

INTRODUCTION and EXECUTIVE SUMMARY

Introduction

WaterTech International has been retained by the Town of North Reading, Massachusetts, to conduct an assessment of water conservation opportunities for some of the town's municipal buildings and schools. The assessment was conducted under the oversight of North Reading's Department of Public Works Superintendent, Mr. Richard Carnevale.

The assessment or Water Conservation Master Plan as part of an overall Draft Environmental Impact Statement or DEIR, which is necessitated by the town's goal to seek connection to the MWRA water supply. The assessment is also part of a general requirement of the water purchasing contract with the town of Andover from whom North Reading purchases 60 to 70% of the current water needs of the town.

The data for the report was collected during the spring and summer of 2014.

EXECUTIVE SUMMARY

The following municipally owned /operated buildings were audited.

- Existing Buildings

North Reading Town Hall

North Reading Police Headquarters

Flint Memorial Library

North Reading Fire Headquarters

L.D. Batchelder Elementary School

E. Ethel Little Elementary School

J. Turner Hood Elementary School

Damon Tavern

DPW Operations Garage

Ipswich River Park Facility

Parks & Recreation Building

Building on the Common

- New Building Construction Review

The Town of North Reading is currently in the final phases of building a new high school and middle school complex. Construction has been ongoing for some time and the plumbing fixtures were specified and installed long before *WaterTech* started analysis for the town. Thus in addition to the review of older existing buildings, *WaterTech International* conducted a review of the new construction documents for the North Reading Middle-High School building currently under construction.

A discussion of each of the fixture types is included along with possible changes that could be made to make the specified fixture more water efficient.

Water

The Town of North Reading Department of Public Services provides water to the town. The Town purchases water from the Town of Andover as needed. At the time of this report, approximately 60 to 70% of the Town's water was purchased from Andover. Each public building is separately metered and billed.

A breakdown of each building's usage (where available) over the past four (2011 - 2014) fiscal years appears in the following table (Chart A) below.

Since each building reviewed in this assessment consumes a wide range of water in the billing three tier groups, the average cost per gallon varies from building to building. Thus Chart A below was included to accurately describe the annual water consumption per building. The chart includes a breakdown of the building metered consumption for fiscal years 2011 thru 2014. An important item shown in Chart A is the average incremental cost per 1000 gallons consumed associated with each building.

Chart A

Building	Annual Fiscal Year Usage (in gallons)				
	2011	2012	2013	2014	FY 2014. \$/K-Gal
<i>North Reading Town Hall</i>	53,000	61,000	74,000	89,000	\$8.77
<i>North Reading Police Department</i>	137,000	48,000	45,000	50,000	\$ 7.70
<i>North Reading Fire HQ</i>	80,000	140,000	150,000	160,000	\$11.89
<i>North Reading Public Library*</i>	-	-	-	73,000**	\$ 7.70***
<i>Parks & Recreation Building</i>	Well Water-	-	-		NA
<i>Ipswich River Park Restroom Facility</i>	-Well Water	-	-		NA
<i>Damon Tavern</i>	4,000	7,000	5,000	6,000	\$7.48
<i>DPW Operation Garage</i>	67,320	97,240	104,720	112,200	\$11.86
<i>L.D. Batchelder Elementary</i>	360,000	310,000	340,000	310,000	\$13.38
<i>E. Ethel Little Elementary</i>	312,000	301,000	298,000	308,000	\$13.37
<i>Hood Elementary</i>	373,000	247,000	360,000	300,000	\$13.32
<i>Building on the Common</i>	53,000	61,000	74,000	80,000	\$8.83
<i>Overall Average \$/ K-gal across Town Buildings</i>					<i>\$10.74</i>

* Water use readings for the Public Library were limited due to inoperable meter. However, usage was recorded to be approximately 200-gals/day after a new meter was installed in mid-October 2014

** Estimated annual consumption based on 60 days of use with new water meter

*** \$/K-gal based on similar annual consumption for the Police Station

Sewer

Although plans are in place for a possible connection to the Greater Lawrence WWT plant in the future, the Town of North Reading does not currently provided town sewage.

Scope of the Report

The purpose and scope of this report is to document existing conditions and evaluate the potential for water conservation opportunities in the selected North Reading Municipal buildings. This water-use assessment includes the review and viability associated with the replacement of fixtures as well as the expected water conservation results derived by a replacement program.

For example;

In compiling the saving potential for a domestic fixture replacement, this report takes into account not only the obvious water saved by the replacement of an old style toilet that may use significantly more water per flush than a new ultra-high efficiency toilets that can use as little as 0.8 to 0.5 gallons per flush. But rather, the report takes into account, where applicable, patterns of use such as location or accessibility of the fixture to public use; number of people likely to use a particular fixture in high traffic areas verses a fixture located in a back office or other not so public location.

In conjunction with the evaluation of the water savings potential associated with a domestic sanitary fixture replacement program, the report also includes the discussions and evaluations of non-domestic water conservation opportunities. Such opportunities can be easily overlooked, yet when implemented, may offer greater water and manpower savings which in most cases results in a cost/gallon saving figure which is significantly lower then a domestic sanitary fixture replacement savings figure.

While we didn't find any such opportunities during our assessment of N. Readings buildings, non-domestic water conservation opportunities reviewed during this evaluation include such items as practices associated with school food preparation areas, one-pass non-contact process cooling water, equipment washing practices and irrigation techniques used at the school sites.

Of the areas evaluated, the following items /areas, were found to have cost- effective water conservation opportunities.

1. The reduction of water use associated with domestic plumbing fixtures. Depending on the particular areas or buildings and also the age and configuration of individual sanitary fixtures, the recommendations include but may not be limited to;
 - Total removal and replacement of toilet and accompanying flushometer valves
 - Urinal valve and or flushing mechanism rebuild or replacement

REPORT PURPOSE AND SCOPE STRATEGY

Purpose

The purpose of providing the water use assessment (audit) for Town of North Reading Municipal Buildings is to establish the feasibility of various water conservation opportunities and measures.

The following is a discussion that is intended to encompass the audit's approach to the final design and implantation of the proposed recommendations. The conceptual design should not be considered final and is presented as a measurement of the viability of implementation.

Toilets

As in other municipal/institutional facilities we have audited, we found several different manufacturers, models and ages of sanitary fixtures installed in the municipal buildings.

The likelihood that a retrofit or replacement recommendation is made depends partially on the value of the conservation opportunities associated with each recommendation and fixture. Therefore, in some cases we may call for a total replacement of a fixture or, in other cases we may suggest a partial rebuild. In some cases, access, frequency of use, the configuration of the plumbing or environmental concerns in the area or plumbing material itself may be such that we may not recommend the retrofit be completed at this time. Conceptually, we envision a town wide domestic fixture replacement program that will encompass a cost effective replacement of toilets bowls, tanks, flushometers, and urinal valves and faucets. Where it is appropriate, we will recommend just the replacement of faucet aerators.

For the most part fixture replacement programs can be accomplished without the replacement or disruption of the water supply or waste lines in the walls, ceiling or pipe chases. Unless a total renovation of a restroom is planned, we do not anticipate the need for the Town to repair floor and or wall tiles as part of a replacement program in the buildings. However there will be cases especially in older buildings such as Damon Tavern and the Building on the Common where the footprint of a new fixture may not match the older fixture's footprint. In most cases some fine steel wool and cleaner can be used to remove as much as of the discoloration as possible on the floors and or walls.

In cases where we may have identified a water conservation opportunity where there may be a need to break into an existing walls floors etc. Our estimated costs includes painting, tiling or other re-work to bring the existing surfaces back to "as found" conditions.

Toilets

When a new porcelain toilet fixture is recommended for installation, depending on the configuration of the existing toilet, the complete cost estimate includes but may not be limited to the following.

1. Residential floor mounted/floor outlet bowl with tank we recommend the replacement with a new 0.8-gpf or 0.5/ 0.8-gpf dual flush unit.
2. Wall hung or floor mounted toilet bowls with flushometer shall be replaced with a 1.28-gpf, porcelain bowl, and 1.28 flushometer with wall stop, tailpiece and spud.

Both installation types would also include new wax or wall seal rings, appropriate fittings, bolts and seats.

Urinals and Urinal Flushing Valves

The report includes a break down of two separate options and cost estimates.

1. Option A, includes just the valve replacement
2. Option B includes the valve and fixture replacement

Both options include the installation of a sensor-activated urinal flush mechanism, which flushes at 0.5-gpf or less depending on urinal manufacture.

Water-Less Urinals

While not as common on the east coast, urinals that do not use water for flushing have become almost commonplace in municipal buildings in California, Arizona and other water starved western states. Waterless urinals are manufactured by several major fixture manufacturers such as Sloan, American Standard and Waterless. They have their place in the conservation arena. However, because the elimination of the water supply line is needed along with some wall work, the use of this type of urinal should only be considered when planning new construction or when a space is under consideration for total renovations. However, careful consideration of the manpower need to do the necessary twice daily swabbing down of the urinal and the cost of replacement cartridges should be compared to fixtures such as the Zurn 1-pint/flush and the American Standard 0.5-gal/flush urinals.

Sinks and Faucets / Aerators

We found most sinks equipped with the standard 2.5-gpm or greater aerators. The installation of tamper resistant 0.5 or 1.0-gpm units is certainly cost effective and an easy to install solution to high flow rates. Where needed, or if new sinks are called for, we will call for the total replacement of faucets. If no replacement faucet is called for, new low-flow (0.5-gpm) rated aerators should be considered the most cost effective implementation strategy.

Suggested Contractor Standards and Requirements

While the town may undertake the installation of some or all of the conservation measures highlighted by this assessment on its own, we should take into consideration that the town may hire an outside contractor to complete the work. A contractor should include and furnish all labor, materials, tools, and equipment to perform a complete installation including, but not limited to the following:

- Replace existing toilets where it is called for with: Ultra low-flow Toto, American Standard, Kohler (or equal) wall hung and floor mounted toilets (color white).
- Where the toilets are configured as residential style (with tanks) floor mounted/ floor or wall outlet toilet with tanks are called for, Niagara Stealth 0.8 and or the 0.5/.08-gpf dual flush ultra-efficient toilets shall be used.
- Flushometers shall be Sloan Optima (or equal) 1.28 gpf flush valves for toilets
- Urinal flush valves shall be Sloan Optima 0.5-gpf or Zurn 1-pint per flush (or equal) valves.
- All Flush valves will include wall stops
- Commercial grade white plastic open front /no cover toilet seats
- Where urinal flush valves rebuild kits are called for, Sloan (or equal) 0.5 gpf urinal rebuild valve kits shall be installed.
- The contractors are required to supply all state and local permits

Implementation Strategy

The replacement of sanitary fixtures requires planning for both mechanical conditions such as shutting off risers and wall stop valves. Because the installation of the fixtures will most likely be completed during the normal town business and or school day, the installation will require the coordination with the building's personnel to assure student / staff comfort during the installation process.

In order to find a standardized solution to calculating savings and to the application of demographic data to water conservation program, WaterTech International, has developed what we call a stipulated savings chart. The information used in the chart is compiled of standards by which many other conservation programs have been implemented throughout the country. Those standards pull information for conservation publications, water conservation publications and US Censor Bureau figures and the US EPA and the American Water Works Association and from specific information for the communities were the conservation programs are to be implemented.

A copy of the "Exhibit A," chart "*Stipulated Savings for the Town of North Reading* is attached for review. The exhibit clearly shows the savings on a per fixture basis and the resultant daily savings that can be expected based on the variables listed on the exhibit for schools and municipal buildings.

While the format for "Exhibit A" has proven to be extremely useful in many water conservation programs we have implemented, it should be understood that not all situations could be put into a box that can be replicated time and time again.

Exhibit A

Stipulated Water Savings for Retrofit Devices, Town of North Reading, Massachusetts

WaterTech International, Inc. 2014

A	B	C	D	E	F	G		I
Fixtures	Years Manufactured Or Installed ¹	Existing Device Usage	Highest Possible Retrofit Device Usage	Retrofit Savings ² (C-D)	Capita Per Household	Usage Rates (Usage per Capita per Household) 1.71 p/household	Gallons Saved Per Capita Per Day ³	Average Daily Savings Per Retrofit ⁸
Toilets	2008 to Present	1.28	0.8	0.48	1.71	4.2 fpd ⁴	2.0	3.45
	1994 - 2008	1.6gpf	1.28	NA	NA	NA	NA	NA
	1980 - 1994	3.5 gpf	1.6gpf	1.9 gpf	1.71	4.2 fpd ⁴	8 gpd	13.6 gpd
	1950 - 1980	5.0 gpf	1.6 gpf	3.4 gpf	1.71	4.2 fpd ⁴	14.2 gpd	24.3 gpd
	Pre 1950	7.0 gpf	1.6 gpf	5.4 gpf	1.71	4.2 fpd ⁴	22.7 gpd	38.8 gpd
Faucets	2008 to Present	1.0	0.5 gpm	0.5 gpm	1.71	8.1 mpd ⁶	4 gpd	6.9 gpd
	1994 - 2008	2.0	1.0 gpm	1 gpm	1.71	8.1 mpd ⁶	8.1 gpd	20.7 gpd
	1980 -1994	2.5	1.0 gpm	1.5 gpm	1.71	8.1 mpd ⁶	12.1 gpd	30.9 gpd
	Pre 1980	3.5	1.0 gpm	2.5 gpm	1.71	8.1 mpd ⁶	20.2 gpd	51.5 gpd
Showerheads	2008 to present	2.0 gpm ⁹	1.5 gpm	0.5 gpm	1.71	5.3 mpd ⁷	2.65 gpd	4.5 gpd
	1994 - 2008	2.5 gpm ⁸	2.00 gpm	0.5 gpm	1.71	5.3 mpd ⁷	2.65 gpd	4.5 gpd
	1980 -1994	3.5 gpm	2.00 gpm	1.5 gpm	1.71	5.3 mpd ⁷	7.9 gpd	13.6 gpd
	Pre 1980	4.3 gpm	2.00 gpm	2.3 gpm	1.71	5.3 mpd ⁷	12.2 gpd	20.9 gpd

See Notes below For Exhibit A above:

1. Handbook of Water Use and Conservation, MWRA Handouts 1992
2. Retrofit Savings = existing device usage – replacement device usage
3. Gallons saved per capita per day = Retrofit savings x Usage Rate
4. Table 2.2 - Handbook of Water Use and Conservation, MWRA, Handouts, 1992
5. Table 2.15 - Handbook of Water Use and Conservation, MWRA Handouts, 1992
6. Table 2.11 - Handbook of Water Use and Conservation, MWRA Handouts, 1992
7. Average Daily savings/household = Gallons saved per Capita per Day
8. Per capita figures based on latest US Census bureau figures as received from the North Reading Town Hall

Standard abbreviations for Exhibits A

gpf = gallons per flush mpd = minutes per day gpm = gallons per minute
cph = capita per household Fpd = flushes per day gpcd = gallons per capita per day

Operational & Maintenance Strategy

Operational issues surrounding the retrofitting of domestic sanitary fixtures are essentially a non-issue. Once the installation is complete, no regular maintenance should be required.

Offset Maintenance Costs

None of the departments included in this study were able to identify a specific value in terms of savings that could be broken out as specific cost offsets that could be identified and documented as a result of ongoing or projected fixture replacement programs.

Annual Equipment Performance Verification

Realistically, other than monitoring building water use on a daily or weekly basis, little can be done to verify the performance of domestic fixtures. Aside from catastrophic product failure, a small leak or improperly operating flush valves can cause a substantial water loss. These leaks can be hard to detect. Thus a water use monitoring program is recommended

We recommend that the North Reading Department of Public Works undertake a concerted effort to foster an aggressive conservation minded attitude in building maintenance personnel for the various departments. We suggest a series of water conservation seminars for maintenance employees be considered.

Town of North Reading
Water Conservation Master Plan
Facility Audits

Selected Building Profiles, Description
&
Water Conservation Opportunities
&
Recommendations

North Reading Town Hall

Building Profile



North Reading Town Hall is a one-story brick structure dating back to the sixties. The building is located on North Street, North Reading, MA.

The building houses many of the town's major administrative departments, such as the Department of Public Works, Center for Conservation and Human Resources.

Town Hall was documented to have 9 toilets, 6 urinals and 10 sinks. A Fixture Count Chart "Figure B" can be found below with locations and counts of the fixtures in the building.

A detailed listing of the locations, quantity, usage, savings and cost related to conservation program specific information for the Town Hall can be found on fold out sheet immediately following the discussion of this building.

Visitors/ Employees

No records are kept as to the number of people visiting Town Hall on a daily basis. However, based on our discussions with Town personnel, a daily average of approximately 40 employees work at the Town Hall and 200 daily visitor count was established.

The lobby area restrooms get the most daily usage. The Town Hall officials reported that kids groups report to the building's gym on average about 6-7 days a week. Thus, the primary usage of lobby area restrooms has been reported to be by daily visitors and children. The approximate male to female ratio for visitors was said to be 40/60. For sake of conservative values we will assume 10% of the 200 daily visitors, use the restrooms.

Water Usage History

Since fiscal year 2011, water consumption at Town Hall both has risen significantly. The usage has changed rather significant over the past few years. In 2011, the usage was approximately 84,000-gals/yr. In 2012 usage dropped to 69,000-gals/yr. In 2013 the consumption level was back to 81,000-gals/yr. Then in fiscal year 2014 water usage rose to an all time high of 89,000-gals/yr.

Recently, in an attempt to meter water consumption more accurately, the incoming water meter was significantly reduced in size to reduce the amount of inaccuracies in the readings.

Figure "A"
North Reading Town Hall Water Consumption History

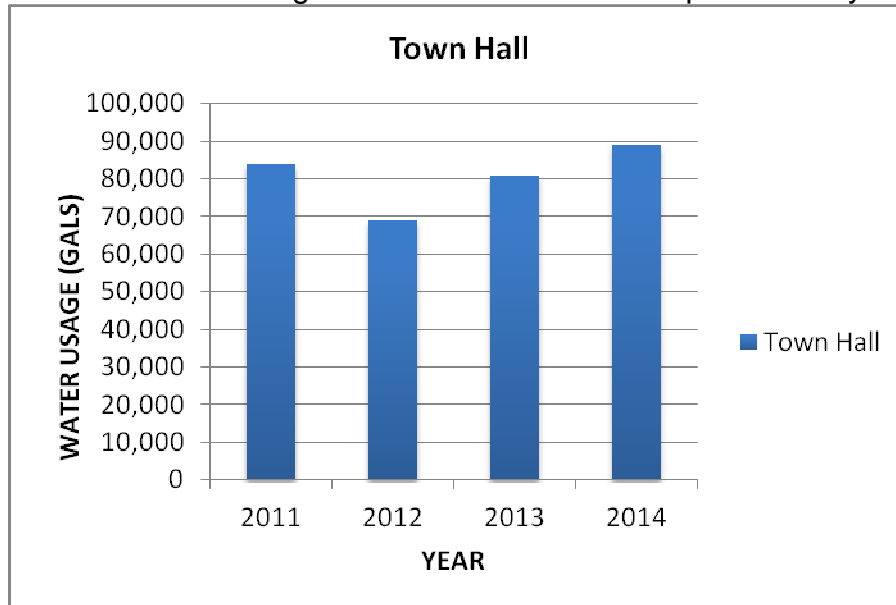


Figure "B"
North Reading Town Hall Fixture Count

<i>Town Hall</i>	<i>Location</i>	<i>Toilets</i>		<i>Urinals</i>	<i>Sinks</i>	<i>Comments</i>
		<i>Quantity</i>	<i>Type</i>			
Lobby Area	Gentlemen	1	3.5gpf	1 (newer body, older head)	1 (2.5 gpm)	
	Ladies	1	3.5gpf	0	1 (2.5 gpm)	
		2	5.0gpf	2	2	
Human Resources	1 st Floor	1	FM/FO w/ LC flush valve	0	1 (2 gpm)	Used by 1 person
Large Ladies Room	1 st Floor	5	(4) @5gpf and 1 @3.5gpf	0	3 (2.5 gpm)	4 of the 5 toilets have LC flush valves
Large Men's Room	1 st Floor	1	3.5gpf	5	2 (3gpm)	Sinks w/o screens, aerators

Recommendations

Restrooms

There are two sets of public restrooms and one private “staff only” restroom in Town Hall. One group of restrooms are located in the front lobby of the building. The second set of restrooms are located midway down the main hallway of the building. Another single toilet restroom is located in the Human Resources Department offices.

The restrooms in the lobby and in mid hallway of Town Hall are used by staff members of the Town Hall as well as the general public that come in to do business with the Town. The location of both the men and ladies rooms within the lobby are also used extensively the children’s groups that frequent the buildings gymnasium for various programs.

The men’s room in the lobby area has one urinal and one toilet. Both appear to have a mixture of either new fixture with old valve body or vise versa. The ladies room in the lobby has two older toilets with older flush valves as well.

The combination of new and old fixtures combined was found to be a fairly common find through-out the town building we reviewed.

The toilets were found to all be floor mounted /floor outlet flushvalve operated toilets.

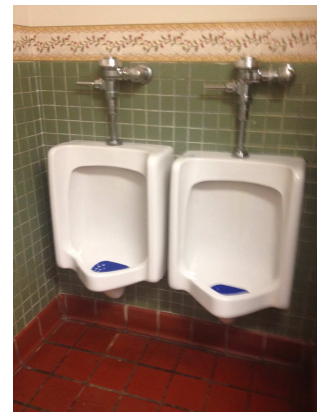


The sinks in the Men’s and Ladies restrooms are equipped with standard 3-gpm aerators. All sink aerators in the lobby restrooms have been tampered with and are missing screens. We recommend that installation on tamper resistant 0.5 gpm aerators.

By installing new tamper resistant 0.5-gpm laminar flow aerators on the new faucets, a significant reduction can be made in the amount of water used.

The installation of the new laminar flow aerators will produce a more precise and shower type flow pattern, washing quality will not be reduced. Water flow will be cut by 80% without increasing washing time.

The urinal valve body flow rates were also found to be turned down to a very small flow, though-out the town’s building as well.



Findings and Recommendation

Savings Calculation

Flow reductions savings can be expressed as follows:

Toilet / Urinal Savings

Employees x m/f ratio x gals saved/fl x use/day

Females	40 x 60% x (3.5-1.28) gal/fl x 3* fl/day =	160.0 gals/day
Male (toilets)	40 x 40% x (3.5- 1.28) gal/fl x 1* fl/day =	35.5 gals/day
Male (urinals)	40 x 40% x 1 gal/fl x 2* fl/day =	32.0 gal/day

* see note 8 Exhibit A, ** see note 6, Exhibit A

Visitors x m/f ratio x % of use x savings/fl x # of usage/day

Fem visitor	200 visitor x 60% x 10% use x (3.5 -1.28)gpf x 1	= 38.5 gal/day
Male (toilets),	200 x 40% x 10% x (3.5-1.28) gal/fl x 1	= 52.2 gal/day
Male (urinals),	200 x 40% x 10 x 1 gal/fl x 1	= 12.3 gal/day

Sink Savings

Employees x m/f ratio x gals saved/fl x use/day x workdays/yr ratio

Female,	40 employees x 60% x 2.0 gpm x 1 min/day	= 48.0gals/day
Male	40 employees x 40% x 2.0 gpm x 1 min/day	= 32.0
gals/day		

Visitors x savings/gpm x # of usage/day x workday/yr ratio

Visitor	200 visitors x 10% use of restroom x 1gpm x 1 use/day =	20 gals/day
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Total Average Daily Savings, Town Hall = 394.5 gals/day

Cost Estimates

Please note that the values shown below were used to generate estimated implementation costs on a per unit basis. They are based on specific manufacturer's products, which are typically used during conservation retrofit programs. The estimated costs represent budget prices based on estimated Davis Bacon wages for the northeast region. The cost unit costs below can be applied to all retrofit programs on-going in the Town of North Reading.

Toilet Retrofit Unit Cost

Sloan Royal Valve	\$ 75
Floor mounted Floor outlet porcelain	\$ 155
Installation	\$ 235
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 8
Toilet seat	\$ 15
Miscellaneous Finish Kits	\$ 35
Total Cost / fixture	\$528

Based on a total fixture count of 11 toilets, the estimated cost to replace the existing toilets at Town Hall is **\$ 5,808.⁰⁰**

Urinal Retrofit Program

Town Hall has a total fixture count of 8 urinals. For most retrofit programs, two options are available when retrofitting urinals.

Retrofit - A, would include a new 0.5-gpf-diaphragm kit for the flush valve and labor to install and test the unit. The existing valve bodies and existing porcelain urinals would remain unchanged.

Retrofit – B, includes all the above but would also include the cost of a new porcelain fixture. 1.0gpf urinals intended as retrofit options are designed to fit over and cover the wall “foot print” of older 3.0 gpf urinals.

Urinal Retrofit–A Unit Cost (recommended)

Sloan Royal 0.5 Urinal Valve Kit	\$ 75
Installation	\$ 80
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 2
Miscellaneous Finish Kits	\$ 5
Total Cost / urinal fixture	\$ 167.⁰⁰

Urinal Retrofit–B Unit Cost (alternative)

Sloan Royal 0.5 Urinal Valve	\$ 175
Wall hung 0.5 Urinal	\$ 325
Installation	\$ 250
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 5
Miscellaneous Finish Kits	\$ 5
Total Cost / urinal fixture	\$ 760.⁰⁰

The estimated cost for the 8 urinals is therefore, **\$1,336** for Retrofit-A and \$6,080 for Retrofit-B, including overhead and profit.

Sinks

Town Hall was found to have a total fixture count of 8 sinks. The retrofit cost would include a new 1.0 gpf female aerator and labor to install and test the unit. The existing faucet bodies and existing sinks would remain unchanged.

Sink Retrofit Unit Cost

Niagara 0.5 female aerators (or equal)	\$ 8
Installation	\$ 1
Permit Cost per fixture	\$ 0
Disposal cost per fixture	\$ 0.50
Miscellaneous adapter Kits	\$ 0.50
Total Cost / sink fixture	\$ 10.⁰⁰

The estimated cost for the 8 sinks is therefore, **\$ 80**, including overhead and profit.

Design/Construction

Very little or no actual design or construction per-say will be required to implement this program at the Town Hall. Each retrofit is completed on a room-by-room basis. The old fixtures are taken off the wall; the new fixtures are taken out of the box and installed on the wall. The old fixtures are placed in the waiting box. The fixtures are then taken to a waiting dumpster.

Other Costs

As in any project, hidden costs can affect the project's viability. During the performance of this assessment, we have strived to identify any potential problems in order to assess how best to deal with or avoid them altogether.

Town Hall Total Costs

Toilet retrofits	\$ 5,808.00
Urinal retrofits	\$ 1,336.00
Sinks	\$ 80.00
<i>Sub-Total</i>	<i>\$ 7,224.00</i>
Contingency (15%)	\$ 1,084.00
<i>Total</i>	<i>\$ 8,308.00</i>

North Reading Police Department

Building Profile



North Reading Police Department located at 150 Park Street, North Reading, MA. The building is built on a sloping grade and from the front door, gives the impression of single story structure.

The police department building was documented to have 15 toilets, 7 of which are stainless steel specialty unit located in the lock-up area. Another toilet (1) is in the Police Chief's private office.

And another 1 urinal and 17 sinks are located in various part of the building. A Fixture Count Chart "Figure B" can be found below with locations and counts of the fixtures in the building.

A detailed listing of the locations, quantity, usage, savings and cost related to conservation program specific information for the Police Department can be found on a data fold out sheet in Section 3 of this report.

Visitors/ Detainees/Employees

No records are kept as to the number of people visiting the Police Station on a daily basis. However, we were given estimates of approximate visitors access to the building and restrooms. The average number of detainee's per week ranges from about 3 to 5, and their estimated length of stay is about 2 days.

Water Usage History

Since the fiscal year 2010, water consumption at the police department significantly dropped for a year then spiked at just over 63,000 CCF in 2012. Here it then remained rather steadily around 50,000 CCF for the next year.

Figure "A"
Water Consumption History

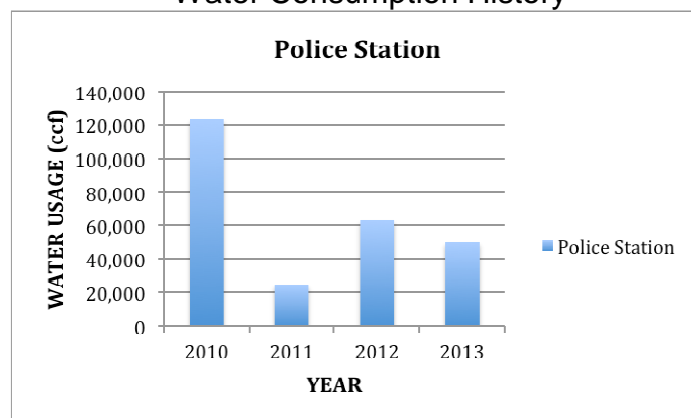


Figure “B”
North Reading Police Department Fixture Count, July 2014

Peabody Police Headquarters	Locations	Toilets		Urinals	Sinks	Comments
		Quantity	Type			
First Floor	Lobby Men	1	3.5	0	1 (0.5)	Old Valve on new fixture
	Lobby Ladies	1	3.5	0	1 (0.5)	Identical to men's
Second Floor	Single Restroom (2)	2	3.5	0	2 (0.5)	Identical to Lobby Restrooms
	Police Chiefs Private bathroom	1	3.5	0	1 (0.5)	
Cell Block	RM20	1	3.5	0	1	Youth Holding Cell
	RM23	0	-	0	1	Also Shower and Eye Wash
	RM003 and RM002	2	3.5	0	2	
	RM004 and RM005	2	3.5	0	2	
	RM09 and RM15	2	3.5	0	2	RM09 Women's cell
Locker Rooms	Women's Locker Room	1	3.5	0	2 (2.5 gpm) and (1.5 gpm)	Handicap Toilet and 1 Double Shower (1.5 gpm) Right hand sink sticks*
	Men's Locker Room	2	3.5	1	2	2 Showers (1.5 & 2.5 gpm)

Recommendations

It should be noted that all savings associated with fixture use by officers would be subject to a multiplier of 3 to take into consideration that the police department is a 24/7 operation. All savings calculations for officer fixture use will be based on the “10 officers at all times” factor.

Lobby Restrooms (moderate use)

The public restrooms located off the lobby of the station are relatively new. The toilets are 1.6-gpf or less fixtures, but strangely the flushvalves are not new but reused 3.5 valve bodies with 1.6-gpf retrofit inserts. A similar situation is present in the women's room near-by.



Public use of the lobby Men's and Women's rooms is moderate. Fixtures in both rooms are similar. Toilets use 1.6 gpf units,

Sinks are also new and have 0.5-gpm aerators already installed. No recommendations are made for the sink aerators. In the police station



Usage for both restrooms was estimated at less than 10 visitor uses per day. The male to female ratio of usage was estimated at 8 men and 2 female visitor/s/day. Usage by officers is estimated at also 10 per day.

By replacing the existing mismatched flush valves, the toilet will be able to flush at its intended design flow rates.

Findings and Recommendation

Savings Calculation

Flow reductions savings can be expressed as follows:

Saving for Lobby

Male (toilets),	10 visitors x .2 x 1.6 gpf x 1 fl/day	=	3.2 gals/day
Female	10 visitors x .8 x 1.6 gpf x 1 fl/day	=	<u>12.8 gals/day</u>
<i>Total Lobby Savings</i>			<i>16.0 gals/day</i>

Staff Restrooms (moderate)

The office staff and officers working the front desk and dispatch room use the front lobby Men's and Ladies rooms as well.

Officers (toilets), 10 staff x 1.6 gal/fl x 3 fl/shift x 3 shifts = 144 gals/day

Chief's Private Restroom

The Chief's restroom fixtures include a 1.6 gpf toilet, and one sink with a flow rate of 0.5 gpm. From all accounts, no one other than the chief uses his private bathroom. No recommendations are put forth for the chief's private restroom

Lower Level

Lock-up (No Recommendations)



The lock-up area in the lower floors houses Men, Women and if the need arises, even Juveniles.

All fixtures in the cells are designed to correctional institutional standards. There are no recommendations that can be offered for the lock-up area.

Men's Locker room

The men's locker room has two 1.6gpf toilets, and 2 showers. The existing showerheads were rated at 1.5 gpm. The urinal's are standard 1.0 gpf units

The two sinks were equipped with 0.5 gpm faucet aerators. No recommendations are offered at this time

Total Savings,:

First Floor	160 gal/day
Lower Floor	0 gal/day
Total Police HQ.	160 gal/day

Total Average Daily Savings, Police HQ 160 gals/day

Costs

Toilet Retrofit Unit Cost

Sloan Royal Valve	\$ 175
Installation	\$ 85
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 1
Toilet seat	\$ 1
Miscellaneous Finish Kits	\$ 0
Total Cost / toilet fixture	\$ 267.⁰⁰

Based on a total fixture count of 2 toilets, the estimated cost to replace the existing toilets flush valves at the Police Station is **\$534.**

Police Station Costs

Toilet retrofits	\$ 534.00
Urinal retrofits	\$ 0.00
Sinks	\$ 0.00
Sub-Total	\$ 540.00
Contingency (15%)	\$ 81.00
Total	\$ 621.00

North Reading Fire Headquarters

Building Profile.

North Reading Fire Headquarters is located on 152 Park Street next to the North Reading Police Station across from the Town Common. A total of 20 firefighters are stationed at Headquarters. At any given time, eight to ten men are in the building. The unisex bathroom in the dispatch area has one toilet and a sink. Two additional toilets and one urinal are located upstairs in the locker room area. The toilets are all 3.5 gpf fixtures minus the toilet located on the first floor and, sinks have a flow rate ranging from less than 1 gpm to 1.5 gpm.

The building has two restrooms, one for the first floor lobby area, and the other on the second floor of the commons area. The 1st floor bathroom has one 3.5 gpf toilet, and a sink with a low flow measuring less than 1-gpm.



The building has a total of 3 toilets, one located on the main floor and 2 on the second floor housing area. The restrooms located on the main floor are located in the dispatch room by the main truck bay. The truck bay bathroom is used on occasions by outside visitors but that has become very infrequent.

The two toilets upstairs in the housing area were found to be 1.6 gpf units with low consumption heads. One urinal rated at a 3.0 flush rate is also located in the second floor rest room. There are four showers in the buildings located on the second floor housing area. The showerheads flow measured less than 1.5 gpm.

A Fixture Count Chart “Figure B” can be found below with locations and counts of the fixtures in the building.

The detailed listing of the locations, quantity, usage, savings and cost related to conservation program specific information for the fire department building can be found on the chart B found on the next page of this report.

Visitors/ Employees

No significant outside usage of the restrooms was reported for the building.

Water Usage History

Since the fiscal year 2010, water consumption at the Fire Headquarters in North Reading has fluctuated with a tremendous decline in 2011 to 80,000 CCF from a high 210,000 CCF. Thereafter a gradual rise in water usage followed where 2012 and 2013 saw rather steady rates of nearly 150,000 CCF. See chart below for details.

Figure “A”
Water Consumption History

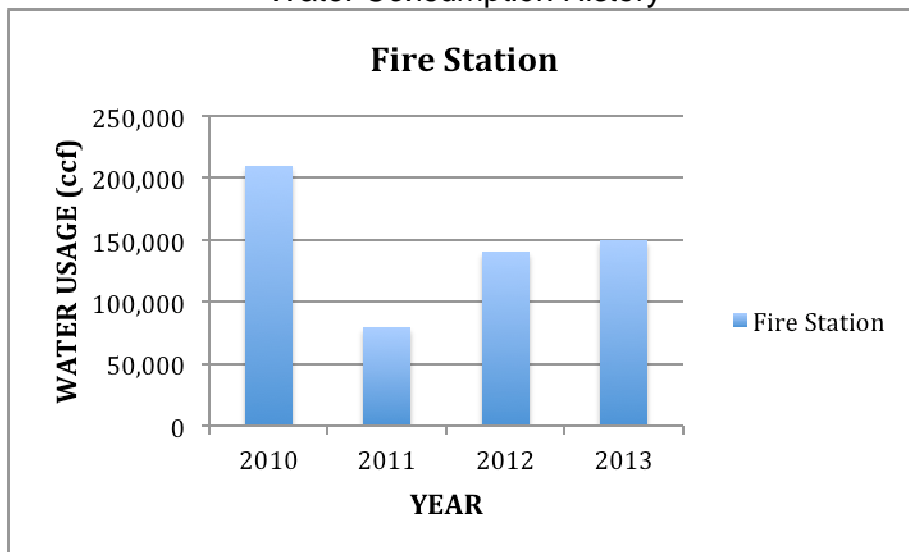


Figure “B”
North Reading Fire Headquarters

	<i>Locations</i>	<i>Toilets</i>		<i>Urinals</i>	<i>Sinks</i>	<i>Comments</i>
		Quantity	Type			
Headquarters First Floor	Dispatch Unisex	1	3.5	0	1	Sink with low flow, less than 1 gpm
Fire Headquarters Second Floor	Men's Locker room	2	1.6	1	2 (1.5)	4 showers

Recommendations

It should be noted that all savings associated with fixture use by firefighter will be subject to a multiplier of 3 to take into consideration that the fire department is a 24/ 7 operation.

Findings and Recommendation

Savings Calculation

Flow reductions savings can be expressed as follows:

Fire Headquarters Building Savings

Male (toilets),	4 staff x 2.22 gal/fl x 2 fl/day	=	17.8 gals/day
Male (sinks)	10 staff x 1 gpm x 4 min/day	=	40.0 gal/day
Male (urinals),	10 staff x 0.5 gal/fl x 2 fl/day	=	10.0 gal/day

Non-Domestic Water Use (For Future Consideration)

Hose Washing

When the department responds to a fire call and uses its hoses, the hoses need to be rinsed out and washed to remove dirt and other debris that accumulated on the hoses while in service at a fire prior to being stored..

North Reading Fire department indicated that the hoses are usually washed or flushed out at a fire scene prior to being stored in the fire truck before returning to the fire house. Thus there are no further recommendations made for hose washing.

However, if the time comes that the department is interested in obtaining a hose washing unit to be located in the fire house itself, then we recommend the purchase and installation of a hose washing unit as manufactured by the E-Darly Company. This equipment can significantly reduce washing time and water usage. The washing unit is portable and can wash a fifty foot section of hose in one minute with as little as 40 gallons. Based on ten hose sections being washed a week, the normal water consumed in the washing of ten hose section is approximately 5,000 gals per week. Thus water consumption is reduced to 400 gallon or a reduction of over 90%.

At a water cost of for the fire station at \$11.89/k gal, the cost per ten section washed would be approx \$59.45 as compared to \$4.76 with the hose washer.

With an equipment cost of over \$13,000 (washer model H886 and loading table model H686), the cost of the washer far out weights the savings that would be generated by its use. Therefore, while we have provided the hose washing equipment information for consideration in the future, until such time that the North Reading Fire Department should grow in size and its fire call duty increases, we do not recommend the need for the hose washing equipment.

Truck Washing

According to information gathered during our visits, the fire department washes the fire trucks, fire prevention's cars and a couple of department related trucks at least once a week. In addition, the floor of the firehouse is washed once a week as well.

The department already has and uses a pressure washer. By using the pressure washer vs; a standard hose, the water flow is reduced to 2.5 gpm and the washing time is also reduced in half because of the pressurized water.

Total Average Daily Savings, Fire Headquarters 67.8 gal/ day

Cost

Toilet Retrofit Unit Cost

Sloan Royal Valve	\$ 175
Floor mounted floor outlet porcelain	\$ 220
Installation	\$ 175
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 5
Toilet seat	\$ 15
Miscellaneous Finish Kits	\$ 35
Total Cost / toilet fixture	\$630.⁰⁰

Based on a total fixture count of 3 toilets, the estimated cost to replace the existing toilets at the Fire Headquarters \$ **1,890.⁰⁰**

Urinal Retrofit–A Unit Cost (Recommended)

Sloan Royal 1.0 Urinal Valve Kit	\$ 75
Installation	\$ 85
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 2
Miscellaneous Finish Kits	\$
Total Cost / urinal fixture	\$ 167.⁰⁰

The estimated cost for the 1 urinal is therefore, **\$167** for Retrofit A and Retrofit B is not recommended.

Sink Retrofit Unit Cost

Niagara 0.5 female aerators (Or equal)	\$ 9
Installation	\$ 1
Permit Cost per fixture	\$ 0
Disposal cost per fixture	\$.50
Miscellaneous adapter Kits	\$.50
Total Cost / sink fixture	\$ 11.⁰⁰

The estimated cost for the 3 sinks is therefore, **\$ 33.00** including overhead and profit.

Fire Headquarters Total Costs

Toilet retrofits	\$ 1,890.00
Urinal retrofits	\$ 167.00
Sinks	\$ 33.00
<u>Sub-Total</u>	<u>\$ 2,090.00</u>
Contingency (15%)	\$ 313.50
Total	\$ 2,403.50

North Reading Public Library

Building Profile

The North Reading Public Library is a historical landmark located on Main Street in North Reading.



The Flint Memorial Hall was built originally sometime in the late 1800's and previously acted as one of the most elegant and modern buildings within the town. Its main purpose as Town Hall lasted until the 1970's.

Finally during 1988 most of the building was left vacant, as a renovation took place. Then in 1991 the Flint Memorial Hall was reopened as the Flint Memorial Library.

The Flint Library is the corner stone of The Town of North Reading library system.

It serves an average 38,000 total visitors per year, or approximately 107 visitors/day. The building is open 6 days per week on average and closed only on a few holidays. There are 17 employees in the library each day.

The main floor of the library has two restrooms to the corridor on the right of the front lobby as you enter the building. These were found to be equipped with similar fixtures throughout the building.

The ground level restrooms located next to the Activity Room are in high use by which a yearly average of approximately 7,600 people will visit this area of the library. This figure is made up of some 6,729 children, 100 young adults and 800 adults.

Additional rest rooms are located throughout the building (see Chart B below) The typical Ladies Room, fixtures found in the building are equipped with 3.5-gpf wall hung/wall outlet toilets, and 2.5-gpm faucet aerator equipped sinks with hand operated handles.

The Men's Room is equipped with 1.28 gpf fixtures, also wall hung/wall outlet toilets. There are a total of 3 urinals in the building.

Water Usage History

There is no record of the water usage history for the Flint Memorial Library.

Figure "A"

Limited Water Consumption Data Was Available At the Issuing of the Report
Thus, No Water Use History Can be Displayed

Figure “B”

North Reading Public Library, Fixture Count, July 2014

Peabody Institute Library	Location	Toilets		Urinals	Sink	Comments
		Quantity	Type			
Ground Floor	Men’s Bathroom	1	1.28 gpf	2 (1 gpf)	2 (2.5 gpm)	Urinal has sticky flush valve
	Women’s Bathroom	3	3.5 gpf	0	2 (2 gpm and 1 gpm)	Flush valve turned down **Both next to activity Rm High Use**
Main Floor	Women’s Bathroom	2	3.5	0	2 (1.5 gpm)	
	Men’s Bathroom	1	1.28	1 (2.5 gpf)	2 (1.5 gpm)	
Fourth Floor	Bathroom #1	1	3.5	0	1 (2.5 gpm)	Same for both
	Bathroom #2	1	3.5	0	1	Out of use

Findings and Recommendation

The library is open 6 day/ week except for holidays. Thus the open days/year ratio is 0.94.

Savings Calculation

Flow reductions savings can be expressed as follows:

Anticipated saving can be expressed as follows:

Employees x m/f ratio x gals saved/fl x use/day x workdays/yr ratio

Female, 17 employees x .9 x 2.22 gal/fl x 3* fl/day = 0.7 gal/day

Male (urinals), 17 employees x .1 x 2 gal/fl x 2* fl/day = 6.4 gal/day

Sinks, 17 employees x 1.5 gpm x 1 min/day = 23.9 gal/day

Male (toilets), no recommendation

Visitors x m/f ratio x % of use x savings/fl x # of usage/day x workday/yr ratio

Female visitor 107 x 25% x .75m/f x .1 use x 2.8 gal/fl x 1 use/day = 22.5 gal/day

Male (toilets), 107 x 25% x .02 x 2.22 gal/fl x 1* fl/day = 1.2 gals/day

Male (urinals), 107 x 25% x .08 x 3 gal/fl x 1* fl/day = 6.4 gal/day

Sinks 107 x 25% x 2.0 gpm x 33%/min = 17.6 gal/day

Total Average Annual Daily Savings, Public Library = 78.7 gal/day

Project Cost

Toilet Retrofit Program

Our on-site assessment of the library documented 9 toilets, 3 urinals, and 10 sinks. Most of the toilets, urinals and sinks were found to be likely candidates for replacement and or retrofit. No showers were found to be in the building.

Please note that the costs shown below were used to generate implementation costs. They are based on specific manufacturer's products, which are typically used during conservation retrofit programs. The estimated costs represent budget prices based on estimated Davis Bacon wages for the mid-west region. More definitive costs can be finalized during final design.

Urinals

Our recommendation is to remove the existing valve body entirely and install a new sensor operated Flushometers (Sloan 192-1 or equal).

Sinks

The retrofit cost would include a new 1.0 gpf female aerator and labor to install and test the unit. The existing faucet bodies and existing sinks would remain unchanged

Toilet Retrofit Unit Cost

Sloan Royal Valve	\$ 175
Wall mounted rear outlet porcelain	\$ 265
Installation	\$ 235
Permit Cost per fixture	\$ 15
Disposal cost per fixture	\$ 8.50
Toilet seat	\$ 15
Miscellaneous Finish Kits	\$ 35
Total Cost / toilet fixture	\$ 748.⁵⁰

Based on a total fixture count of 9 toilets, the estimated cost to replace the existing toilets at the Main Library **\$6,736.⁵⁰**

Urinal Retrofit–A Unit Cost (Recommended)

Sloan Royal 1.0 Urinal Valve Kit	\$ 175
Installation	\$ 125
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 2.50
Miscellaneous Finish Kits	\$ 5.50
Total Cost / urinal fixture	\$ 313.⁰⁰

Urinal Retrofit–B Unit Cost (Alternative) Not Recommended

The estimated cost for the 3 urinals is therefore, **\$939** for Retrofit-A

Sink Retrofit Unit Cost

Niagara 1.0 /1.5 female aerators	\$ 9.00
Installation	\$ 2
Total Cost / sink fixture	\$ 11.⁰⁰

The estimated cost for the 10 sinks is therefore, **\$ 110.00** including overhead and profit.

Library Total Costs

Toilet retrofits	\$ 6,736.50
Urinal retrofits	\$ 939.00
Sinks	\$ 110.00
<i>Sub-Total</i>	<i>\$ 7,785.⁵⁰</i>
Contingency (15%)	\$ 1,168. ⁰⁰
<i>Total</i>	<i>\$ 8,953.⁵⁰</i>

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North Reading L.D. Batchelder School

Building Profile

North Reading Batchelder Elementary School is located at 175 Park Street. Total enrollment at that school is approximately 550 students. The boy to girl ratio is estimated at 50/50.



Our on-site assessment of the L.D. Batchelder School documented 24 toilets, 6 urinals and 20 sinks. A detailed listing of the locations, quantity and other fixture specific information for the elementary school can be found on Fixture Count Chart “Figure B”.

Figure “A”
Water History Chart

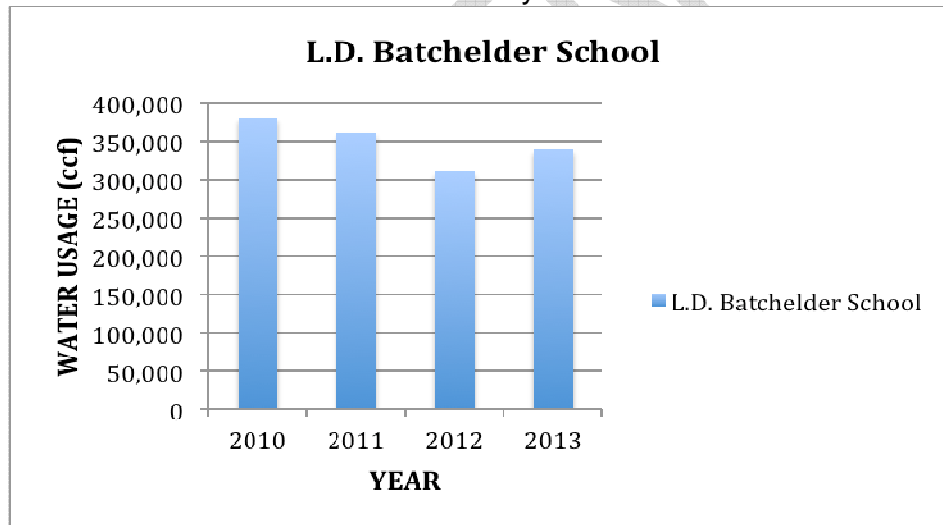


Figure “B”

L.D. Batchelder Elementary School, Fixture Count, July 2014

Batchelder	Location	Quantity	Type	Urinals	Sink	Comments
Main Entrance, 1 st Floor	Admin Office	1	3.5 wm/wo	0	1 (0.5 gpm)	
	Nurses Office	1	“	0	“	Handicap
1 st Floor	Gymnasium Women’s Room	3	3.5	0	2	1 Handicap Toilet
	Gymnasium Men’s Room	1	“	2	2	Left sink sticks
2 nd Floor	Girl’s Room	2	3.5	0	1 (0.5 gpm)	1 Handicap Toilet Each
	Boy’s Room	1	3.5	1	“	“
	Women’s Room	1	“	0	1 (2.2 gpm)	Identical to Boys room
	Men’s Room	1	“	“	1	“
3 rd Floor	Girl’s Room	4	1.28	0	2 (2.2 gpm)	Girl’s Room has a Toto flush valve and older bowls
	Boy’s Room	2	3.5	2	2	
4 th Floor	Girl’s Room	2	3.5	0	1 (0.5 gpm)	1 Handicap
	Boy’s Room	1	3.5	1	1 (2.2 gpm)	
Media Center	Girl’s Bathroom	1	3.5	0	1 (2.2 gpm)	All identical, except for sink in Men’s room
	Boy’s Bathroom	1	“	“	“	
	Women’s Room	1	“	“	“	
	Caf Staff Toilet Ladies Room	1	“	“	1 (0.5 gpm)	

Toilets

All, of the toilets are wall mounted, wall outlet units. The estimated consumption is 3.5 gallons per flush. Most of the flushometers are manually activated; there are also a few 1.28 gpf Toto flushometers on the old 3.5-gpm bowls.



Savings

Because students move around a school so much it's difficult to establish a good basis to assign use patterns to specific areas of the building. Thus, a different approach to calculating the final savings and payback values had to be devised for schools.

Toilet savings

Male Toilet use savings

550 stu x 50% m/f ratio, x 2.0 gals saved x 1fpd = Total 550 gals/day

Male Urinal

550 stu x 50% m/f ratio, x 2.0 gals saved x 3fpd = Total 1,650 gals/day

Female Toilets

550 stu x 50% m/f ratio x 2.0 gals saved x 3flp = Total 550 gals/ day

Total Average Daily Savings for L.D. Batchelder School =2750-gal/day

Cost of Fixture Replacement

Toilet Retrofit Unit Cost

Sloan Royal Valve	\$ 175
Wall mounted rear outlet porcelain	\$ 265
Installation	\$ 235
Permit Cost per fixture	\$ 15
Disposal cost per fixture	\$ 8.50
Toilet seat	\$ 15
Miscellaneous Finish Kits	\$ 35
Total Cost / toilet fixture	\$748.⁵⁰

Based on a total fixture count of 24 toilets, the estimated cost to replace the existing toilets **\$17,952.⁰⁰**

Urinal Retrofit –A Unit Cost (Recommended)

Sloan Royal 1.0 Urinal Valve Kit	\$ 175
Installation	\$ 125
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 2.50
Miscellaneous Finish Kits	\$ 5.50
Total Cost / urinal fixture	\$ 313.⁰⁰

Urinal Retrofit –B Unit Cost (Alternative)

Sloan Royal 1.0 Urinal Valve Kit	\$ 175
Wall hung 1.0 Urinal	\$ 325
Installation	\$ 250
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 2.50
Miscellaneous Finish Kits	\$ 5.50
Total Cost / urinal fixture	\$ 763.⁰⁰

The estimated cost for the 6 urinals is therefore, \$1,878 for Retrofit-A and \$4,578 for Retrofit-B, including overhead and profit.

Sink Retrofit Unit Cost

Niagara 1.0 /1.5 female aerators (Or equal)	\$ 9
Installation	\$ 1
Miscellaneous adapter Kits	\$ 1
Total Cost / sink fixture	\$ 11.⁰⁰

The estimated cost for the 20 sinks is therefore, \$ 220 including overhead and profit.

Savings

Because students move around a school so much it's very difficult to establish a good basis to assign use patterns to specific areas of the building. Thus, a different approach to calculating the final savings and payback values had to be devised for schools.

Batchelder School Total Costs

Toilet retrofits	\$ 17,952.00
Urinal retrofits	\$ 1,878.00
Sinks	\$ 220.00
Sub-Total	\$ 20,050.⁰⁰
Contingency (15%)	\$ 3,007. ⁵⁰
Total	\$ 23,057.⁵⁰

North Reading J. Turner Hood Elementary School

Building Profile



The J. Turner Hood Elementary School is located on 298 Haverhill Street, North Reading, MA.

Total enrollment at that school is approximately 350 students. The boy to girl ratio is estimated at 50/50

Our on-site assessment of the J. Turner Hood Elementary School and documented some 19 toilets, 6 urinals, 19 sinks. A detailed listing of the locations, quantity

and other fixture specific information for the middle school can be found on Fixture Count Chart “Figure B”.

Water Usage History

Water consumption for the Hood Elementary has stayed fairly constant expect for a drop in water usage in 2012, when the CCF decreased roughly 115,000 CCF See chart below for details.

Figure “A”

Water Usage History, J. Turner Hood Elementary School

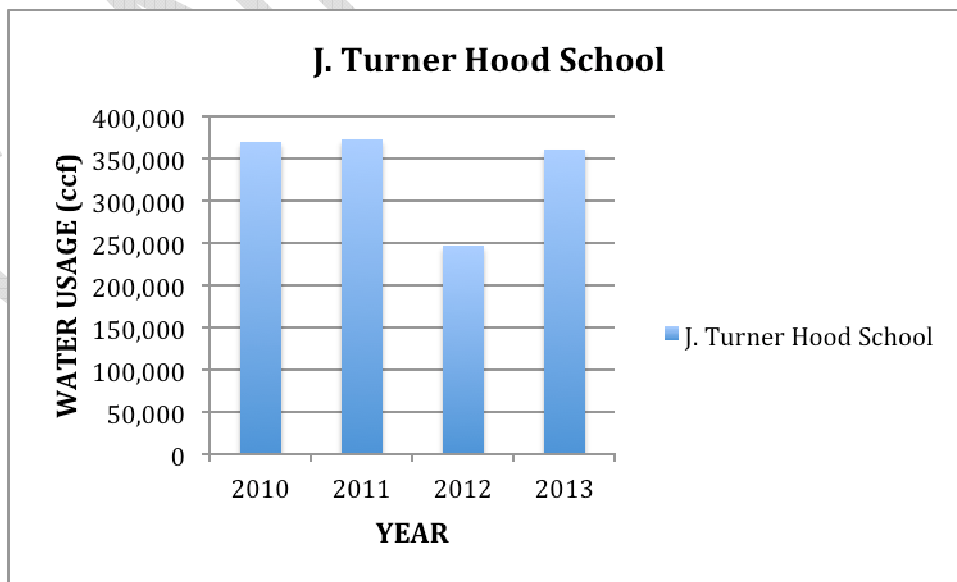


Figure "B"

J. Turner Hood School, Fixture Count, July 2014

Hood School	Location	Quantity	Type	Urinals	Sink	Comments
Main Entrance, Lobby Hallway	Faculty Restroom #1	1	3.5 FM/FO	0	1 (2.2 gpm)	In photo Fig. A
	Faculty Restroom #2	1	1.6 gpf FM/FO	0	1 (2.2 gpm)	
	Nurse's Office	1	1.6 gpf FM/FO	0	"	
	Principal's Bathroom	1	1.6 gpf FM/FO	0	"	
Classroom Corridor #1	Boy's Bathroom	2	3.5	3	3 (2.2 gpm)	Older toilets, new body on one of the urinals
	Girl's Bathroom	4	"	0	3	1 Handicap Toilet
Kitchen	Single Bathroom	1	3.5 gpf FM/FO	0	1 (2.2 gpm)	Very Low Comfort Style
Lower Level Classroom Corridor #2	Girl's Bathroom	4	1 (3.5) and 1 (1.6gpf)	0	3	Right most sink faucet leaks
	Boy's Bathroom	2	"	3	3	Older heads on urinals
Music/Art/Library Wing	Single Restroom	1	1.6 gpf	0	1	Handicap
	Teacher's Only	1	"	0	"	"
Total		19	-	6	19	-

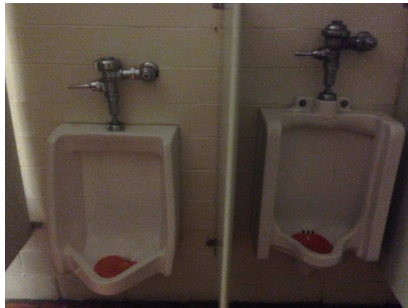
Toilets

Most, not all, of the toilets are floor wall-mounted, floor outlet 3.5 gallons per flush. All flushometers are manually activated.

Figure A. Example of typical restroom toilet and flush valve. Many of the toilets are equipped with very old flushometers.



The urinals in the building were mostly older units with replacement of some flush valves.



Both the toilets and urinal fixtures were found to be of pre-75 vintage and most likely date back to the time the Elementary School was built. The fixtures are large water consumers and are good candidates for a replacement program.

Savings

As with other schools, students move around a school so much it's very difficult to establish a good basis to assign use patterns to specific areas of the building. Thus a more general overall approach to calculating the final savings and payback values had to be taken for the schools.

Toilet savings

Male Toilet use savings:

$$350 \text{ stu} \times 50\% \text{ m/f ratio} \times 2.0 \text{ gals saved} \times 1 \text{ fpd} = \text{Total } 350 \text{ gals/day saved}$$

Male Urinal.

$$350 \text{ stu} \times 50\% \text{ m/f ratio} \times 1.0 \text{ gals saved} \times 3 \text{ fpd} = \text{Total } 525 \text{ gals/day saved}$$

Female Toilets

$$350 \text{ stu} \times 50\% \text{ m/f ratio} \times 2.0 \text{ gals saved} \times 3 \text{ fpd} = \text{Total } 1050 \text{ gals/day saved}$$

Total Average Daily Savings for the J. Turner Hood School = 2,750-gal/day

Cost of Fixture Replacement

Toilet Retrofit Unit Cost

Sloan Royal Valve	\$ 175
Floor Mounted Floor outlet porcelain	\$ 265
Installation	\$ 235
Permit Cost per fixture	\$ 15
Disposal cost per fixture	\$ 8
Toilet seat	\$ 15
Miscellaneous Finish Kits	\$ 35
Total Cost / toilet fixture	\$748.⁰⁰

With a total of 19 toilets, the estimated toilet replacement cost is **\$14,221.⁵⁰**

Urinal Retrofit–A Unit Cost (Recommended)

Sloan Royal 1.0 Urinal Valve Kit	\$ 175
Installation	\$ 125
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 2.50
Miscellaneous Finish Kits	\$ 5.50
Total Cost / urinal fixture	\$ 313.⁰⁰

Urinal Retrofit –B Unit Cost (Alternative) not recommended

Sloan Royal 1.0 Urinal Valve Kit	\$ 175
Wall hung 1.0 Urinal	\$ 325
Installation	\$ 250
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 2.50
Miscellaneous Finish Kits	\$ 5.50
Total Cost / urinal fixture	\$ 763.⁰⁰

The estimated cost for the 6 urinals is therefore, \$1,878 Retrofit-A and \$4,578 for Retrofit-B, including overhead and profit.

Sink Retrofit Unit Cost

Niagara 1.0 /1.5 female aerators (Or equal)	\$ 9
Installation	\$ 1
Miscellaneous adapter Kits	\$ 1
Total Cost / sink fixture	\$ 11.⁰⁰

The estimated cost for the 19 sinks is therefore, \$ 209 including overhead and profit.

J T Hood School Total Costs

Toilet retrofits	\$ 14,221.50
Urinal retrofits	\$ 1,878.00
Sinks	\$ 209.00
Sub-Total	\$ 16,308.⁵⁰
Contingency (15%)	\$ 2,446. ⁰⁰
Total	\$ 18,754.⁵⁰

North Reading E. Ethel Little Elementary School

Building Profile



The North Reading E. Ethel Little Elementary School is located at 7 Barberry Road in a residential area.

Enrollment at that school is approximately 325 children and a 50/50 ration between boys and girls.

Our on-site assessment of the little school, we documented some 21 toilets, 8 urinals and 20 sinks. A detailed listing of the locations,

quantity and other fixture specific information for the school can be found on Fixture Count Chart "Figure B".

Water Usage History

Water consumption for the Little Elementary has been on a decline with a drop in usage from 400,000 CCF in 2010 to around 312,000 CCF in 2011. See chart below for details.

Figure "A"

Water Usage History, E. Ethel Little School

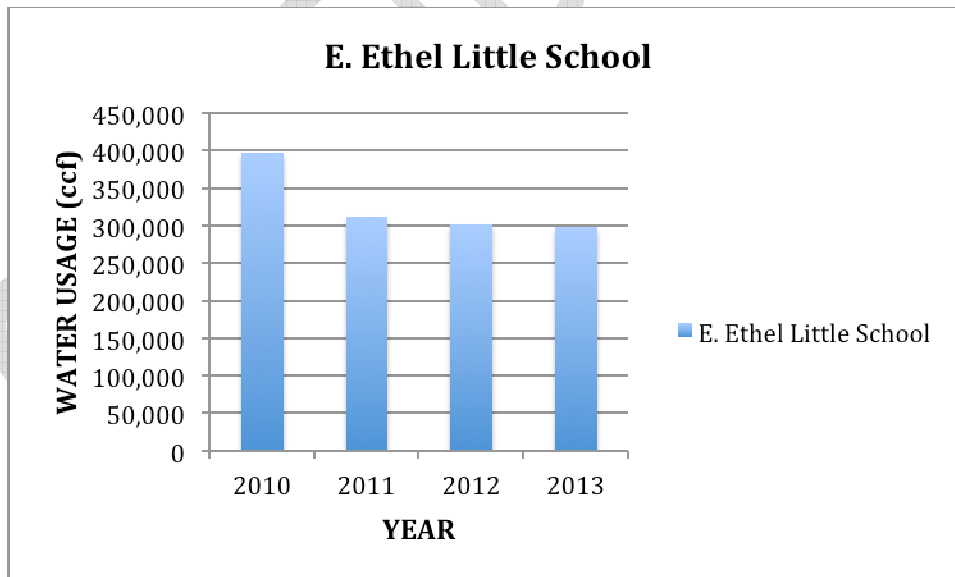


Figure “B”

E. Ethel Little Elementary School, Fixture Count, July 2014

South Elementary	Location	Quantity	Type	Urinals	Sink	Comments
Module Bathroom	Module	1 FM/FO	1.6 gpf	0	1	Residential Style Toilet w/tank
Nurse's Office	Nurse's Single	1	1.6 gpf	0	1 (2.2 gpm)	Handicap
Classroom Bathroom's	#1	1	1.6 gpf	0	0	Toto, and No sink
	#2	1	1.6 gpf	0	0	Toto
Gymnasium	Boy's	2	3.5 and 1.6	5	3	Urinals 1 gpf
	Girl's	4	"	0	3 total, 2 (2.2 gpm and 1, 0.5 gpm)	1 Handicap Toilet
RM 19	Kindergarten Classroom	1	3.5 gpf	0	1 (2.2 gpm)	Very old sink
RM 20	Kindergarten Classroom	1	"	0	1 (2.2 gpm)	
RM 21 Between Classrooms	#1	1	1.6 gpf	0	1	Faucet Aerator has been removed
	#2	1	1.6 gpf	0	1	
Cafeteria Area Restrooms	Men's Room	1	1.6 gpf	0	1 (2.0 gpm)	Handicap
	Women's Room	1	"	"	1	"
	Girl's Bathroom	3	1.6 gpf	0	3	All Sinks Toto, and 3 Toto urinals w/ auto flush
	Boy's Bathroom	2	"	3 (Toto)	3	
Total		21		8	20	0 showers

Toilets

Most of the existing toilets are wall hung wall outlet toilets. Two of the twenty one toilets are residential style 1.6-gpf toilets. Eight of the total toilets are still 3.5-gpf toilets. These toilets are located near the school's gymnasium and the two kindergarten classes. The remaining units are 1.6-gpf toilets. Most of the flushometers are manually activated, while some are installed with Toto automatic flush.

The 3.5-gpf toilets are large water consumers and are good candidates for a replacement program.

Urinals

Most of the urinals can be retrofitted with lower consumption valve kits. The majority of the urinal valves have all be turned down manually to reduce the flow. However there is no way of telling if the reduced volume is sufficient to rinse the urinal properly. We recommend the installation of lower flow internal kits in the valve body

Sinks

The sink flow rates were measured at a flow rate of 2.2-gpm. There is no need for flow rates that high. We recommend the installation of tamper resistant 0.5 aerators on all sinks in the school.

Savings

While the two restrooms located near the gym my see a substantial amount of usage each day, we have to take into consideration that they other boys and girls rooms located in other parts of the building also see a large part of use as well. To be conservative, we will put a 40/60% split between the gym area restrooms vs. the other restrooms located elsewhere in the school. The toilet recommendation below is specifically for the restrooms near the gym only.

Average Daily Savings

Male Toilet use savings:

$$325 \text{ stu} \times 50\% \text{ m/f ratio} \times 2.22 \text{ gals saved} \times 1 \text{ fpd} \times .40 = \text{Total } 144 \text{ gal/day}$$

Male Urinal.

$$325 \text{ stu} \times 50\% \text{ m/f ratio} \times 1.0 \text{ gals saved} \times 3 \text{ fpd} \times .40 = \text{Total } 195 \text{ gal/day}$$

Female Toilets

$$325 \text{ stu} \times 50\% \text{ m/f ratio} \times 2.22 \text{ gals saved} \times 3 \text{ flp} \times .40 = \text{Total } 433 \text{ gals/day}$$

Total Average Daily Savings for the E. Ethel Little School: 772 gals per day

Cost of Fixture Replacement Toilet Retrofit Unit Cost

Sloan (or Toto) Royal Valve	\$ 175
Wall mounted rear outlet porcelain	\$ 265
Installation	\$ 235
Permit Cost per fixture	\$ 15
Disposal cost per fixture	\$ 8.50
Toilet seat	\$ 15
Miscellaneous Finish Kits	\$ 35
Total Cost / toilet fixture	\$748.⁵⁰

Based on a total fixture count of 6 toilets, the estimated cost to replace the existing toilets at the school **\$4,491.⁰⁰**

Urinal Retrofit –A Unit Cost (Recommended)

Sloan Royal 1.0 Urinal Valve Kit	\$ 175
Installation	\$ 125
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 2.50
Miscellaneous Finish Kits	\$ 5.50
Total Cost / urinal fixture	\$ 313.⁰⁰

Urinal Retrofit –B Unit Cost (Alternative) Not recommended

Sloan Royal 1.0 Urinal Valve Kit	\$ 175
Wall hung 1.0 Urinal	\$ 325
Installation	\$ 250
Permit Cost per fixture	\$ 5
Disposal cost per fixture	\$ 2.50
Miscellaneous Finish Kits	\$ 5.50
Total Cost / urinal fixture	\$ 763.⁰⁰

The estimated cost for the 8 urinals is, \$2,504 for Retrofit-A and \$6,104 for Retrofit-B, including overhead and profit.

Sink Retrofit Unit Cost

Niagara 1.0 /1.5 female aerators	\$ 9
Installation	\$ 1
Miscellaneous adapter Kits	\$ 1
Total Cost / sink fixture	\$ 11.⁰⁰

The estimated cost for the 20 sinks is therefore, \$ 220 including overhead and profit.

E. Ethel Little School Total Costs

Toilet retrofits	\$ 4,491.50
Urinal retrofits	\$ 2,504.00
Sinks	\$ 220.00
Sub-Total	\$ 7,215.⁵⁰
Contingency (15%)	\$ 1,082. ⁰⁰
Total	\$ 8,297.⁵⁰

Damon Tavern

Building Profile

The Damon Tavern is located at 21 Bow Street in North Reading. The Tavern was built in 1817 and originally served as a half way stop between various coach routes as well as serving as a post office.

In 1828 the Tavern was expanded and a second story ballroom was included. The Tavern was last renovated in 1999.



Today, the Damon Tavern is home to North Reading's public access television, NORCAM, which is open Monday-Wednesday: 9:00am to 8:00pm and Thursday-Friday: 9:00am to 5:00pm.

Occasionally, the North Reading historical and antiquarian society also has access to a meeting space on the second floor of the Damon Tavern.

Water Usage History

Water consumption for the Damon Tavern peaked in the span of 2011-2012 to 11,000 CCF from a low of 6,000 CCF in 2009-2010. Consumption then again dropped significantly the following year and settled off at 8,000 CCF between late 2013 and early 2014.

See Chart A below for details:

Figure "A"

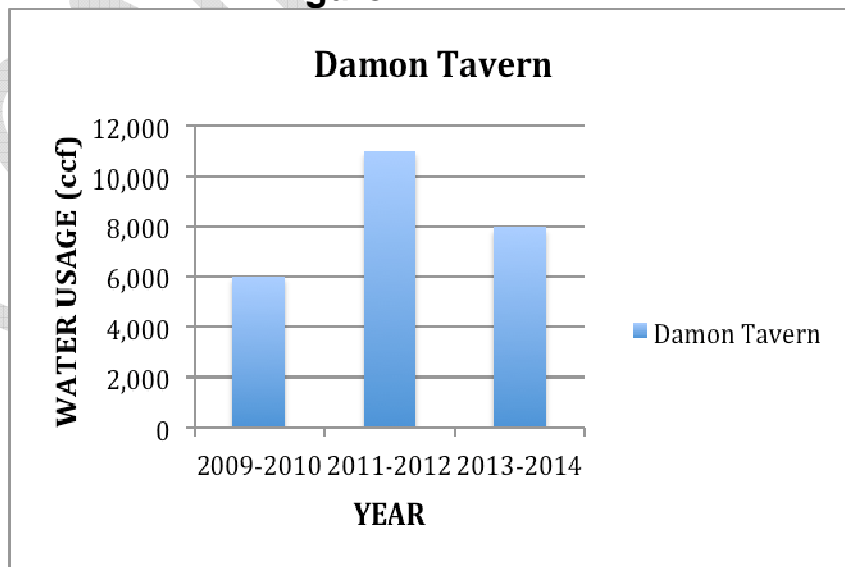


Figure “B”
Damon Tavern, Fixture Count, July 2014

<i>Damon Tavern</i>	<i>Type</i>	<i>Quantity</i>	<i>Type</i>	<i>Urinals</i>	<i>Sink</i>	<i>Comments</i>
1 st Floor	Single	1	1.6	0	1 (0.5 gpm)	P Flush w/ tank that has been recalled
	Handicap	1	“	“	1	
2 nd Floor	Out of Order	1	1.6 gpf	“	1 (0.5 gpm)	Recall on pressurized valve (tank)
Total		3			3	

Toilets

The building has two restrooms located on the first floor, and one “out of order” bathroom on the second floor. The first floor bathrooms are residential style floor-mounted, floor-outlet with a tank that has a recall on it. No recommendations are made at this time for the two toilets

Urinals

There are no urinals in the building.

Sinks

The two sink flow rates were measured at a flow rate of 0.5-gpm. Since this flow rate is considered to be the best possible rate for a sink faucet, there are no recommendations made at this time.

Damon Tavern Total Costs....

No Recommendations for Retrofits

North Reading Department of Public Works Operations Garage

Building Profile



The North Reading DPW Operations Garage...

Our on-site assessment of the DPW garage documented 2 toilets, and 1 standard sink, 1 gain sink and 2 urinals. A detailed listing of the locations, quantity and other fixture specific information for the school can be found on Fixture Count Chart “Figure B”.

The building is comprised of a large open inside garage which is used for various task such as equipment storage and repair. There is a small office/dispatch area in the corner of the garage space

Water Usage History

Water consumption for the DPW Operations Garage has been gradually moving on an incline to increased water usage in recent years. Thus, there was a low just over 65,000 CCF in 2010 that rose to a high of nearly 105,000 CCF in 2013. See chart below for details.

Figure “A”

DPW Operations Garage, Water Usage History

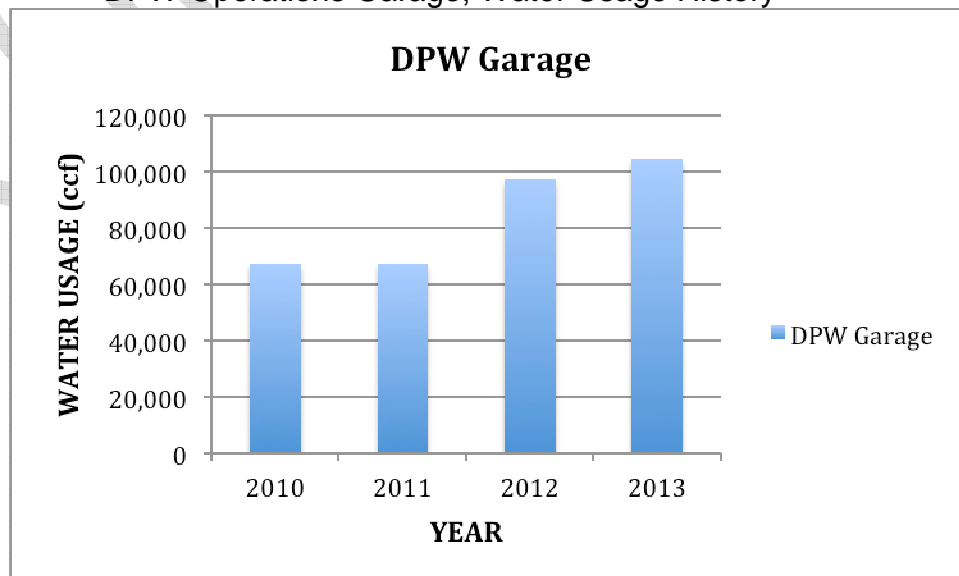


Figure “B”
DPW Operations Garage, Fixture Count, July 2014

DPW Operations Garage	Location	Quantity	Type	Urinals	Sink	Comments
Main Men's Room	Restroom	2	3.5	2 (1 gpf)	2 – (1 at 3 gpm) and 1 gang sink	*Older valves on urinals have been turned down
Total		2		2	2	

Toilets

The two existing toilets are wall mounted/outlet 3.5 gpf units. We recommend the replacement of these units with new 1.28-gpf wall mounted toilets.

Sinks

There are two existing sinks and one half circle “gang” sink. The two sinks both have large flow aerators, while the gang sink has a large spray ring which is intended to allow several workers to wash up at the same time. These gang sinks tend to waste a great deal of water when used by one or two men at a time.



There was also a high-pressure washer for trucks that frequent the DPW Operations Garage. It is heavily used during the winter months when plow trucks are clearing up the town's public streets.

Because of the availability of the pressure washer, there is very little use of garden hoses to wash down floors and equipment

Savings

Employees x gals saved/fl x use/day

Male toilet Use	10 employees x 2.22 gal/fl x 3* fl/day =	66.0 gals/day
Sinks,	10 employees x 2.0 gals/min x 1 min/day =	20.0 gals/day

Total Average Daily Savings for DPW Headquarters Building: 86 gals/day

**Cost of Fixture Replacement
Toilet Retrofit Unit Cost**

Sloan (or Toto) Royal Valve	\$ 175
Wall mounted rear outlet porcelain	\$ 265
Installation	\$ 235
Permit Cost per fixture	\$ 15
Disposal cost per fixture	\$ 8.50
Toilet seat	\$ 15
Miscellaneous Finish Kits	\$ 35
Total Cost / toilet fixture	\$748.⁵⁰

Based on a total fixture count of 2 toilets, the estimated cost to replace the existing toilets at the school **\$1,497.⁰⁰**

Sink Retrofit Unit Cost

Niagara 1.0 /1.5 female aerators (Or equal)	\$ 9
Installation	\$ 1
Miscellaneous adapter Kits	\$ 1
Total Cost / sink fixture	\$ 11.⁰⁰

The estimated cost for the 2 sinks is therefore, \$22.00 including overhead and profit.

DPW Headquarters Total Costs

Toilet retrofits	\$ 1,497.00
Sinks	\$ 22.00
<u>Sub-Total</u>	<u>\$ 1,519.00</u>
Contingency (15%)	\$ 228. ⁰⁰
Total	\$ 1,747⁰⁰

Building on the Common



Building Profile

The Building on the Common (BOC) is used as a senior citizen activity center. The building overlooks the North Reading Town Common across the street from the town's Police Station and Fire Headquarters.

The building is one of the older historical structures in the town, and is reported as having been built in 1829. The Building on the Common see's roughly sixty (60) people per day and is open five (5) -days/week.

The main floor restrooms are equipped with 5 gpf toilets and handicap style sinks with 1-gpm faucet aerators. The first floor bathroom is used by elderly daily visitors.

The upper floor has one bathroom is in very poor condition. The building's staff indicated that upper floor is used by town group meetings each month. The approximate number of people using the upper floor was estimated at 15 people about twice a month. The upstairs bathroom is also equipped with a 5-gpf bowls, and a 1-gpm faucet aerator.

Water Usage History

Since the fiscal year 2010, water consumption at the BOC had steadily declined for a little over a year from 68,000 CCF to about 53,000 CCF. Then, in 2012 water usage began gradually increasing back up and reached a steady high of 74,000 CCF for 2013. See chart below for details.

Figure "A"

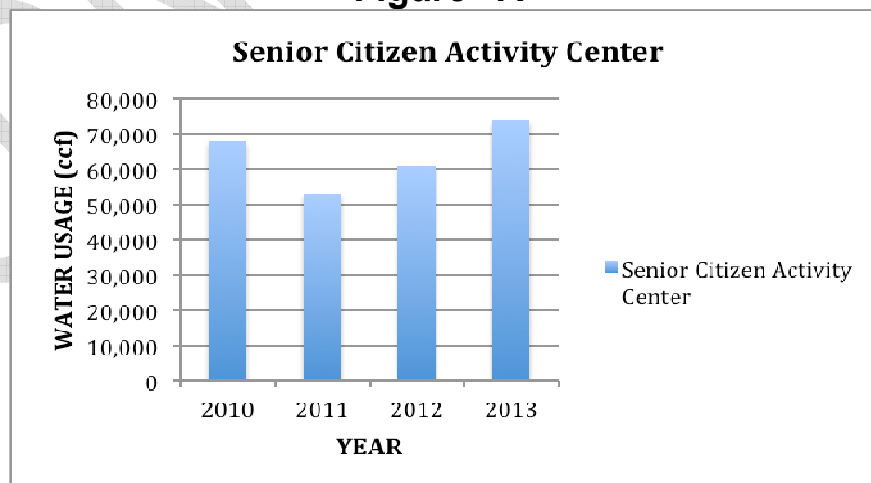


Figure “B”

Building on the Common, Fixture Count, July 2014

	Locations	Toilets		Urinals	Sinks	Comments
		Quantity	Type			
First Floor	Men’s Room	1	3.5 gpf	0	1	Handicap
	Ladies Room	1	“	0	1	“
2nd Floor	Upstairs “Ancient Single”	1	5 gpf	0	1 (1 gpm)	Used by apx.15 people

Toilets

The building has two restrooms located on the first floor, and one antique bathroom on the second floor. The first floor bathrooms have residential comfort style toilets and sinks. All of the toilets on the first floor are 3.5 gpf bowls and should be replaced with new 0.8-gpf toilets. The bathroom on the second floor has one 5-gpf bowl and is desperate need of replacement with a 0.8-gpf toilet as well.

1. Toilet / Urinal Savings,

Employees x m/f ratio x gals saved/fl x use/day

Females 6 x 60% x (3.5-0.8) gal/fl x 3* fl/day = 29.0-gals/day

Male 6 x 40% x (3.5-0.8) gal/fl x 2* fl/day = 13.0-gals/day

* see note 8 Exhibit A, ** see note 6, Exhibit A

Visitors x m/f ratio x % of use x savings/fl x # of usage/day

Fem visitors 60 visitors x 60% x 20% x (3.5 -1.28) gpf x 1 = 19.5 gal/day

Male visitors 60 visitors x 40% x 10% x (3.5-1.28) gpf x 1 = 13.0 gal/day

Sinks

2. Sink Savings

No Recommendations are made for the sinks at this time

Total Average Daily Savings, Town Hall = 74.5 gals/day

Cost of Fixture Replacement

Toilet Retrofit Unit Cost

Niagara 0.8-gpf toilet	\$ 220
Installation	\$ 235
Permit Cost per fixture	\$ 15
Disposal cost per fixture	\$ 8.50
Toilet seat	\$ 15
Miscellaneous Finish Kits	\$ 35
Total Cost / toilet fixture	\$528.⁵⁰

Based on a total fixture count of 3 toilets, the estimated cost to replace the existing toilets
\$1,585.⁵⁰

BOC Total Costs

Toilet retrofits	\$ 1,585. ⁵⁰
<i>Sub-Total</i>	<i>\$ 1,585.⁵⁰</i>
Contingency (15%)	\$ 238. ⁰⁰
<i>Total</i>	<i>\$ 1,823.⁵⁰</i>

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North Reading Parks and Recreation Building

Building Profile



The North Reading Parks and Recreation Building is located at 5 central Street, North Reading, MA. It is a residential style building made of two floors, however various groups frequent only the ground level restroom.

Approximately 15-20 toddlers ages 3 to 6 come to the building 4-days/ week accompanied by 4 adult counselors. There are also 2 Basketball teams that come to the building for approximately 1 hour on

weekends.

Finally, during the school year there are about 5 classes per week with an average of 10-20 children and adolescent's ages 3-18.

The Parks and Recreation Building has one primary facility that is being used by incoming groups. This facility is a residential style floor-mounted/ floor-outlet toilet that runs at 1.6 gpf, and one sink measured at 2.5 gpm. The other facility is located on the second floor and is currently out of order.

Water Usage History:

There is no record of the water usage history for the North Reading Recreation Center Building.

Figure "B"

Parks and Recreation Building, Fixture Count, July 2014

	Locations	Toilets		Urinals	Sinks	Comments
		Quantity	Type			
First Floor	Off of common room	1	1.6 gpf	0	1 (2.5 gpm)	Toilet is FM/FO
Upstairs	2 nd Level	1	-	0	1 (2.5 gpm)	Out of Order

Toilets

The two existing toilets are already 1.6-gpf toilets. While the toilet on the second floor is in need of repairs, it was not clear if the problem was with the toilet or the plumbing system. Since the water supply for the building is well water, the cost benefit of replacing the two existing 1.6-gpf is just not there. Thus we do not feel that a recommendation for replacement of the existing 1.6-gpf toilets is needed at this time.

If however, a replacement toilet should be needed in the future, we recommend that a 0.8-gpf toilet be installed to replace the 1.6-gpf toilets.

Sinks

The two sinks in the building have 2.5 gpm faucet aerators installed. We recommend that for the cost of two aerators it would be worth saving the additional water even though the cost of the well water is minimal (pumping costs only). We recommend the installation of two 0.5-gpm faucet aerators on the two bathroom sinks.

Savings

Since the water supply is town well water, the savings based on replace two aerators is manual. However, since the cost to replace two aerators is a manual \$22, we recommend the replacement of the two aerators

Total Average Daily Savings, Parks and Rec Building = 16.0 gals/day

Cost of Fixture Replacement

Toilet Retrofit Unit Cost

No Recommendations are proposed at this time

Sink Retrofit Unit Cost

Niagara 1.0 /1.5 female aerators (Or equal)	\$ 9
Installation	\$ 1
Miscellaneous adapter Kits	\$ 1
Total Cost / sink fixture	\$ 11.⁰⁰

The estimated cost for the 2 sinks is therefore, \$22.00 including overhead and profit.

Parks and Rec Building Total Costs

Sinks	\$	22.00
Sub-Total	\$	22.⁰⁰
Contingency (15%)	\$	3. ³⁰
Total	\$	25.⁵⁰

Ipswich River Park Restroom Facility



Building Profile

The Ipswich River Park Restroom facility is centrally located from within the park grounds. It is a small building that serves only the function of two single sex restrooms.

The facility is run on well water, and is fairly new, having been built within the last 15 years.

The park see's a large number of visitors, mostly during the non-winter months. There are no official reports regarding the number of visitors to the park on a daily basis. However, there are many visitors including both residents of the community, and various sports teams that practice on the vast fields.



The facilities located at the Ipswich River Park are equipped with Stainless steel institutional type toilets and sinks. The toilets are equipped with behind the wall automatic sensor flushometers, and stainless steel sinks with 0.5 gpm aerators.



Water Usage History:

There is no record of the water usage history for Ipswich River Park facility.

Figure "B"

Ipswich River Park Restroom Facilities, Fixture Count, July 2014

	Locations	Toilets		Urinals	Sinks	Comments
		Quantity	Type			
Men's Room	Right	1	3.5	0	1 (0.5)	Automatic flush. well water
Ladies Room	Left	1	3.5	0	1 (0.5)	Automatic flush, same as Men's

No recommendations are offered for this building

North Reading High School /Middle School New Construction Plumbing Fixture Review

Overview

During the past three years, the Town of North Reading has been undertaking the construction of a new High School and Middle School complex.

While our review was undertaken well into the substantial completion stages for the complex, our goal was not to re-engineer or to suggest new plumbing fixture specifications. But rather, to take an overview of the specified fixtures to assure the town that the fixtures installed, met the best possible standards for water conservation for is specifically targeting the plumbing fixtures.

As part of our review, we visited with and interviewed the construction team, represented by Mr. Jeff Wetton, Senior Associate with the firm of PMA consultants. We were offered access to the construction drawings/documents for the High School /Middle School complex.

The complex was designed to meet USGBC's LEED Silver requirements, for which the parameters can be found on the website; www.usbc.org/.

On the following pages, we have attached the plumbing specification cut sheets for sink faucets/aerators, urinals, toilets and showers that were spec'd-out approved by the town and installed in the school complex.

Fixture Discussion

Faucets

All faucets installed are SLOAN EAF-275 Optima Systems single spray system. The faucet is equipped with a solar powered sensor activated flow hand washing system equipped with a 0.5-gal/min flow aerator.

Showers

The design for the showers incorporates a flat wall mounted showers system. The HYDRAPIPE design is a Symmons Product and meets ANSI A112.18.1M and EPA 92 standards. There are two separate Hydrapipe system installed. The handicap accessible shower (model 1-912RSB) through the wall piping configuration with soap dish incorporates a dual fixed on the wall showerhead as well as an adjustable, hand-held shower sprays head. Where-as, the standard shower configuration (model 1-911RS) is also a through the wall piped system with only one showerhead and a soap dish.

All spray heads are equipped with a 1.5-gal/min spray.

Toilets

All toilets are American Standard, Afwall FloWise elongated toilets which are a wall-hung/wall outlet 1.28-gal/flush configuration equipped with a 1.28-gal/flush auto sensor flush valve. Each toilet had a 2-1/8 trapway

The Afwall FloWise toilet have a System MaP rating to flush 1,000 grams of test waste (miso paste), when combined with a 1.28 or 1.6-gal/flush flush valve. The toilet meets or exceed ASME A112.9.2-2008/CSA B45.1-08 for vitreous china.

Urinals

The American Standard WashBrook FloWise Universal urinal was selected as the standard installation for the complex. The WashBrook is a barrier free unit which can be mounted a standard height as well as at handicap accessible heights. This design is an ultra high efficiency low consumption design which operates at flow rates ranging from a low of 0.125 gal/flush to 1.0-gal/flush. The units meet ASME flush requirements at all ranges of flow from the low of 0.125 to 1.0-gal/flush. The urinal design meets or exceeds ASME A112.19-2008/CSA B45.1-08 for vitreous china.

Conclusion of the Review

Simply put, overall, the fixtures which were found to be specified and installed were of the most water efficient and appropriate as could have been called for under any strict water conserving design.