%
27			
28	Pro Forma Corporate Expenses	$	114,641
29	Corporate savings		(3,000)
30			
31		$	111,641
32			
33	Test Year Expense		115,184
34			
35	Pro Forma Expense Adjustment	$	(3,543)
36			
37			
38			
39			
40			

Shared IT Services

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 13
Page 1 of 1

Line No.	Description		Amount
1			
2	**Purpose and Description:** In accordance with the existing service agreement, Aquarion Water Company of Connecticut allocates common Information		
3	Technology operating and maintenance expenses and the rate of return and associated depreciation on shared IT software assets to its subsidiaries based		
4	on the number of customers for each respective utility.		
5			
6			
7			
8			
9	SAP-Return on Investment Allocated per CT Docket 13-02-20	$	558,071
10	SAP-Depreciation per CT Docket 13-02-20		1,859,901
11	906204 IT - SAP Software Maintenance		562,999
12	906001 IT Labor (includes 3% increases at 04/01 2017 and 04/01/2018		877,804
13	906203 IT - SAP License Fees		572,571
14	906002 IT Outside Services		224,049
15	906202 IT - Software Maint		474,182
16	906201 IT - Hardware Maint		121,864
17	906XXX IT - Miscellaneous Expenses		621,794
18			
19	Total Annual Costs	$	5,873,234
20			
21	AWCMA % Share of Costs		8.68%
22			
23	AWCMA % Share of Costs	$	509,776
24			
25	Test year Expense		518,229
26			
27	Pro Forma Adjustment	$	(8,453)
28			
29			
30			
31			
32			
33			
34		**AWC Customers-12/31/2016**	
35	AWCMA	19,626	8.68%
36	AWCNH	9,418	4.17%
37	AWCCT	197,071	87.16%
38	**Total AWC**	**226,115**	**100.00%**
39			
40			

Shared Customer Services

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 14
Page 1 of 1

Line No.	Description	Amount
1		
2	**Purpose and Description:** All Aquarion Water Company utility subsidiaries use Aquarion Water Company of Connecticut's call center for customer	
3	service and collections activities. As such these costs are incurred on the books of AWCCT and then allocated to the subsidiaries based on customer	
4	counts[1]. The adjustment here, in accordance with the service agreement, allocates shared customer labor after the appropriate wage increases for	
5	04/2017 and 04/2018.	
6		
7		
8		
9		
10	AWC-CT Shared Customer Service/Collections Labor	$ 2,214,896
11	Increases effective 04/01 2017~~1~~ and 2018~~2~~	134,887
12	Adjusted Total	$ 2,349,783
13		
14	% to AWCMA	8.86%
15		
16	Shared costs to AWCMA	$ 208,291
17		
18	Test Year Costs	195,035
19		
20	Pro Forma Adjustment	$ 13,256
21		
22		
23		
24		
25		
26		
27		
28		
29		
30	**AWC Customers-12/31/2016**	
31	AWCMA 19,626 8.86%	
32	AWCNH[1] 4,709 2.13%	
33	AWCCT 197,071 89.01%	
34	**Total AWC 221,406 100.00%**	
35		
36		
37		
38	[1]AWCNH incoming customer service calls are placed directly to the NH office. As such the customer service labor by CT employees on behalf	
39	of NH customers is limited. Therefore the customer count for AWCNH in the above allocation formula is reduced to 50%.	
40		

Shared Office Costs

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 15
Page 1 of 1

Line No.	Description	Lindley St Operations Center	Main St Corporate Office	Monroe Take Customer Service/IT	
1					
2	**Purpose and Description:** In accordance with the existing Service Contract, AWCCT allocates costs associated with common facilities to the respective				
3	subsidiaries based on the time charged/allocated by the employees from those facilities. The following pro forma adjustment adjusts AWCMA's allocation based on				
4	the 2016 costs of running the respective facilities.				
5					
6					
7					
8					
9	**Calculation of Hourly Building overhead rate**				
10	Cost Pool (AWCCT books)				
11	Depreciation	$ 242,355	$ 43,948	$ 133,291	
12	Property Taxes	115,093	60,052	60,071	
13	Return on Investment	972,974	102,266	597,263	
14	Operation & maintenance Expenses	590,350	234,245	443,198	
15	Total Annual Costs	$ 1,920,772	$ 440,511	$ 1,233,823	
16	Assumed Hours from Above	9,010,244	2,124,194	5,528,674	
17	Total Hourly Building Cost	21.32%	20.74%	22.32%	
18					
19					
20	**Calculation of Building Overhead Charge**				
21	Building Labor Charged	$ 115,532	$ 46,650	$ -	
22	Building Labor Allocated (IT/CS)			$ 284,481	
23	Total Labor per Building for MA Activities	$ 115,532	$ 46,650	$ 284,481	
24	Overhead Rate	21.32%	20.74%	22.32%	
25	Building Overhead	$ 24,629	$ 9,674	$ 63,487	$ 97,790
26	Building Overhead in Test Year	26,187	10,013	62,525	98,725
27	Pro Forma Building Overhead	$ (1,558)	$ (339)	$ 962	$ (935)
28					

Payroll & Benefit Allocations

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 16
Page 1 of 1

Line No.	Description		Amount
1			
2	**Purpose and Description**: AWCMA receives the benefit of services from AWCCT. While the labor is charged to AWCMA directly or via allocation (see		
3	Schedules 13 & 14), benefits and payroll taxes must be allocated. The Company proposes no change to the level of direct support from AWCCT, other than		
4	for the wage increases consistent with those in Schedule 3. A pro forma adjustment is required to correct the level of benefits and taxes charged to AWC-MA		
5	during the test year.		
6			
7	**Direct Labor**		
8	CT Direct Expense Labor from Test Year		$ 242,973
9	3% increases effective April 1, 2017 and April 1, 2018	A	14,797
10	Pro Forma CT Labor		$ 257,770
11			
12	**Benefits and Payroll Taxes**		
13	Direct Labor from CT Employees		$ 257,770
14	Allocated Customer Service/Collections labor		208,291
15	Allocated IT labor		76,190
16	Total Labor Pool		$ 542,251
17			
18	CT Benefit Rate for Test Year		60.00%
19	Allocated Benefits		$ 325,351
20	Benefits Allocated in Test Year		373,529
21	Pro Forma Adjustment	B	$ (48,178)
22			
23	CT Payroll tax Charge for Test Year		8.00%
24	Payroll Taxes to Allocate		$ 43,380
25	Payroll Taxes Allocated in Test Year		48,267
26	Pro Forma Adjustment	C	$ (4,887)
27			
28	Total Operating & Maintenance Expense Adjustment (A + B)		**$ (33,381)**
29	Total Other Taxes Adjustment (C)		**$ (4,887)**
30			
31			
32			
33			
34			
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40			

Purchased Water

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 18
Page 1 of 1

Line No.	Description	CCF	Rate	Pro Forma Expense
1				
2	**Purpose and Description:** To reflect the appropriate purchase water costs from the Company's Test Year.			
3				
4				
5				
6				
7				
8	City of Worcester Purchased Water - 2016	60,156	$ 3.93	$ 236,414
9				
10	Test Year Expense			496,922
11				
12	Pro Forma Adjustment			(260,508)
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
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37				
38				

Legal Expense

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 20
Page 1 of 1

Line No.	Description	Amount
1		
2		
3	**Purpose and Description:** The pro forma legal cost reflects a three year average for general legal expenses, excluding litigation expenses relating to the	
4	Hingham and Oxford Takeover proceedings. The pro forma amount also reflects $14,000 estimated annual savings resulting from utilizing resources from	
5	the parent company Eversource.	
6		
7		
8		
10		
11	Pro Forma Costs for Legal	$ 21,072
12		
13	Total Amount Expensed in the Test Year	205,395
14		
15	Adjustment	$ (184,323)
16		
17		
18		
19		
20		
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Uncollectibles

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 22
Page 1 of 1

Purpose and Description: The following adjustment calculates an uncollectible ratio by dividing net write-offs by total revenues for the three most recent years including the test year. This ratio is then applied to the pro forma revenues in order to derive that portion of revenues that will be deemed uncollectible.

Line No.	Description	Year Ending December 31, 2014	2015	2016	Average
10	Actual Operating Revenue	$ 15,618,343	$ 15,921,335	$ 15,960,894	
12	Net Write-Offs	23,940	47,603	9,893	
14	Net Write-Offs as % of Operating Revenue	0.15%	0.30%	0.06%	0.17%
16	Operating Revenues at Present Rates				$ 15,960,894
18	Pro forma Uncollectibles				27,360
20	Test Year Expense				12,169
22	Adjustment at Present Rates				$ 15,191
25	Adjustment for Pro Forma Revenue Increase				
27	Pro Forma Revenue Increase				$ 2,121,117
29	Net Write-Offs as % of Operating Revenue				0.17%
31	Pro Forma Uncollectibles for Revenue Increase				$ 3,636
33	Total Pro Forma Uncollectibles Adjustment (Line 22 + Line 31)				$ 18,827

Unadjusted Test Year Expenses

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 23
Page 1 of 1

Line No.	Description		Amount
1			
2			
3	**Purpose and Description:** To reflect the impacts of inflation on otherwise unadjusted test year amounts. The adjustment is calculated using the Real GDP Chained Price Index as per the January 2018 ~~February 2017~~ Blue Chip Economic Indicators.		
4			
5			
6	Unadjusted Test Year Expenses	$	2,220,341
7			
8	Less:		
9	Postage Expenses	$	45,201
10	Auto Mileage Reimbursement		12,644
11	Gen. & Admin Business Meals		14,308
12	Office Supplies & Materials		1,474
13	O&M Expenses Not Subject to Inflation	$	73,627
14			
15	Residual Unadjusted Test Year Expenses	$	2,146,714
16			
17	Total Amount Expensed during the test year		5.84%
18			
19	Pro Forma Adjustment	$	125,368
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

GDP Chained Price Index	
2Q 2016	111.3
2Q 2019	117.8
Increase	6.50
Increase %	5.84%

Depreciation

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 24
Page 1 of 2

Line No.	Account Number	Account Description	Plant Balance 12/31/16	Pro Forma Additions		Pro Forma Retirements	Pro Forma Utility Plant	Depreciation Rates	Depreciation Expense
1									
2									
3									
4									
5		*Source of Supply Plant*							
6	301	Organization	$ 82,595				$ 82,595		$ -
7	310	Land & Land Rights (Supply)	168,756				168,756		-
8	311	Structures & Improvements	792,023				792,023	2.74%	21,684
9	312	Collecting & Impounding Reservoirs	153,822				153,822	1.72%	2,639
10	313	Lake, river and other intakes	1,109				1,109	3.55%	39
11	314	Wells & Springs	5,946,854				5,946,854	1.73%	102,808
12	316	Supply Mains	1,166,910				1,166,910	1.21%	14,171
13	317	Other Water Source Plant	707,656				707,656	3.39%	23,991
14			$ 9,019,724	$ -		$ -	$ 9,019,724		$ 165,333
15		*Pumping Plant*							
16	320	Land & Land Rights (Pumping)	$ 58,597				$ 58,597		$ -
17	321	Structures & Improvements	2,005,570				2,005,570	2.96%	59,416
18	325	Electric Pumping Equipment, Booster	1,976,627				1,976,627	7.99%	157,932
19	328	Other Pumping Equipment	117,646				117,646	3.31%	3,898
20			$ 4,158,440	$ -		$ -	$ 4,158,440		$ 221,247
21		*Water Treatment Plant*							
22	330	Land & Land Rights (Treatment)					$ -		$ -
23	331	Structures & Improvements	$ 5,391,326				5,391,326	2.69%	144,813
24	332	Water Treatment Equipment	3,623,620				3,623,620	5.76%	208,874
25			$ 9,014,946	$ -		$ -	$ 9,014,946		$ 353,687
26		*Transmission & Distribution Plant*							
27	340	Land & Land Rights (T & D)	$ 16,492				$ 16,492		$ -
28	34l	Structures & Improvements	217,634				217,634	2.40%	5,214
29	342	Distribution Reservoirs & Standpipes	496,218				496,218	1.82%	9,031
30	343	Transmission & Distribution Mains	36,403,431	$ 1,309,067		$ (59,684)	37,652,814	1.42%	535,687
31	345	Services	7,480,284				7,480,284	2.38%	178,031
32	346	Meters	2,406,296				2,406,296	8.33%	200,444
33	347	Meter Installation	672,540				672,540	2.39%	16,048
34	348	Hydrants	595,134				595,134	1.66%	9,867
35	349	Other T & D Plant	895,310				895,310	11.33%	101,458
36			$ 49,183,339	$ 1,309,067		$ (59,684)	$ 50,432,722		$ 1,055,780
37									
38									
39									
40									

Depreciation

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 24
Page 2 of 2

Line No.	Account Number	Account Description	Plant Balance 12/31/16	Pro Forma Additions		Pro Forma Retirements	Pro Forma Utility Plant	Depreciation Rates	Depreciation Expense
1									
2									
3									
4									
5		*General Plant*							
6	389	Land & Land Rights(General)							
7	390	Structures & Improvements	$ 590,511				$ 590,511	5.05%	$ 29,798
8	391	Office Furniture & Equipment	148,562				148,562	4.51%	6,697
9	391H	Computer Hardware	252,507				252,507	20.00%	50,501
10	391S	Computer Software	870,209				870,209	20.00%	174,042
11	392	Transportation Equipment	656,206				656,206	19.74%	129,535
12	393	Stores Equipment	20,025				20,025	8.13%	1,627
13	394	Tools, Shop & Garage Equipment	295,598				295,598	3.58%	10,591
14	395	Laboratory Equipment	36,005				36,005	3.63%	1,307
15	396	Power Operated Equipment	113,867				113,867	14.30%	16,283
16	397	Communications Equipment (non-telephone)	124,582				124,582	6.63%	8,259
17	398	Miscellaneous Equipment	117,872				117,872	4.89%	5,760
18			$ 3,225,944	$ -		$ -	$ 3,225,944		$ 434,400
19									
20			$ 74,602,394	$ 1,309,067		$ (59,684)	$ 75,851,777		$ 2,230,447
21									
22		Less Depreciation on CIAC Property	$ 15,672,570				$ 15,672,570	1.42%	222,974
23									
24		Pro Forma Depreciation Expense							$ 2,007,473
25									
26		Test Year Depreciation							$ 1,821,208
27									
28		Pro Forma Adjustment							$ 186,265
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

Payroll Taxes

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 27
Page 1 of 1

Purpose and Description: Adjust payroll taxes based on pro forma adjustments made to wages .

Line No.				Medicare	FICA	FUTA	SUTA	Workforce Training	MA State Health Fee	Total Payroll Taxes
8	**Tax Base Calculation:**									
9	Total Pro Forma Payroll	$	1,976,528							
10	Add: Incentive Compensation		53,563							
11										
12	Medicare Tax Base	$	2,030,091	2,030,091						
13	Less: Non-taxable wages over Limit		(104,859)							
14	FICA Tax Base	$	1,925,232		1,925,232					
15										
16	FUTA tax base ($7,000 * 20 emp.)					140,000				
17										
18	SUTA tax base ($15,000 * 20 emp.)						300,000			
19										
20	Workforce Training / Health Fee ($15,000*20 emp)							300,000	300,000	
21	**Tax base**			$ 2,030,091	$ 1,925,232	$ 140,000	$ 300,000	$ 300,000	$ 300,000	
22										
23	**Tax rate**			1.45%	6.20%	0.60%	1.83%	0.56%	0.34%	
24										
25	**Pro Forma Taxes**			$ 29,436	$ 119,364	$ 840	$ 5,478	$ 1,680	$ 1,020	$ 157,818
26										
27	**Percentage applicable to expense**									94.69%
28										
29	**Pro Forma Payroll Tax Expense**									$ 149,438
30										
31	**Test Year Payroll Tax Expense**									$ 128,982
32										
33	**Adjustment**									$ 20,456

State Income Taxes

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 28
Page 1 of 1

Line No.	Description	Test Year	Present Pro Forma	Proposed Pro Forma
1				
2	Operating Revenues	$ 16,054,888	$ 15,960,894	$ 18,082,012
3	Operating Expenses	(8,209,229)	(8,012,505)	(8,016,141)
4	Operating Expenses-Plant	(3,567,602)	(3,572,861)	(3,572,861)
5	Merchandising & Jobbing Income	56,854	56,854	56,854
6	Depreciation	(1,821,208)	(2,007,473)	(2,007,473)
7	Taxes:			
8	Property	(465,813)	(504,004)	(504,004)
9	Property-Plant	(606,104)	(604,402)	(604,402)
10	Payroll	(177,249)	(192,818)	(192,818)
11	Other Non-Operating Income	102,986	74,135	74,135
12	AFUDC	90,723	-	-
13	Deductions from Gross Income			
14	Interest on Long Term Debt	(1,105,561)	(1,200,356)	(1,200,356)
15	Misc Income Deductions	(36,868)	-	-
16	Amortization of Debt Discount & Expense	(25,391)	-	-
17		6,625	6,629	6,633
18	Income Before Taxes	$ 297,051	$ 4,093	$ 2,121,579
19				
20	Adjustments			
21	Permanent Items	(6,213)	(6,213)	(6,213)
22	Capitalized Repairs Deduction	(1,421,177)	(1,421,177)	(1,421,177)
23	Excess Flowthough Depreciation	94,233	94,233	94,233
24	Normalized Depreciation	(960,862)	(960,862)	(960,862)
25	Other Timing/Normalized Items	(278,628)	(278,628)	(278,628)
26				
27	Taxable Income (Loss)	$ (2,275,596)	$ (2,568,554)	$ (451,068)
28	Bonus Depreciation	961,137	961,137	961,137
29	State Taxable Income (Loss)	$ (1,314,459)	$ (1,607,417)	$ 510,069
30				
31	Tax @ 8.0%	$ (105,157)	$ (128,593)	$ 40,805
32	Provision to Return Adjustment	(304,902)		
33	Adjust to Books	(530)	(530)	(530)
34	Current State income Tax	$ (410,589)	$ (129,124)	$ 40,275
35				
36	Total Normalized Items	$ (1,239,490)	$ (1,239,490)	$ (1,239,490)
37	Less Bonus Depreciation	961,137	961,137	961,137
38	Net Normalized Items for State	(278,353)	(278,353)	(278,353)
39	State Tax @ 8%	22,268	22,268	22,268
40				
41	Correct Def Tax Liability	3,768,215		
42	State Tax @ 8%	301,457	-	-
43				
44	Total Deferred Taxes	$ 323,725	$ 22,268	$ 22,268
45				

Federal Income Taxes

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 2, Schedule 29
Page 1 of 1

Line No.	Description	Test Year	Present Pro Forma	Proposed Pro Forma
1				
2				
3	Taxable Income per SIT Computation	$ (2,275,596)	$ (2,568,554)	$ (451,068)
4				
5	Add: SIT Current	105,157	128,593	(40,805)
6				
7	Federal Taxable Net Income (Loss)	$ (2,170,439)	$ (2,439,960)	$ (491,874)
8				
9	Federal Tax Rate	35.0%	21.0%	21.0%
10				
11	Current Federal ~~State~~ Tax	$ (759,654)	$ (512,392)	$ (103,294)
12	Provision to Return Adjustment	106,716	-	-
13	Provision to Return Adjustment	(1,333,948)		
14	Adj to Books	(2,133)	(2,133)	(2,133)
15	Current Tax	$ (1,989,019)	$ (514,525)	$ (105,426)
16				
17	Total Normalized Items	$ (1,239,490)	$ (1,239,490)	$ (1,239,490)
18	Less Def State Tax	$ 22,268	$ 22,268	$ 22,268
19	Net Normalized Items for Federal	$ (1,217,222)	$ (1,217,222)	$ (1,217,222)
20	Federal Tax ~~State Tax @ 35%~~	426,028	255,617	255,617
21				
22	Correct Def Tax Liability	$ 3,768,215	$ -	$ -
23	Less Def State Tax	(301,457)	-	-
24	Correct Def Tax Liability for Federal	3,466,758	-	-
25	Fedral Tax	1,213,365	-	-
26				
27	American Flowthrough	(5,420)	(5,420)	(5,420)
28				
29				
30	Total Deferred Taxes	$ 1,633,973	$ 250,197	$ 250,197
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

Treatment Plant Operating Lease

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit No. 3, Schedule 1
Page 1 of 2

Line No.	Description	Amount
1		
2		
3	**Purpose & Description:** The Treatment Plant lease is calculated in two parts. Part one is a fixed amount required for debt service. Part two is variable or	
4	Percentage Rent based upon the volume of water treated by the WTP that exceeds 30 million gallons a month multipied by the 2018 Pecentage Rent	
5	Rate.	
6		
7		
8		
9		
10		
11	Pro Forma Treatment Plant Lease	$ 2,881,239
12		
13	Less: Amount Charged To Expense During Test Year	2,821,531
14		
15	Subtotal	$ 59,709
16		
17	Allowance for Cash Working Capital on Above ($355,257 x 8.00%)	28,421
18		
19	Tax Gross Up on Above	6,560 (1)
20		
21	Total Pro Forma Adjustment	$ 94,690
22		
23		
24		
25		
26		

Note: (1) Calculation for Tax Gross Up

Pro Forma Plant Lease	$	2,881,239
Allowance for Working Capital		12.33%
	$	355,257
Weighted Cost of Equity		4.91%
	$	17,443
Gross Up Factor		1.3785
	$	24,045
Effective Tax Rate		27.28%
	$	6,560

Treatment Plant Operating Costs

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit No. 3, Schedule 2
Page 1 of 6

Line No.	Description	Proforma Annual Expense	Less: Amount Charged to Exp During Test Year		Pro Forma Adjustment
1					
2					
3					
4	Property Tax	$ 604,402	$ 606,104		$ (1,702)
5					
6	Chemicals	300,812	328,033		(27,221)
7					
8	Power (includes power for pumping, a/c and offices)	228,078	272,078		(44,000)
9					
10	Waste Disposal	59,135	106,705		(47,570)
11					
12	Heating	60,739	39,256		21,483
13					
14	Total	$ 1,253,166	$ 1,352,175		$ (99,009)
15					
16	Allowance for Cash Working Capital on Above ($79,993 x 8.00%)				6,399
17					
18	Tax Gross Up on Above			(1)	1,477
19					
20	Total Pro Forma Adjustment				$ (91,133)
21					
22			**Total Operating Costs**	**>>**	**$ 1,261,042**
23					

24	Note: (1) Calculation for Tax Gross Up		
25	Pro Forma Expense	$	648,764
26	Allowance for Working Capital		12.33%
27		$	79,993
28	Weighted Cost of Equity		4.91%
29		$	3,928
30	Gross Up Factor		1.3785
31		$	5,414
32	Effective Tax Rate		27.28%
33		$	1,477
34			
35			
36			
37			

Treatment Plant Operating Costs

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit No. 3, Schedule 2
Page 2 of 6

AQUARION WATER COMPANY OF MASSACHUSETTS- TREATMENT PLANT
SUMMARY OF PROPERTY TAX, PER BOOK COST
AND PROFORMA COST
TEST YEAR: December 31, 2016

Purpose & Description:
Property Tax is calculated by multiplying the current tax rate by the current assessed value.

	2/1/2016 Payment	5/1/2016 Payment	8/1/2016 Payment	11/1/2016 Payment	Tax
Test Year:					
Land/Building	41,139	41,139	41,271	41,271	$ 164,820
Machinery	108,408	108,632	112,122	112,122	441,283
Total					$ 606,104

	Assessed Value	Rate per 1000	CPA Charge	Tax
Pro Forma:				
Land	1,784,600	12.25	2,432	$ 24,293
Building	11,448,200	12.25		140,240
Machinery	35,907,620	12.25		439,868
Total				$ 604,402

Treatment Plant Operating Costs

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit No. 3, Schedule 2
Page 3 of 6

AQUARION WATER COMPANY OF MASSACHUSETTS- TREATMENT PLANT
SUMMARY OF HEATING EXPENSE, PER BOOK COST
AND PROFORMA COST
TEST YEAR: December 31, 2016

Purpose & Description:

Heating expenses reflects mostly 2017 actual expenses except for the last two months. ~~Heat was calculated by using the cost per gallon of the last bill received for heating oil multiplied by the test year quantity used~~.

Test Year

Month	Qty (gal)	$/gal	Total Cost
Jan-16	2,500	1.560	$ 3,900
Feb-16	2,500	1.480	3,700
Mar-16	5,300	1.520	8,056
Apr-16	2,500	1.580	3,950
May-16	2,500	1.760	4,400
Jun-16	-	-	-
Jul-16	-	-	-
Aug-16	-		-
Sep-16	-	-	-
Oct-16	2,500	1.880	4,700
Nov-16	2,500	2.100	5,250
Dec-16	2,500	2.120	5,300
Total	22,800		$ 39,256

Pro Forma

Month	Qty(gal)	$/gal	Total Cost
Jan-17	5,100	2.150	$ 10,965
Jan-17	3,000	2.100	6,300
Feb-17	3,000	2.120	6,360
Mar-17	4,900	2.120	10,388
Apr-17	2,600	2.120	5,512
May-17			-
Jun-17	2,600	2.120	5,512
Jul-17	-		-
Aug-17	-		-
Sep-17	-		-
Oct-17	2,300	2.240	5,152
Nov-16	2,500	2.100	5,250
Dec-16	2,500	2.120	5,300
Total	28,500		$ 60,739

~~*Last Oil Bill Received as of February 14, 2017~~

Massachusetts Retail Heating Oil Prices Season Average $2.41
Information from http://www.mass.gov/eea/energy-utilities-clean-tech/home-auto-fuel-price-info/historical-heating-oil-prices.pdf

Treatment Plant Operating Costs

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit No. 3, Schedule 2
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AQUARION WATER COMPANY OF MASSACHUSETTS- TREATMENT PLANT
SUMMARY OF WASTE DISPOSAL, PER BOOK COST
AND PROFORMA COST
TEST YEAR: December 31, 2016

Purpose & Description:

Waste Disposal is calculated by using a rate of residual produced per million gallons multiplied by the current rate for disposal. Waste Disposal not determined by water pumped was unchanged due to consistent pro forma vendor pricing.

Waste Disposal- Test Year			**Waste Disposal- Pro Forma**		
			Pro Forma Sys Delv 1166.03		
Per Books	$	106,705	Residual Disp	$	33,935
			TTL Tons		498.89
			Tons/MG Sys Del		0.427853486
Per Books	$	106,705	Cost per ton	$	68
			Residual Hauling	$	10,800
			Tons of Residual		679.41
			Tons/Trip		18.87
			Cost per hauling (36)	$	300
			Waste Water Disposal	$	14,400
			Monthly Removal Cost		12
			Cost per Removal	$	1,200.00
			Total	$	59,135

Treatment Plant Operating Costs

Aquarion Water Company of Massachusetts
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Test Year: Twelve Months Ended 12/31/2016
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AQUARION WATER COMPANY OF MASSACHUSETTS- TREATMENT PLANT
SUMMARY OF CHEMICAL USAGE, PER BOOKS COST
AND PROFORMA COST
TEST YEAR: December 31, 2016

Purpose & Description:

Chemicals are calculated by applying the unit or contract prices for each chemical required in water treatment to the total quantities used by the Hingham WTP during the twelve months ended December 31, 2016. The current contract prices used in the following adjustments are those currently in effect.

Chemical Name	WTP USAGE IN POUNDS/GALS	PROFORMA COST PER UNIT WTP	PROFORMA COST WTP
ALUMINUM SULFATE (in Gals)	70,059	$ 0.78500	$ 54,996
SODIUM HYPOCHLORITE (in Gals)	20,086	$ 0.76400	15,346
ZINC ORTHOPHOSPHATE (in Gals)	2,656	$ 3.59000	9,535
HYDROFLUOSILICIC ACID (in Gals)	2,453	$ 2.20900	5,419
POSTASSIUM PERMANGANATE	29,470	$ 2.23000	65,718
SODIUM CARBONATE (SODA ASH)	601,323	$ 0.16610	99,880
LIME	188,545	$ 0.11738	22,130
Anionic Polymer - Gen Floc 620 (Lbs)	3,300	$ 4.12000	13,596
Cationic Polymer - Gen Floc 610 (Lbs)	3,355	$ 4.23000	14,192
	921,247		$ 300,812
		COST PER BOOKS WTP	$ 328,033
		ADJUSTMENT WTP	$ (27,221)

Treatment Plant Operating Costs

Aquarion Water Company of Massachusetts
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Test Year: Twelve Months Ended 12/31/2016
Exhibit No. 3, Schedule 2
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Line No.												
1	**AQUARION WATER COMPANY OF MASSACHUSETTS- TREATMENT PLANT**											
2	**SUMMARY OF POWER (includes power for pumping, a/c and offices), PER BOOK COST**											
3	**AND PROFORMA COST**											
4	**TEST YEAR: December 31, 2016**											
5	**Purpose & Description:**											
6												
7	~~Power is calculated by multiplying the average cost per million gallons pumped by the pro forma plant production.Also this expense has been reduced by the test year Demand Response~~											
8	~~Program~~. Power reflects the actual 2017 results.											
9												
10	**Test Year**	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17			
11	Billed Amount	$ 20,643.75	$ 20,551.00	$ 16,746.13	$ 17,743.56	$ 17,872.29	$ 23,394.55	$ 17,860.29	$ 24,861.15			
12	General Service Demand	$ 17,944.25	$ 17,900.69	$ 14,242.16	$ 15,073.10	$ 15,115.80	$ 20,239.80	$ 9,465.23	$ 13,679.05			
13	KWH	144,200.00	143,850.00	114,450.00	123,550.00	123,900.00	165,900.00	156,450.00	226,100.00			
14	Effective Rate	0.1244400	0.1244400	0.1244400	0.1220000	0.1220000	0.1220000	0.0605000	0.0605000			
15	Customer Charge	$ 25.00	$ 25.00	$ 25.00	$ 25.00	$ 25.00	$ 25.00	$ 36.86	$ 36.86			
16	Demand Charge	$ 2,516.85	$ 2,463.30	$ 2,394.00	$ 2,557.80	$ 2,652.30	$ 2,964.15	$ 3,945.61	$ 4,662.62			
17	PCA/Energy Charge	$ 2,206.26	$ 2,200.91	$ 1,751.09	$ 1,853.25	$ 1,858.50	$ 2,488.50	$ 5,757.36	$ 8,320.48			
18	Prompt Payment Discount	$ (2,048.61)	$ (2,038.90)	$ (1,666.12)	$ (1,765.59)	$ (1,779.31)	$ (2,322.90)	$ (1,344.77)	$ (1,837.86)			
19												
20	MG of Sys Delv	80.980	83.168	79.288	82.801	82.760	110.436	134.044	150.505			
21	$/MG	$ 254.92	$ 247.10	$ 211.21	$ 214.29	$ 215.95	$ 211.84	$ 133.24	$ 165.18			
22												
23	**Test Year**	Sep-17	Oct-17	Nov-17	Dec-17	**Current/Test Year TTL**						
24	Billed Amount	$ 21,825.33	$ 16,911.17	$ 14,882.36	$ 14,786.54	$ 228,078.12						
25	General Service Demand	$ 11,646.25	$ 8,893.50	$ 7,813.58	$ 7,750.05	$ 159,763.46						
26	KWH	192,500.00	147,000.00	$ 129,150.00	$ 128,100.00	$ 1,795,150.00						
27	Effective Rate	0.0605000	0.0605000	$ 0.06	$ 0.06	0.1244400						
28	Customer Charge	$ 36.86	$ 36.86	$ 36.86	$ 36.86	$ 371.16						
29	Demand Charge	$ 4,696.16	$ 3,849.17	$ 3,404.72	$ 3,404.72	$ 39,511.40						
30	PCA/Energy Charge	$ 7,084.00	$ 5,409.60	$ 4,752.72	$ 4,714.08	$ 48,396.75						
31	Prompt Payment Discount	$ (1,637.94)	$ (1,277.96)	$ (1,125.52)	$ (1,119.17)	$ (19,964.65)						
32												
33	MG of Sys Delv	116.450	92.701	81.881	71.011	$ 1,166.03						
34	$/MG	$ 187.42	$ 182.43	$ 181.76	$ 208.23	$ 195.60						
35												
36	**Pro Forma**											
37												
38	System Delivery	1,166.025										
39	Test Year Cost/MG	$ 195.60										
40	Pro Forma Expense	$ 228,078.12										

Rate Base

Aquarion Water Company of Massachusetts
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Test Year: Twelve Months Ended 12/31/2016
Exhibit 5, Schedule 1
Page 1 of 1

Line No.	Description	Test Year Amount	Pro Forma Amount
1			
2			
3	Plant In Service	$ 74,602,394	$ 74,602,394
4	Pro Forma Additions (Sched 2)		1,309,067
5	Pro Forma Retirements (Sched 2)		(59,684)
6	Pro Forma Plant In Service	$ 74,602,394	$ 75,851,777
7			
8	Less: Depreciation Reserve	$ (18,198,293)	$ (18,198,293)
9	Less: Retirements on Pro Forma Additions		59,684
10			
11	Pro Forma Net Plant in Service	$ 56,404,101	$ 57,713,168
12			
13	Less:		
14	Customer Advances	(151,041)	(151,041)
	Water Balance Plan	(219,874)	(219,874)
15	Contributions in Aid of Construction	(12,647,332)	(12,647,332)
16	Deferred Taxes	(7,098,992)	(7,098,992)
17			
18	Add:		
19	Materials & Supplies (Sched 2)	262,603	262,603
20	Cash Working Capital (Sched 2)	1,012,198	987,942
21			
22	**Rate Base**	$ 37,561,662	$ 38,846,473
23			
24			
25			
26	**Pro Forma Return on Net Book Cost Rate Base**		
27			
28			
29		At Present Rates	At Proposed Rates
30			
31	Utility Operating Income	$ 1,569,004	$ 3,107,988
32			
33	Rate Of Return	4.04%	8.00%
34			
35			
36			
37			
38			
39			
40			

Rate Base

Aquarion Water Company of Massachusetts
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Test Year: Twelve Months Ended 12/31/2016
Exhibit 5, Schedule 2
Page 1 of 1

Line No.			
1			
2	**Pro Forma Adjustments to Utility Plant**		
3		**Additions**	**Retirements**
4			
5	Charlton Street, Oxford Main Replacement	1,309,067	59,684
6			
7	Total Pro Formas to Utility Plant	$ 1,309,067	$ 59,684
8			
9	**Pro Forma Working Capital Allowance**		
10			
11	Pro Forma O&M Expenses	$ 8,209,229	$ 8,012,505
12	Ratio	12.33%	12.33%
13	Pro Forma Cash Working Capital	$ 1,012,198	$ 987,942
14			
15	**Materials & Supplies - 13 Month Average**		
16			
17	December	$ 268,615	
18	January	228,592	
19	February	234,107	
20	March	275,426	
21	April	298,511	
22	May	266,092	
23	June	275,737	
24	July	279,965	
25	August	235,031	
26	September	258,233	
27	October	261,377	
28	November	271,023	
29	December	265,667	
30	13 Month Average	$ 262,603	
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

Capital Structure and Cost of Capital

Aquarion Water Company of Massachusetts
DPU 17-90

Test Year: Twelve Months Ended 12/31/2016
Exhibit 6, Schedule 1
Page 1 of 1

Line No.	Type of Capital	Test Year Amount	Adjustments	Pro Forma Amount	Percent	Cost Rate	Total Weighted Cost
1							
2							
3	**Common Equity**						
4	Common Stock	$ 3,757,100		$ 3,757,100			
5	Paid In Capital	1,171,850		1,171,850			
6	Contributed Capital	3,807,650		3,807,650			
7	Retained Earnings	7,642,226		7,642,226			
8	Total Common Equity	$ 16,378,826	$ -	$ 16,378,826	46.79%	10.50%	4.91%
9							
10							
11	**Long Term Debt**						
12	General Mortgage Bonds 7.71% Series	$ 7,000,000		$ 7,000,000		7.82%	
13	General Mortgage Bonds 9.64% Series	1,400,000		1,400,000		10.13%	
14	MA Pollution Abatement Trust Loan 0% Series	1,410,000	(180,000) [1]	1,230,000		0.16%	
15	General Mortgage Bonbs 4.11% Series	9,000,000		9,000,000		4.35%	
16	Total Long Term Debt	$ 18,810,000	$ (180,000)	$ 18,630,000	53.22%	5.81%	3.09%
17							
18	**Total Capitalization**	$ 35,188,826	$ (180,000)	$ 35,008,826	100.00%		8.00%
19							

[1] Principle payment of $180,000 due on August 1, 2017.