WATER SUPPLY & DEMAND ASSESSMENT
IN RELATION TO
EXELON POWER 'WEST MEDWAY II' PROJECT

FOR
TOWN OF MEDWAY, MA

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A Report Prepared for:

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EXELON POWER 'WEST MEDWAY II' PROJECT

Kleinfelder Project Number: 20161384.001A

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EXECUTIVE SUMMARY

Purpose

Kleinfelder was retained by the Town of Medway to assess the feasibility of providing potable water supply to the proposed West Medway II Project. The West Medway II Project is being proposed by Exelon Corporation. Kleinfelder also identified and ranked possible solutions where limitations exist to provide the requested water supply.

Summary of Findings and Recommendations

Kleinfelder's assessment with regards to water demand and supply for the proposed West Medway II Project focused on two primary objectives. First, Kleinfelder assessed the adequacy of the Town of Medway's water system. Second, Kleinfelder identified potential solutions to address limitations of the Town of Medway's water system. All findings are discussed in detail in this evaluation report. However, for the purposes of condensing the findings, they are summarized below. See Section 1.1.4 for definitions of the terms used in this summary.

Available Supply from the Town of Medway (see Section 2.2)

The Town of Medway draws drinking water from four local groundwater supply wells. The Town has discretion to pump these wells in any combination to meet system demands, provided the following two requirements from the Town's WMA permit are met:

1. Average daily withdrawal from all four wells combined is less than or equal to 0.92 MGD over the course of a calendar year;
2. No groundwater sources are pumped above their individual safe yields shown in Table 2-1 at any time.

The sum of the individual wells safe yield provides the maximum total daily withdrawal available of 2.60 MGD to the Town should it need to meet atypical peak or emergency demands (i.e. firefighting) on a short term basis. The actual available supply is much lower; limited by physical and operational infrastructure factors which prevent the Town of Medway from maximizing withdrawals. The total current maximum daily output (pumping 24 hours per day) and the current normal daily output (typical summer day pumping) for the Town of Medway's water system are 1.72 MGD and 0.99 MGD, respectively.

It is also important to note that anytime the Town pumps above the permitted average daily withdrawal limit, enough corresponding days where pumping is below the average will be necessary to ensure that the annual average of 0.92 MGD is met.

Demand Projections (see Section 2.3)

Town of Medway's average daily demand (ADD) has been increasing since 2006, despite a number of actions taken by the Town to reduce demand. The sharp rise in demand may be attributable to leakage. A leak repair made in December 2014 has reduced daily demand as exhibited in the daily pumping records maintained by the Town and the water demand for the Town of Medway is expected to be lower for 2015 than in previous years. Based on the daily pumping records, Kleinfelder has estimated that ADD for 2015 will be approximately 0.86 MGD.

Using the estimated ADD value for 2015, Kleinfelder projected the 2016 ADD value for the Town of Medway to be 1.00 MGD including pending and proposed developments. The requested supply for Exelon (0.05 MGD) would raise it to 1.05 MGD. Based on population projections, Medway's ADD would be expected to rise to 1.14 by 2028.

Estimated Medway maximum daily demand (MDD) for 2016 (including pending and proposed residential developments) is 1.50 and would rise to 1.65 with the addition of Exelon. Based on population increase, Medway's MDD would be projected to rise to 1.79 by 2028.

Evaluation of Supply Adequacy (see Section 2.4)

Due to high iron and manganese levels, the Oakland well is not being utilized on a daily basis and is only used for short term spikes in demand or if another well is offline for repairs. Assuming normal daily output (NDO) rates, (without the Oakland Street Well running), Medway's supply availability (0.99 MGD) to meet 2016 projected ADD (including proposed new residential development and Exelon) of 1.05 and future ADD of 1.14 is not adequate. **There is a supply deficit of 0.06 MGD in the near term, and a future deficit of 0.15 MGD for meeting ADD by 2028.** If the Oakland Well had iron and manganese filtration installed, it would add an additional 0.2 MGD of supply. This would bring Medway's NDO up to 1.20, or sufficient to meet current and future projected 2028 ADD.

Assuming maximum daily output (MDO) rates for 24 hours per day, using all four of their wells running, Medway's supply availability (1.72 MGD) is adequate to meet estimated 2016 MDD (including development and Exelon) MDD of 1.65. **However, it is insufficient to meet future MDD of 1.79 MGD.** Note that this assumes the 24- hour per day pumping of the Oakland Street Well, which has high levels of iron and manganese. The pumping of Oakland Street for more than a brief period of time will cause discolored water and may require public notification regarding health effects.

With its largest source (the Populatic Street well) offline, the available maximum daily output from the Town of Medway system is reduced from 1.72 MGD to 1.14 MGD. **Therefore, with the Populatic Street well offline the Town of Medway cannot meet its current or future MDD. There is a current supply deficit under this scenario of 0.46 MGD.**

Assessment of Permitted Supply (see Section 2.5; Section 3.1)

Medway's WMA Permit provides sufficient water withdrawal to meet the estimated 2015 ADD but not for the projected 2016 and future (2028) ADD. Therefore, a new permit or permit modification request would be required to increase these limits. New Water Management Act Regulations (310 CMR 36.00) were promulgated in the fall of 2014. The anticipated applicability of the WMA Permit requirements are discussed in more detail in Appendix B. In summary, for almost all of the options considered, Medway will need to apply for a new WMA Permit under 'Tier 2' for requesting a new permit limit above 0.99 MGD (baseline). The specific requirements to allow for an increase in permitted withdrawal must be determined by consultation with MassDEP staff. It appears that the purchase of water from a neighboring community would not trigger the need for a new WMA Permit by Medway, but the specifics this should be confirmed with MassDEP.

Evaluation of Storage Adequacy (see Section 2.6)

Based on the Medway Water Department Public Water System Sanitary Survey (MWD, 2015), the Town of Medway has two active water storage tanks with a total capacity of 2.6 MG. Based on the Town of Medway, *Water System Master Plan* (W&S, 2010) the water storage was determined to be adequate for current and future demands. Although current and future demand estimates included in this assessment differ slightly from the values included in the Water System Master Plan, Kleinfelder anticipates that water storage is still adequate within this minor variation in estimates. It should be evaluated again in the Town's next Water System Master Plan update.

Water Distribution Assessment (see Section 2.7)

Kleinfelder utilized the Town's existing water system hydraulic model to evaluate impacts to fire flow availability in the area of the proposed Exelon peaking station project, as well as to other areas of the Town. The Available Fire Flow (AFF) to the nodes in the vicinity of Exelon, and throughout the Town, remains nearly constant with the increased demands the development would require, both under existing and future peak hour demand conditions. As such, Kleinfelder concludes that the Exelon development will have little impact to the water distribution system's hydraulics and that no new fire flow deficiencies will be created.

The water system hydraulic model, as provided to Kleinfelder, did not include information for Needed Fire Flow (NFF). NFF indicates how much flow is required to a site and is calculated in accordance with Insurance Services Office, Inc. (ISO) guidelines, which considers factors including but not limited to site use, building size, and occupancy limits. When modeled AFF is found to be less than NFF, it indicates that insufficient fire flow is available at that location. As NFF data was unavailable, and this analysis was beyond the scope, Kleinfelder did not determine if there are any locations for which AFF is less than NFF. Further analysis would be required to identify locations with deficient fire flow conditions under the Town's present day demands.

Alternatives for Meeting Future Demand (see Section 3)

In order to safely and reliably meet demands with adequate operational flexibility, Medway will need to:

1) Continue to implement demand management and water loss reduction measures.
2) Supplement its supply in order to provide operational flexibility in order to meet MDD with the Populatic Well offline, and
3) Construct iron and manganese removal treatment for (at a minimum) the Oakland Well.

Options for increasing supply were evaluated, including: well redevelopment to increase normal daily output rates, construction of satellite wells, development of a new supply, and purchasing water from a neighboring community. A program of routine well cleaning / redevelopment is important to maintain existing pumping capacity from year to year. Nevertheless, the efficacy of well rehabilitation over time tends to decline as wells age. The installation of satellite well(s), particularly at the Populatic site, appears to be the most favorable option to provide increased supply and operational flexibility for allowing to rest wells and take them out of service for cleaning. This would need to be further investigated with an exploratory drilling and pump testing effort.
Another way to supplement supply in the near term would be a purchase of water from Millis. The feasibility of this solution would need to be further explored in terms of hydraulics, water quality, and permit requirements.

Conclusions & Recommendations (Section 4)

In summary, the following steps are recommended for Medway:

Ongoing:

- Continue to implement existing and ongoing actions to minimize withdrawal including:
    - UAW Compliance Plan measures and demand management
    - Distribution system improvements

Near Term:

- Consult with MassDEP on regulatory requirements for new WMA Permit application for withdrawal above baseline to identify specific minimization and mitigation credit options available.
- Implement a comprehensive well rehabilitation program.
- Implement a satellite well exploratory phase study.
- Initiate discussions with Millis about potential water purchase.
- Fund design of water treatment facility.
- Construct satellite well(s) if recommended by exploratory study.

Longer Term:

- Continue to construct water main replacement as recommended in 2010 Master Plan to eliminate pipe prone to leakage.
- Construct water treatment facility to remove iron and manganese.

There are a number of funding sources available to help offset costs including the following:

- Drinking Water SRF Grants and Loans (planning and construction)
- MassDEP Water Management Act Grant Program (planning, demand management, implementation projects that demonstrate environmental benefit)

1. INTRODUCTION

Kleinfelder was retained by the Town of Medway (Town) to complete an assessment of the feasibility of providing potable water supply to the proposed Exelon West Medway II Project. Kleinfelder also identified and ranked possible solutions where limitations exist to providing the requested water supply.

The West Medway II Project is a proposed expansion of the West Medway Station, owned by Exelon Corporation. The expansion will include the construction of a new energy peaking facility, south of the existing facility, to be operated during times of peak energy demand. Exelon requests water from the Town of Medway for the proposed facility, mainly for process needs. The Water Mass Balance Characterization (HDR, 2015) report proposes to withdraw water from the Town of Medway at two locations. Water will be supplied through the existing connection to the current facility along Summer Street. In addition, a new service connection from the water main in West Street is proposed. Municipal water is proposed to be used for potable water (plumbing), service water, and fire suppression at the proposed facility. Also, the proposed facility will have a 500,000 gallon storage tank to store water required for processing needs and a dedicated volume for fire suppression.

It should be noted that Kleinfelder's findings in this report are solely based on its review of available information as provided by the Town, Exelon and its representatives, and from other sources of information as described herein. For this assessment, Kleinfelder utilized the average monthly and daily maximum water use values for the proposed Exelon facility as they are presented in Table 4.3-1 in the *Petition Before the Massachusetts Energy Facilities Siting Board for Approval to Construct a Nominal 200 MW Simple Cycle Combustion Turbine Generating Facility* (EFSB Petition), Epsilon, 2015.

1.1 Background

1.1.1 Town of Medway Background

The Town of Medway is approximately 12 square miles in size and is located in Norfolk County; bordered by Holliston, Millis, Milford, Bellingham, and Franklin (see Figure A1 in Appendix A). The Charles River forms about two-thirds of the Town's southern boundary and all of Medway lies within the Charles River major basin. Medway has a population of approximately 12,800 (2010 US Census), which is expected to grow to over 14,000 by 2030 (Metropolitan Planning Commission, 2006).

1.1.2 Town of Medway Water System

The Town of Medway provides drinking water to residents and businesses via four local groundwater supply wells installed in sand and gravel aquifer deposits (Table 1-1). Based on the Medway Water Department *Public Water System Sanitary Survey* (MWD, 2015) and information provided by David D'Amico, the Town of Medway Department of Public Services (DPS) Deputy Director (Damico, 2015c), the four wells have maximum rated capacities ranging from 330 gallons per minute (gpm) to 600 gpm but are normally pumped at rates ranging from 220 gpm to 400 gpm. The distribution system consists of a single pressure zone served by 74 miles of 6-inch to 12-inch diameter water mains and two (2) active water storage tanks with a combined usable capacity of 2.6 million gallons.

Table 1-1: Existing Wells[2], Town of Medway, Massachusetts									
Well #	**Well Name**	**Year Constructed**	**Screen Diameter (in)**	**Depth (ft)**	**Pump (Hp)**	**TDH (ft)**	**Design Capacity (MGD)**	**Current Maximum Daily Output (24-hr) [3] (MGD)**	**Normal Daily Output[3] (MGD)**
1	Water St/ Populatic Well	1943 Deepened 2000[1]	24	61	40	295	0.86	0.58	0.43
2	Oakland Street	1964	24	59	60	265	0.59	0.36	0.0
3	Village Street (Replacement)	1976 Replaced 2008	18	86	60	292	1.01	0.47	0.33
4	Industrial Road	2008	24	86	60	300	0.66	0.32	0.22
						Total	**3.12**	**1.72**	**0.99**

Notes:

(1) Record plans at well sites.
(2) Unless otherwise noted, information was obtained from the Medway Water Department *Public Water System Sanitary Survey* (MWD, 2015).
(3) Haley & Ward, 2015.

Medway has a current WMA Permit annual maximum raw water withdrawal limit (registration + permit volume) of 0.92 million gallons per day (MGD) on an average daily basis, which is discussed in further detail in Section 2. In recent years, Medway has pumped above their maximum withdrawal volume.

The Town has system interconnections with four communities available for use during emergencies; the Towns of Bellingham, Franklin, Millis and Milford (Milford Water Company). For more detailed information regarding the Medway water system, refer to the Town of Medway, *Water System Master Plan* (W&S, 2010).

1.1.3 Regional Water Basin Description

Figure A-1, in Appendix A, illustrates the major water basins in the vicinity of the Town of Medway. The Town of Medway's source groundwater wells are located in two separate subbasins within the Charles River Basin (Bogastow Brook sub-basin and Charles Chicken Brook to Stop River sub-basin). The subbasins have been categorized under the Water Management Act Regulations (310 CMR 36.00) as Groundwater Withdrawal Categories 4 and 5, respectively, which requires that the Town minimize existing impacts to the greatest extent feasible, making conservation and water loss reduction in this area important priorities. The Town of Medway sources and associated subbasins are summarized in Table 1-2.

Table 1-2: Medway Supply Well & Subbasin Summary		
Well #	**Location**	**Charles River Subbasin Name & Subbasin ID #**
# 1	Populatic Street	Charles, #21162
# 2	Oakland Street	Bogastow Brook, #21132
# 3	Village Street	Charles, #21162
# 4	Industrial Rd	Bogastow Brook, #21132

1.1.4 Definitions

Kleinfelder utilizes several different key terms in this assessment which are defined in this section.

1.1.4.1 Water Management Act (WMA) Permit

The Water Management Act (WMA) became effective in March 1986. The WMA regulates the quantity of water withdrawn from both groundwater and surface water sources. Any proposed withdrawal in excess of an annual average of 100,000 GPD, or 9 million gallons in any three month period must apply for a permit.

The Town of Medway owns and operates its water supply and distribution system under the requirements of WMA Permit #9P4-2-20-177.01. The WMA permit was issued to The Town of Medway on June 7, 2011. The WMA permit establishes allowable withdrawal limits over a 20-year period, divided into four 5-year Periods. The specific limits made by this permit are discussed in this assessment.

1.1.4.2 Sustainable Water Management Initiative (SWMI)

The Sustainable Water Management Initiative (SWMI) is a policy framework developed by the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) which informs and guides the development of future WMA permits. SWMI is intended to balance the need to provide water to Massachusetts communities, while also recognizing the need for ecological health and promoting economic development. The framework for the SWMI was published in November 2012. MassDEP has begun to incorporate the SWMI principles into its WMA permitting process by conducting several rounds of pilot projects with communities in the Commonwealth.

1.1.4.3 Safe Yield

The term safe yield is often used to describe the total volume of water that may be withdrawn from a source without causing failure. Safe yield is also used to describe the maximum authorized daily withdrawal that is available from an individual groundwater supply. This limit is defined in the Town of Medway's WMA permit. For the purposes of Kleinfelder's evaluation, safe yield is the latter definition and specifically applies to maximum daily withdrawals (raw water pumped from the wells). This is a theoretical safe yield based on aquifer and well characteristics. Actual well yield depends on operational considerations and current well conditions and are described by normal and maximum daily output (see below).

1.1.4.4 Average Daily Demand (ADD)

The term average day demand is used throughout this evaluation and is abbreviated by ADD. The ADD is the total water supplied to a service area in the period of one year and divided by 365 days. The total water provided includes any water used for maintenance, hydrant flushing and any unaccounted for water that may not be used directly by the end user. Daily demand data for the estimation of 2015 ADD was provided by Tom Holder, the Town of Medway DPS Director (Holder, 2015b).

1.1.4.5 Maximum Daily Demand (MDD)

The term maximum day demand is used throughout this evaluation and is abbreviated by MDD. The MDD is the maximum water demand over a 24-hour period in the course of one year.

When evaluating the adequacy of supply sources to meet water demand it is critical to account for MDD. The Town of Medway's system should be capable of meeting the MDD each year without relying on system storage. Storage should be reserved to meet demands during periods of peak consumption and should provide the volume of water required for fire protection.

1.1.4.6 Normal Daily Output (NDO)

Normal Daily Output (NDO) values were provided by Haley & Ward on behalf of the Town of Medway (Haley & Ward, 2015). These values are the actual pumping rates for 2015 at the typical run times for summer. These values have been assumed to be the average daily supply for the Town of Medway for the purposes of Kleinfelder's assessment.

1.1.4.7 Maximum Daily Output (MDO)

Maximum Daily Output (MDO) values were provided by Haley & Ward on behalf of the Town of Medway (Haley & Ward, 2015). These values are reported maximum operational capacity for wells pumping at 24 hours per day and assumed to be the maximum daily supply for the Town of Medway for the purposes of Kleinfelder's assessment.

1.1.4.8 Peaking Factor

The peaking factor is unit-less and calculated as a ratio of MDD to ADD and represents the relationship between MDD and ADD for the given community for water supply.

1.1.4.9 Peak Hour Demand

All community water systems experience a peak hour demand due to events like water main breaks, and fires. Peak hourly flows are supplied from storage constructed at appropriate locations within the distribution system and not from the design capacity of the sources of supply.

1.2 Information Sources Reviewed

Kleinfelder's scope of review was limited to documents provided by the Town of Medway. Specifically, those documents that relate to water supply and demand were reviewed for this study, as summarized below.

1. American Water Works Association, *Distribution System Requirements for Fire Protection*, Fourth Edition, 2008.
2. D. D'Amico, 2015a (email communication, *Water Production and Consumption Data*, July 8)

3. D. D'Amico, 2015b (email communication, *Exelon Work*, July 8)
4. D. D'Amico, 2015c (email communication, *Well Information*, July 10)
5. *Epsilon Associates, Inc. (Epsilon), 2015, Petition Before the Massachusetts Energy Facilities Siting Board for Approval to Construct a Nominal 200 MW Simple Cycle Combustion Turbine Generating Facility, March.*
6. Grasso Associates (Grasso), 2015, *Report to Town of Medway on West Medway Expansion Project*, July 21.
7. Haley & Ward, 2015 (email communication, *Medway Wells*, September 3)
8. HDR, Inc. (HDR), 2015, *Water Mass Balance Characterization*, West Medway II Project, April 27.
9. Kleinfelder, 2013, *Final Technical Report Sustainable Water Management Initiative Feasibility Study,* Medway, Massachusetts, June.
10. Liston Utility Services (Liston), 2014. *Final Report Town of Medway Massachusetts 2014 Leak Correlation Survey*, December 19.
11. Massachusetts Department of Environmental Protection (MassDEP), 2010, *Final 20 Year Permit Renewal*, Medway, Massachusetts, February 26.
12. *MassDEP, 2014, Guidelines for Public Water Systems,* Chapters 1-12, April.
13. MassDEP, 2011, *Public Water System Annual Statistical Report Reporting Year 2010*, Medway Water/Sewer Department, Medway, Massachusetts.
14. MassDEP, 2012, *Public Water System Annual Statistical Report Reporting Year 2011*, Medway Water/Sewer Department, Medway, Massachusetts.
15. MassDEP, 2013, *Public Water System Annual Statistical Report Reporting Year 2012*, Medway Water/Sewer Department, Medway, Massachusetts.
16. MassDEP, 2014, *Public Water System Annual Statistical Report Reporting Year 2013*, Medway Water/Sewer Department, Medway, Massachusetts.
17. MassDEP, 2015a, *Environmental Notification Form,* West Medway II, Medway, June 11.
18. MassDEP, 2015b, *Public Water System Annual Statistical Report Reporting Year 2014*, Medway Water/Sewer Department, Medway, Massachusetts, March 9.
19. Medway Water Department (MWD), 2015, *Public Water System Sanitary Survey*, May 15.
20. T. Holder, 2015a (email communication, July 8, 2015).
21. T. Holder, 2015b (email communication, *2015 Daily Water Production*, August 16, 2015).
22. Weston & Sampson Engineers, Inc. (W&S), 2010, *Water System Master Plan,* Town of Medway, Massachusetts, January.

2. WATER SYSTEM ADEQUACY

2.1 Approach

The ability of a water system to meet the water demand in the system must be evaluated from: (A) the adequacy of its supplies; (B) the adequacy of its treatment; (C) the adequacy of its storage; and (D) the adequacy of its distribution system to deliver the supply.

A. Water supply adequacy is evaluated based on how the supply is permitted and how the water system operates. In most cases, one of these two factors (permit limits or operational limits) is what determines the actual available supply.

    1. Compare the actual operational capacity of the sources with water demand (current and future) in the system.
    2. Compare the permitted withdrawal amount for the sources with water demand in the system.

B. Treatment adequacy is evaluated by comparing the available treated supply to current and future demands.

C. Storage adequacy is evaluated by comparing storage capacity to current and future demands.

D. Water distribution system adequacy is evaluated by determining the impacts of the proposed Exelon development to the Town of Medway's distribution system and its ability to supply adequate fire flow during peak hour demand in the system while maintaining adequate service pressure to customers.

2.2 Available Supply from the Town of Medway

As discussed in Section 1.1.2, the Town of Medway draws drinking water from four local groundwater supply wells. The groundwater withdrawals are permitted through the established WMA safe yield for each individual groundwater source. An evaluation of Medway's annual permitted groundwater withdrawal is discussed in Section 2.5.

2.2.1 Safe Yield

The groundwater sources utilized by the Town of Medway include the Populatic Street Well, Oakland Street Well, Village Street Well, and Industrial Road Well. The Town has discretion to pump these wells in any combination to meet their system demands, provided the following two requirements from the Town's WMA permit are met:

    3. Average daily withdrawal from all four wells combined is less than or equal to 0.92 MGD over the course of a calendar year;
    4. No groundwater sources are pumped above their safe yields shown in Table 2-1 at any time.

As was previously defined, "safe yield" is the maximum daily withdrawal that can be made at an individual groundwater source as set by the WMA permit so as to ensure that neither the well nor

the aquifer contributing to it, are ever overstressed. As such, the sum of each well's safe yield provides the maximum total daily withdrawal available to the Town should it need to meet atypical peak or emergency demands (i.e. firefighting) on a short term basis. The safe yield for each groundwater source as well as the total maximum daily withdrawal are presented in Table 2-1. Note that the safe yield is lower than the design capacity of the sources, since it considers the effect of pumping during drought conditions. It is also important to note that anytime the Town pumps above the permitted average daily withdrawal limit, enough corresponding days where pumping is below the average will be necessary to ensure that the annual average of 0.92 MGD is met.

Table 2-1: Safe Yield – Groundwater Sources

Source	WMA Permit Approved Max Daily Withdrawal (MGD)
Populatic Street Well	0.87
Oakland Street Well	0.59
Village Street Well	0.66[1]
Industrial Road Well	0.48
Total	**2.60**

Notes:
(1) Original and replacement well 3R combined volume.

Actual well yields depend on operational considerations and current well conditions and are described by normal and maximum daily output (see below).

2.2.2 Limitations on Average and Maximum Daily Supply

The available daily supply from each source is summarized below in Table 2-2 which reflects the maximum daily output and the normal daily output based on actual operational conditions of each well as provided by Medway (Haley & Ward, 2015). These values have been assumed to represent the maximum and average daily available supply for the purposes of this assessment for comparison with MDD and ADD in Section 2.4.

Table 2-2: Available Water Supply

Source Name	WMA Permit Maximum Daily Withdrawal (MGD)	Available Withdrawal (MGD)	
		Current Maximum Daily Output[1]	Current Normal Daily Output[2]
Populatic Street Well	0.87	0.58	0.43
Oakland Street Well	0.59	0.36	0.0[3]
Village Street Well	0.66	0.47	0.33
Industrial Road Well	0.475	0.32	0.22
Total	**2.60**	**1.72**	**0.99**

Notes:
(1) Haley & Ward, 2015; based on all wells pumping at 24 hours per day.
(2) Haley & Ward, 2015; based on typical summer run times (2015).
(3) The Oakland well water quality is poor, limiting its use to short term spikes in demand or periods when other wells are offline for repairs.

The actual available supply is limited by physical and operational infrastructure factors which prevent the Town of Medway from maximizing withdrawals, not the individual safe yield for each well as established by the WMA permit. Limitations of the WMA permit on average daily withdrawal is discussed below in Section 2.5. Limitations on supply due to water treatment considerations, particularly for the Oakland Street Well, are discussed below in 2.2.3.

2.2.3 Supply Treatment Limitations

Based on information presented in the Medway Water Department *Public Water System Sanitary Survey* (MWD, 2015), the treatment processes utilized by the Town include chemical injection for corrosion control using lime, disinfection using sodium hypochlorite, fluoridation using sodium fluoride, and iron and manganese control using polyorthophosphate for sequestering. The Town of Medway utilizes sequestration, by adding polyorthophosphate to groundwater at the well head in order to control potential aesthetic problems caused by iron and manganese. MassDEP guidelines allow sequestering of iron and manganese if combined levels are below 1.0 mg/L.

The use of sequestering is effective for the Populatic Street, Village Street, and Industrial Road wells, but not for the Oakland well since it has raw water iron and manganese levels that are too high for sequestering to be effective. The Oakland Street Well is currently only used for short term spikes in demand or as necessary if another well is taken offline for repairs. The Town of Medway has included the construction of a water treatment facility to remove iron and manganese in its long term capital plan. Once such a facility is constructed, the Oakland Street Well could be utilized to likely supply up to 0.22 MGD, assuming a recommended operational run time of 12 hours per day (Haley & Ward, 2015).

2.3 Demand Projections

2.3.1 Town of Medway Water Demand

Water demands presented in this section specifically deal with historical and projected water demand for existing and future Town of Medway users, not including the proposed Exelon facility. The projected water demand for the proposed Exelon facility is discussed in Section 2.3.2.

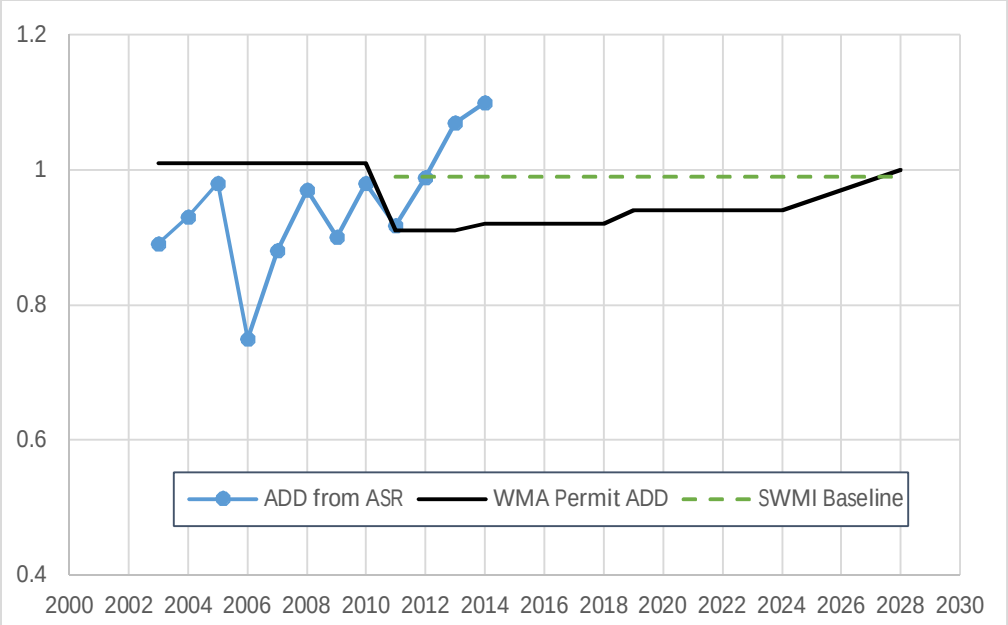
2.3.1.1 Current and Future Average Daily Demand (ADD)

A compilation of ADD based on a review of *Public Water System Annual Statistical Reports* for the Town of Medway since 2003 is shown below in Figure 1, along with the Town's WMA Permit limits.

Based on Figure 1, ADD has been trending upward since 2006, despite a number of actions taken by the Town to reduce demand (discussed in further detail in Section 3). Unaccounted for water (UAW) has also been rising during this interval. In response, the Town has increased its leak detection survey frequency from annually to biannually starting in 2013. Between November 2014 and December 2014, the Town of Medway contracted a vendor to perform a correlation leak detection survey of the Town's entire water distribution system (Liston, 2014). The previous leak detection survey in 2013 (Thurber Assoc.) detected 50 gpm of leakage. The total leakage based on the 2014 survey was estimated at 360 gpm (0.52 MGD), including a large 300 gpm water main leak on Village Street near Walker Street. The Town of Medway repaired the water main break

on Village Street in December 2014. This leak was previously undetected apparently due to its location near the Charles River.

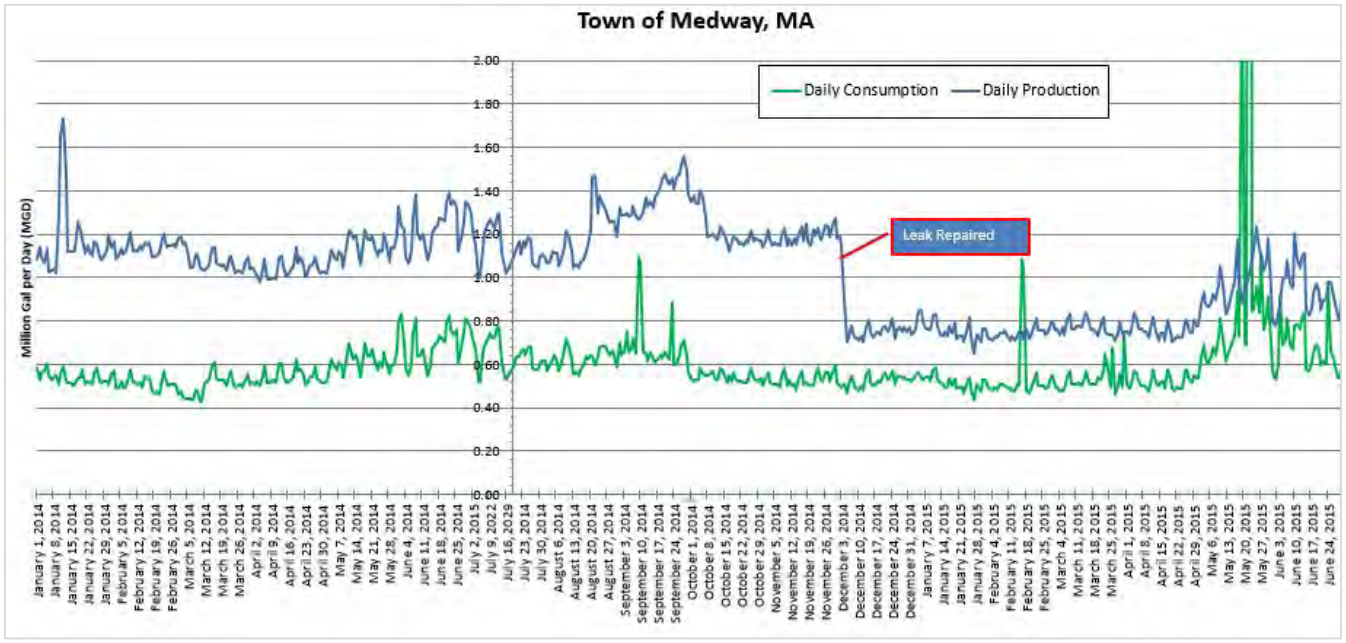
Figure 1: Historic Demands and Permit Limits (MGD), Town of Medway



The sharp rise in demand may be attributable to leakage. The leak repair made in December 2014 has reduced daily demand as exhibited in the daily pumping records maintained by the Town. Figure 2 below shows daily production and consumption from January 1, 2014 through June 24, 2015, with the leak repair of December 2014 effectively dropping the daily production rate from around 1.2 MGD to less than 0.8 MGD for the winter months. Therefore, the water demand (ADD and MDD) for the Town of Medway is expected to be lower for 2015 than in previous years.

In order to estimate current ADD and MDD values for 2015, Kleinfelder utilized the Town's average production value for the year 2015 to date, from January 1st to August 25th (Holder, 2015b). Based on this information, the estimated ADD value for 2015 is 0.86 MGD. While this ADD value is assumed to be representative of the current Town of Medway water system, it is noted that the value accounts for the high-demand summer season yet not the fall and early winter when demands tend to decrease. As such, it is anticipated that the Town's final ADD for 2015 might actually decrease below 0.86 MGD. However, since this is speculative, the ADD of 0.86 MGD was viewed as a more conservative figure and it has been utilized for evaluation purposes in this report.

Figure 2: Decrease in Pumping Following Repair of 300 gpm +/- Leak in 2014



Having estimated the 2015 ADD, it was then necessary to identify system demands when Exelon actually begins using water at the requested flows. As construction of the project will take some time if approved, Kleinfelder has assumed that the Exelon demands will not be present until 2016 at the earliest. Therefore, in order to project a 2016 ADD value for Medway that accounts for possible development in the Town, Kleinfelder added the demand for several proposed new residential developments to the estimated 2015 ADD. These demands included a residential housing unit under construction (Millstone Village) and two proposed residential developments (Willows and Timber Crest Estates) that are in the Planning Board approval and concept phases, respectively. Table 2-3 below summarizes the current demand for Medway, including these development projects. The projected ADD value for 2016 for the Town of Medway, including pending and proposed developments is 1.00 MGD.

According to the Town's *Water System Master Plan* (W&S, 2010) demand projections, future ADD was estimated to be 0.92 MGD by 2018 and 1 MGD by 2028. This is an 8.7% increase in the ADD between 2018 and 2028. These projections were developed using the Massachusetts Department of Conservation and Recreation projections prepared for the WMA permit renewal. Kleinfelder utilized the 8.7% increase in ADD to establish a projected ADD for 2028. Based on the projected 2016 ADD as estimated by Kleinfelder (1.00 MGD), the projected future ADD was estimated to be 1.09 MGD (Table 2-3).

Table 2-3: Estimated Current & Projected Medway ADD, Exclusive of Exelon West Medway II	
Source	**ADD (MGD)**
Medway Estimated 2015 ADD	0.86(1)
Development Projects	
Millstone Village	0.017
Willows	0.056
Timber Crest Estates	0.065
Total Projected 2016 ADD	**1.00**
Estimated Future (2028) ADD	**1.09**(2)
Notes: (1) Average 2015 ADD to date (January 1st to August 25th) (2) 8.7% increase based on Master Plan 2010	

2.3.1.2 Town of Medway Current and Future Maximum Daily Demand (MDD)

As shown in Table 2-4, the MDD in the Town of Medway system averaged 1.43 MGD from 2008 through 2012 based on a review of the *Annual Statistical Reports* for the Town of Medway. Projected future MDD is included in the Town of Medway, *Water System Master Plan* (W&S, 2010). According to this document, the future MDD is estimated to be 1.5 MGD by 2028. As discussed in Section 2.3.1.1, Kleinfelder estimated an ADD of 1.00 MGD in 2016. A peaking factor of 1.5, which is the average peaking factor reported in the *Public Water System Annual Statistical Reports* between 2003 and 2014, was used to calculate a current MDD of 1.50 MGD. The peaking factor (1.5) was also applied to the ADD for 2028 to calculate a projected MDD of 1.64 MGD.

Table 2-4 summarizes the historic and projected water use by the Town of Medway, as well as the source of the information.

Table 2-4: Historic and Projected Town of Medway Water Demand, Exclusive of Exelon				
Year	**Average Daily Demand (ADD) (MGD)**	**Maximum Daily Demand (MDD) (MGD)**	**Peaking Factor (MDD/ ADD)**	**Data Source**
2008	0.97	1.46	1.5	Public Water System Annual Statistical Reports
2009	0.9	1.35	1.5	
2010	0.98	1.47	1.5	
2011	0.918	1.43	1.6	
2012	0.988	1.46	1.5	
Average 2008 - 2012	0.951	1.43	1.5	
2015	0.86	1.29	1.5	Average 2015 ADD to date (Holder, 2015b)
2016	1.00	1.50	1.5	Kleinfelder projection including new development projects
2028	**1.09**	**1.64**	1.5	Kleinfelder projection based on W&S, 2010 demand projections

2.3.2 Exelon Facility

2.3.2.1 Average Daily Demand (ADD) and Maximum Daily Demand (MDD)

The estimated average monthly water use for the proposed Exelon facility was outlined in the *Petition Before the Massachusetts Energy Facilities Siting Board for Approval to Construct a Nominal 200 MW Simple Cycle Combustion Turbine Generating Facility* (EFSB Petition), Epsilon, 2015. According to this document, the average monthly water use for the proposed facility is 97,228 gpd (0.097 MGD). According to the *Environmental Notification Form* for the West Medway II Project (MassDEP, 2015a), Exelon will supply 48,960 gpd using an on-site well. Therefore, the proposed Exelon facility should only require an average daily supply of 48,268 gpd (0.048 MGD) from the Town of Medway. For the purposes of this evaluation, Kleinfelder has rounded this demand estimate to 0.05 MGD ADD. If provided, this will result in a total Medway ADD of approximately 1.05 MGD. It is noted that should Exelon's on-site well not provide the production estimated in their filings or should it experience any operational issues, the Town may be requested to provide additional water to the site. Under such circumstances, the total Medway ADD could rise to 1.10 MGD.

The estimated daily maximum water use for the proposed facility was also included in the EFSB Petition. According to this document, highest daily maximum water use occurs in January and is 191,010 gpd and the on-site well at the proposed facility will supply 48,960 gpd to the proposed facility. Therefore, the proposed Exelon facility will require maximum daily supply of 142,050 gpd (0.14205 MGD) from the Town of Medway. For the purposes of this evaluation, Kleinfelder has rounded this demand estimate to 0.15 MGD MDD. If provided, this demand will result in a total Medway MDD of approximately 1.65 MGD.

2.4 Evaluation of Supply Adequacy

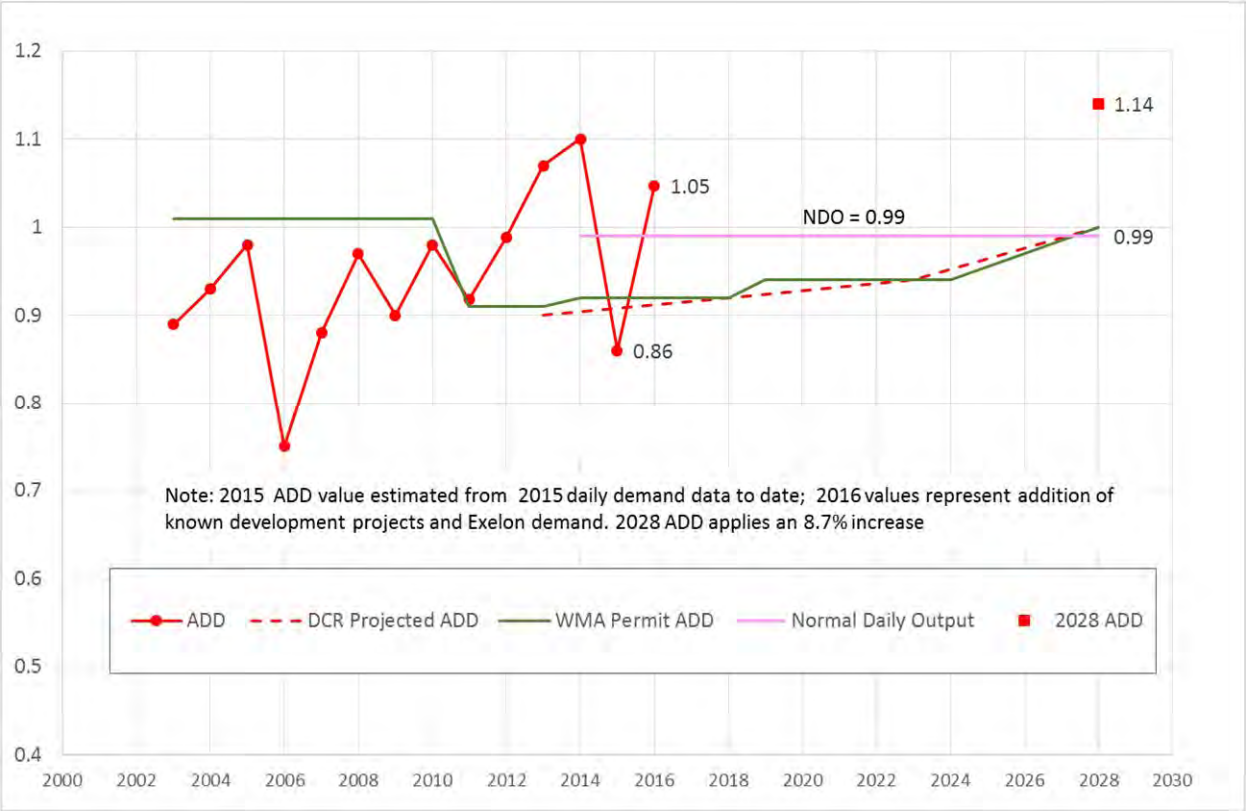
The current available supply from the Town of Medway was discussed in Section 2.2. Estimates of existing and future demand for the Town of Medway and the proposed Exelon facility were discussed in Section 2.3. This section presents the comparison between available supplies in relation to projected demands (including the Exelon facility) without regard to the WMA Permit limits, which are discussed in Section 2.5.

2.4.1 Supply Adequacy to Meet Average Day Demand (ADD)

Figure 3 graphically summarizes Medway's supply in comparison with average day demand. Permit limits are also presented for reference.

The system adequacy evaluation has been based on estimated normal and maximum daily output capacities of the wells as reported by Medway (Table 2-2). As seen on Figure 3, assuming normal daily output (NDO) rates, without the Oakland Street Well running, Medway's supply availability (0.99MGD) to meet 2016 projected (including development and Exelon) ADD of 1.05 and future ADD of 1.14 is not adequate. **There is a supply deficit of 0.06 MGD in the near term, and a future deficit of 0.15 MGD for meeting ADD.**

Figure 3: Historic and Projected ADD Compared with Supply and Permit Limits (MGD), Town of Medway



Due to high iron and manganese levels, the Oakland well is not being utilized on a daily basis and is only used for short term spikes in demand or if another well is offline for repairs. If the Oakland Well had iron and manganese filtration installed, it would add an additional 0.2 MGD of supply. This would bring Medway's NDO up to 1.20, or sufficient to meet current and future projected 2028 ADD.

2.4.2 Supply Adequacy to Meet Maximum Day Demand (MDD)

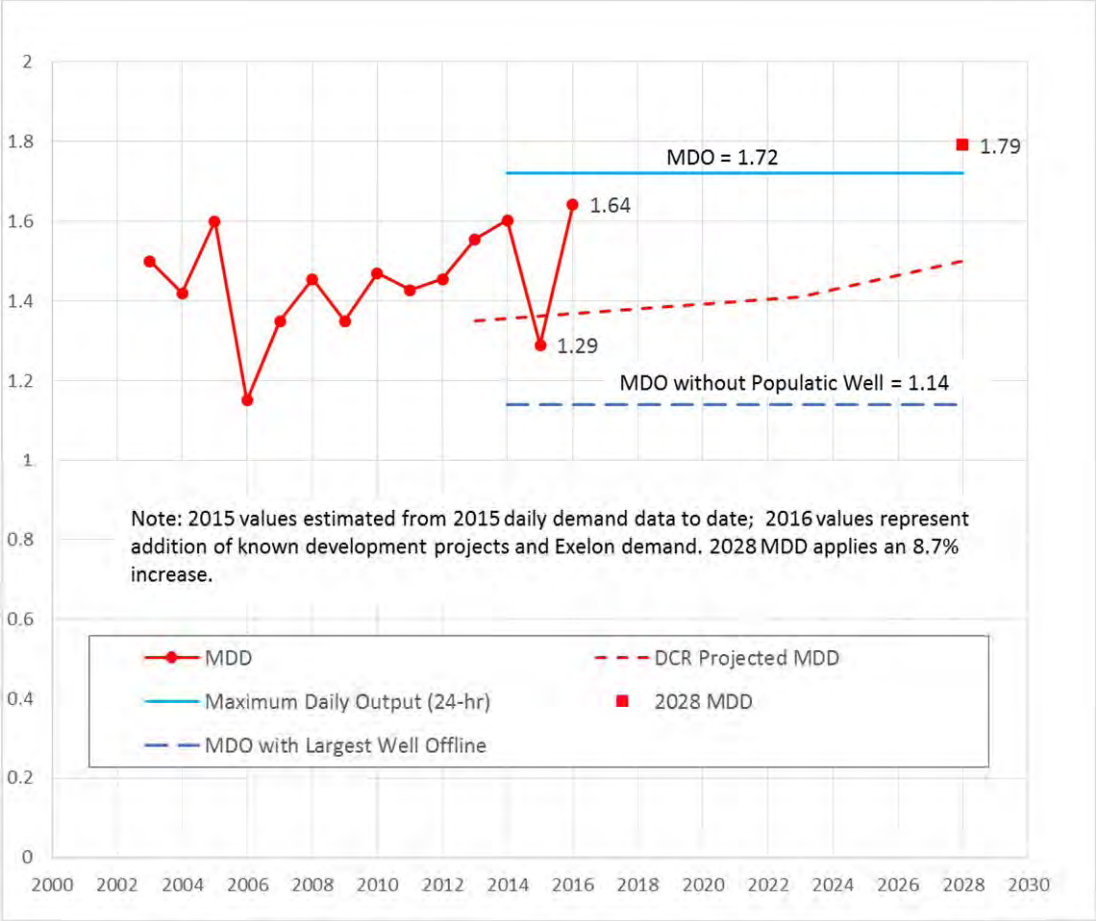
Figure 4 below illustrates Medway's supply in comparison to MDD. Assuming maximum daily output (MDO) rates for 24 hours per day, using all four of their wells running, Medway's supply availability (1.72 MGD) to meet estimated 2016 (including development and Exelon) MDD of 1.65 is adequate. **However, it is insufficient to meet future MDD of 1.79 MGD.** Note that this assumes the pumping of the Oakland Street Well, which has high levels of iron and manganese. Medway is in the process of developing a corrective action plan to address manganese in order to meet new MassDEP health advisory for manganese. In the interim, Medway may have to provide public notification regarding high levels of manganese and potential health effects when Oakland Street Well is pumped in order to meet MDD.

When performing this type of water supply analysis it is typical to not consider the supply available from the single, largest source within the system, so as to provide a factor of safety. The MassDEP "Guidelines and Policies for Public Water Systems" and the American Water Works

Association (AWWA) "Distribution System Requirements for Fire Protection Manual" describe that "[with] any pump out of service, the remaining pump or pumps shall be capable of providing the maximum daily pumping demand of the system".

In the case for the Town of Medway, the single, largest source is the Populatic Street well, because it has the highest permitted withdrawal volume as well as the highest pumping rate (0.58 MGD pumping at 24 hr/day). With the Populatic Street well offline, the available maximum daily output from the Town of Medway system is reduced from 1.72 MGD to 1.14 MGD. **Therefore, with the Populatic Street well offline the Town of Medway cannot meet its current or future MDD. There is a current supply deficit under this scenario of 0.46 MGD.**

Figure 4: Historic and Projected MDD Compared with Supply and Permit Limits (MGD), Town of Medway



2.5 Comparison of Demand to Permitted Withdrawal Limits

The Town of Medway's WMA permit dated June 7, 2011, covers a 20-year term. The permit term is divided into four 5-year periods and permits average daily withdrawal rates on an annual basis during each period (MassDEP, 2010). The permitted average daily withdrawals are summarized in Table 2-5.

Table 2-5: Summary of WMA Permitted Daily Withdrawal Limits			
Period	**Date Range**	**Daily Withdrawal (MGD)**	**Annual Withdrawal (MGY)**
1	3/1/10 – 2/28/14	0.91	332.15
2	Present through 2/29/19	0.92	335.80
3	3/1/19 – 2/28/24	0.94	343.10
4	3/1/24 – 2/28/29	0.95 / (1.00)(1)	346.75/ (365.00)(1)
Notes: (1) The WMA permit allows for a 5% buffer in Period 4 to account for uncertainty in future water demand.			

The proposed Exelon facility was assumed to come online during the current permit period (Period 2), which is coincident with the period where Medway's permitted daily withdrawal is 0.92 MGD. The WMA permitted daily withdrawal limit increases to 0.94 MGD in Period 3 and 1.00 MGD in Period 4 (including the 5% allowance). As seen in Table 2-6, in all WMA permitting periods, both the current and future ADD exceeds the WMA permitted average daily withdrawal limit.

Table 2-6: Comparison of Demand and Permitted Withdrawal Limits				
	Projected (2016) Demand (MGD)[2,3]		**Future (2028) Demand (MGD)[2,3]**	
User	**ADD**	**MDD**	**ADD**	**MDD**
Town of Medway System	1.00	1.50	1.09	1.64
Proposed Exelon Facility	0.05[4]	0.15[4]	0.05[4]	0.15[4]
Total	**1.05**	**1.65**	**1.14**	**1.79**
Permitted Withdrawal Limit	0.92[5]	2.60	0.95 / (1.00)(1)	2.60
Volume Above Permitted Withdrawal	**0.13**		**0.19 / 0.14**	

Notes:

(1) The WMA permit allows for a 5% buffer in Period 4 to account for uncertainty in future water demand.
(2) The Existing and Future Demands for the Town of Medway were calculated by Kleinfelder following a review of various resources, as discussed in Section 2.3.
(3) The Existing and Future Demands for the proposed Exelon Facility were outlined in the *EFSB Petition* (Epsilon, 2015). The Existing and Future Demands assume that the on-site well will supply 0.049 MGD as discussed in the *Environmental Notification Form* for the West Medway II Project (MassDEP, 2015a).
(4) The Existing and Future Demands assume that the on-site well will supply 0.049 MGD as discussed in the *Environmental Notification Form* for the West Medway II Project (MassDEP, 2015a).
(5) WMA Permit Period 2 limit.

The future (2028) ADD of 1.00 MGD as was presented in the Town of Medway's *Water System Master Plan* (W&S, 2010), is equal to the future WMA permit withdrawal limit of 1.00 MGD identified for Period 4, inclusive of the 5% allowance for uncertainty. However, as discussed in Section 2.3.1.1, Kleinfelder calculated a future (2028) ADD of 1.09 MGD, which exceeds the future WMA permit withdrawal limit of 1.00 MGD. **Therefore, a permit modification request**

would be required to increase the limits set in the WMA permit. Refer to Appendix B for information regarding a permit modification request.

2.6 Storage Adequacy Evaluation

Based on the Medway Water Department Public Water System Sanitary Survey (MWD, 2015), the Town of Medway has two active water storage tanks. The storage tank on Lovering Street (Tank #1) has a capacity of 1.8 MG and the storage tank on Highland Street (Tank #2) has a capacity of 0.8 MG. It is noted in the document that Tank #1 controls the operation of the water system. Based on the Town of Medway, *Water System Master Plan* (W&S, 2010) the water storage was determined to be adequate for current and future demands. Although current and future demand estimates included in this assessment differ slightly from the values included in the Water System Master Plan, Kleinfelder anticipates that water storage is still adequate within this minor variation in estimates. It should be evaluated again in the Town's next Water System Master Plan update.

Based on available supply, the Town of Medway system should be capable of meeting MDD each year without relying on system storage. Storage should be reserved to meet demands during periods of peak consumption and should provide the volume of water required for fire protection.

2.7 Water Distribution System Adequacy

Kleinfelder utilized the Town's existing water system hydraulic model to evaluate impacts to fire flow availability in the area of the proposed Exelon project, as well as to other areas of the Town. This section documents the results of this analysis.

Kleinfelder's hydraulic model analysis was completed using WaterGemsV8i modeling software by Bentley. The Town's water distribution system model was originally developed by Tata and Howard for the establishment of a unidirectional flushing program and was most recently updated in 2015 by Tata and Howard to reflect changes to the system. This updated model was provided to Kleinfelder for the purpose of analyzing the system hydraulics with and without the Exelon development. Per the scope of Kleinfelder's analysis, it was assumed that the model accurately reflects the conditions of the Town's distribution system per this recent calibration. However, Kleinfelder did complete a spot check of the model to determine if any obvious errors or concerns with the model were present. During this screening, Kleinfelder determined that the Tata and Howard model did not include the Oakland Street and Industrial Park wells. Discussions with the Town indicated that the exclusion of these wells was due to the model's original use in the establishment of a flushing program and that they were aware of this issue. The Town verified that Kleinfelder would have to add these wells for the hydraulic analysis related to the Exelon development. These pumps were subsequently added by Kleinfelder and no other significant concerns were identified.

The intent of the analysis completed by Kleinfelder was to determine if Available Fire Flow (AFF) will be significantly reduced following the construction of the Exelon project. To make this determination, four scenarios were analyzed:

1. Present Day: This scenario analyzed the existing system to identify AFF under current demand conditions to determine if any problem areas already exist.

2. Present Day with Exelon: This scenario analyzed the impact of Exelon on AFF assuming current demand conditions with the Exelon demand included.
3. Future Day: This scenario analyzed the existing system to identify AFF under future demand conditions in the year 2028 to determine if any new problem areas are predicted assuming the distribution system remains in its current form.
4. Future Day with Exelon: This scenario analyzed the impact of Exelon on AFF assuming the future demand conditions in the year 2028 with the Exelon demand included.

The existing model as created by Tata and Howard is a steady state model that uniformly distributed water demands throughout the Town based on the average daily demand. However, the model analysis required that peak hour demand be analyzed to determine how the Exelon development would impact AFF during peak system demands. The Town of Medway, *Water System Master Plan* (W&S, 2010) utilized peaking factors to estimate peak hour demands from average daily flows. Kleinfelder utilized the data presented by this plan to establish the peak hour demands used throughout both the present day and future day model scenarios.

In evaluating the four scenarios discussed above, Kleinfelder assumed the source pumps would be providing a constant flow to the distribution system at the wells' "normal daily output" flow rate presented in Table 2-2. These values represent the flow the Town prefers to keep the wells operating at, even though they can pump at a higher rate. While the constant flow does not necessarily reflect the actual operation of the pumps based on changing heads, it was determined that maintaining the flows at this normal daily output would provide a conservative analysis of the Town's production capabilities. Further, AWWA Standards recommend that distribution system models be analyzed with the single largest available water source offline so as to provide a conservative estimate of a system's redundancy and ability to deliver adequate flow under peak demand conditions. As such, the Populatic Street well was considered to be unavailable in the hydraulic analysis completed by Kleinfelder. The analysis therefore considered water production to the system to only be coming from Village Street Well, Oakland Street Well, and the Industrial Park Well.

In addition, for the two model scenarios that evaluated the presence of Exelon, it was assumed that the demand from Exelon would also be at its peak. Based on the information provided to the Town by Exelon and its representatives, Kleinfelder understood that this facility's peak demand will be 250 gpm and it will occur when Exelon is filling its on-site water storage tanks. Further, as the information indicated that the Exelon site will be served by two individual services (one off of Summer Street and one off of West Street) and it was not known what the anticipated demands at each individual service would be, Kleinfelder assigned a demand of 250 gpm to both services to provide a conservative analysis.

Based on these assumptions, the four demand scenarios previously described were evaluated. Based on the results of the model, the addition of the peak demands are estimated to have limited impact to not only the distribution system in the vicinity of the site, but also to the Town water system as a whole. The model consists of a total of 615 individual nodes at which AFF was calculated. Nodes refer to locations within the water distribution system model. The greatest percent difference for a drop in AFF at a single node was 2.3%, which represented an insignificant reduction as AFF remained above 4,700 gpm at this node. The average percent difference in AFF from existing conditions to future peak conditions with Exelon was found to be approximately 0.3% and the average reduction in AFF was determined to be 35 gpm, further indicating that the Exelon development has a negligible impact on AFF town wide.

The model as built by Tata and Howard did not include information for Needed Fire Flow (NFF). NFF indicates how much flow is required to a site and is calculated in accordance with Insurance Services Office, Inc. (ISO) guidelines, which considers factors including but not limited to site use, building size, and occupancy limits. When modeled AFF is found to be less than NFF, it indicates that insufficient fire flow is available at that location. As NFF data was unavailable, and this analysis was beyond the scope, Kleinfelder did not determine if there are any existing locations within the distribution system for which AFF is less than NFF. Further analysis would be required to identify locations with deficient fire flow conditions under the Town's present day demands.

The AFF to the nodes in the vicinity of Exelon, and throughout the Town, remained nearly constant with the increased demands the development would require, both under existing and future peak hour demand conditions. As such, Kleinfelder concludes that the Exelon development will have little impact to the water distribution system's hydraulics and that no new fire flow deficiencies will be created.

As was previously noted, it was Kleinfelder's understanding that Exelon's peak demands will occur when the company's on-site water storage tanks are being filled. While the analysis indicated that Exelon's peak demands would not adversely impact the distribution system, it is recommended that the Town work with Exelon to schedule the filling of these tanks during overnight, low-demand hours, so as to further reduce the risk of any unanticipated distribution system issues should the development move forward.

3. ALTERNATIVES FOR MEETING FUTURE DEMANDS

This section discusses potential ways for Medway to meet the current and projected future demands presented in Section 2. As discussed in Section 2, there is a projected **near term ADD supply deficit of 0.06 MGD** and a **future ADD supply deficit of 0.015 MGD.** Additionally, Medway cannot meet its MDD with its largest source offline. For 2016 MDD this represents a gap of 0.5 MGD and for 2028 this would be a gap of 0.65 MGD. Therefore, in order to safely and reliably meet demands with adequate operational flexibility, Medway will need to:

4) Continue to implement demand management and water loss reduction measures.
5) Supplement its supply in order to provide operational flexibility in order to meet MDD with the Populatic Well offline, and
6) Construct iron and manganese removal treatment for (at a minimum) the Oakland Well.

Supply could be augmented by: well redevelopment to increase normal daily output rates, by the use of satellite wells, by the development of a new supply, or by purchasing water from a neighboring community. Each of these options is discussed below. Recommendations are summarized in Section 4.

3.1 Water Management Act Permitting Implications

New Water Management Act Regulations (310 CMR 36.00) were promulgated in the fall of 2014. Many of the regulations remain vague and direct the water supplier to consult with MassDEP on specific requirements. The anticipated applicability of the WMA Permit requirements are discussed in more detail in Appendix B. In summary, for all of the almost all cases presented below, Medway will need to apply for a new WMA Permit under 'Tier 2' for requesting a new permit limit above 0.99 MGD ('baseline). It appears that the purchase of water from a neighboring community would not trigger the need for a new WMA Permit, but this should be confirmed with MassDEP before proceeding.

3.2 Demand Management Measures & Water Loss Reduction

The first step in meeting demands is to implement best practices for demand management and water loss reduction. All water suppliers are required to meet minimum measures and other requirements as dictated in their WMA Permits. Medway's 2013 SWMI Feasibility Study (Kleinfelder, 2013) documented existing practices and provided recommendations for additional steps. Medway has already carried out many of these 2013 recommendations and others are in progress. Additional detail is provided in Appendix B – Sustainable Water Management Initiative and Medway's Water Management Act Permit Requirements.

Medway has been proceeding with water main replacement projects as recommended in its Master Plan. The Town has increased its frequency of leak detection efforts and this has paid off as described in Appendix B. The year to year effects of leak detection cannot be easily quantified and this is excluded from quantitative analysis of the ability to meet the supply deficit.

3.3 Increasing Supply from Local (Medway) Sources

3.3.1 Increased Pumping of Existing Wells

As shown on Table 3-1, the NDO of the wells is below the permitted maximum daily withdrawals. Theoretically, this means that rehabilitation or other improvements could result in increased pumping rates. The potential additional supply above NDO was estimated from knowledge of current and past well rehabilitation efforts and operational and aquifer constraints, and was provided by Haley and Ward (personal communication 2015).

Potential increased supply was divided into near term and longer term volumes. Near term improvements that can be funded via annual operations include well cleaning and redevelopment. These increases are small and are estimated to add up to 0.14 MGD of supply (Table 3-1).

Longer term increases would require moderate to large capital investments. Both the 2010 Master Plan (Weston & Sampson, 2010) and the 2013 SWMI Feasibility Study (Kleinfelder, 2013) recommended that a satellite well or wells be explored as an option for optimizing existing supplies. The aquifer that supplies the Populatic Street and Village Street wells has a high transmissivity (126,000 to 220,000 gpd/ft) and is thicker as compared to the other well locations. For the purpose of this evaluation it has been assumed that one satellite well could be installed at the Populatic site that would yield the same as the existing well's NDO of 0.43 MGD. Exploratory drilling and pump testing would be required to confirm the feasibility of this option.

Table 3-1: Potential For Increased Supply from Existing Wells

Source Name	WMA Permit Maximum Daily Withdrawal Rate (MGD)	Normal Daily Output[1] (MGD)	Near Term Additional Potential Supply Above NDO[2] (MGD)	Longer Term Additional Supply Above NDO (MGD)
Populatic Street Well	0.87	0.0.43	0.05	0.43[3]
Oakland Street Well	0.59	0.0.00	0.03	0.2
Village Street Well	0.66	0.0.33	0.06	
Industrial Road Well	0.475	0.22	0.0	
Total	**2.60**	**1.99**	**0.14**	**0.63**

Notes:
(1) Haley & Ward, 2015
(2) Additional supply estimated from rehabilitation and cleaning efforts (Haley & Ward, 2015).
(3) Additional supply estimated from a satellite well at the Populatic site.
(4) Additional supply estimated from construction of filtration treatment plant to allow use of Oakland to its normal output (post-cleaning).

The other primary longer term supply solution is to construct iron and manganese removal treatment for the Oakland Well. Provided that the well is cleaned annually to remove natural iron

and manganese buildup on the well screen, it is estimated that the source could provide an NDO of at least 0.2 MGD (Haley & Ward, personal communication, 2015).

Since the other three wells already have moderate levels of iron and manganese, it would not be cost effective or conservative to build a treatment facility to exclusively treat the Oakland Well. As wells age and aquifers are stressed, raw water iron and manganese levels often trend upward, sometimes suddenly increasing. A centralized facility with ability to remove iron and manganese from at least half of the supply wells, and flexibility to be expanded for all supplies would be the recommended long term solution. The planning, design, and construction of a treatment facility can take several years. It is our understanding that a future treatment facility is part of Medway's capital improvements program for FY17. As a shorter term solution, it is recommended that funding for well rehabilitation and satellite well(s) should be appropriated as soon as possible.

Kleinfelder has consulted briefly with MassDEP to discuss the permitting implications of requesting additional withdrawals from the existing source wells. More detailed discussions will be required, but at this time it appears that additional pumping from either the Populatic or Village Wells (Subbasin 21162) would be more environmentally favorable because the subbasin and the associated streamflows are much larger and therefore less likely to be negatively impacted by additional groundwater withdrawal. Appendix B provides further detail on Permitting implications.

3.3.2 New Local Source

As reported in the 2013 SWMI Feasibility Study (Kleinfelder, 2013), a new groundwater source at a different location in Medway is not a viable option to augment supply. Previous investigation work had identified only two potential areas in Medway where aquifer yield and available land made them potentially suitable for consideration: Lovering Street and Adams Street in subbasin #21153. This subbasin has only 0.02 MGD of available safe yield (Kleinfelder, 2013). With a maximum withdrawal of 0.02 MGD, the well would be too small to be a viable alternative. In addition the potential well sites may have water quality problems and the potential presence of volatile organics, as well as elevated levels of iron, manganese, and hydrogen sulfide. Therefore, treatment may be required for a source developed in these locations.

The development and permitting of the new source and the associated likely treatment system would entail considerable time and expense on the order of several million dollars. Therefore, a new well in subbasin #21153 is not a feasible minimization proposal given the high expense and limited production capacity available.

3.4 Interconnections with Surrounding Water Suppliers

The Town of Medway has interconnections with four different communities including Millis, Franklin, Bellingham, and Milford (Milford Water Company). However, at present, all interconnections with Town of Medway are for emergency supply only.

As indicated in Section 2.5, the Town of Medway's average daily demand is projected to exceed the permitted withdrawal limit under both near term (2016) and longer term future conditions. Therefore, to meet the Town's average daily demand, it is possible that the Town of Medway may seek to address the supply deficit volume of 0.06 MGD for present and 0.14 MGD for future needed above their present and 2028 permit limit, respectively through interconnections with neighboring communities.

The assessments described below were conducted using the MassDEP Water Management Act Permitting Tool (release date 5/14/14)- (http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html). This tool is a database that can be queried in order to determine subbasin status and the capacity of the subbasin to sustain additional withdrawals in relation to the subbasin safe yield. Kleinfelder held preliminary discussions with MassDEP in developing this section. However, it was clear from those discussions that **more detailed consultation with MassDEP to discuss specific scenarios will be needed before any of these solutions can be considered fully vetted.**

3.4.1 Interconnection with Millis

Medway has an interconnection with Millis which is currently utilized as an emergency interconnection only. There is no record of this interconnection being recently utilized. This alternative considers supplementing Medway withdrawals by establishing a permanent interconnection with Millis to be used for regular (non-emergency) water purchases.

The Millis Water Department has two wells (Well #1 on Water Street and Well #4 on South End Point) in the Bogastow Brook sub-basin (#21123) located in the Charles River basin. There is reportedly an additional capacity of 0.202 MGD that can be withdrawn from this sub-basin before it changes its existing groundwater withdrawal classification (GWC) from Category 4 to 5. The other potential groundwater source in Millis (Well #3 on Village Street) is in a different sub-basin (21133) of the Charles River, which is at the maximum alteration category with respect to both groundwater withdrawal category (Category 5), as well as biological category (Category 5).

The Millis combined registration and permitted average daily withdrawal authorization is 0.99 MGD which remains the same through 2029. Millis's average demand from 2008-2012 was 0.61 MGD. This implies that Millis has up to 0.84 – 0.61 = 0.23 MGD of unused permitted capacity and that Medway could seek the option to withdraw its supply deficit from Millis.

There are two potential points of interconnection to the Medway system from Millis – at Main Street and at Village Street. Based on a review of Medway's hydraulic model, there are no significant differences in hydraulic grade from either interconnection point to the Exelon site, indicating that the efficiency of water delivery through Medway would be similar from either location. Should Millis be interested in selling water to Medway as proposed, a further review of Millis' distribution system hydraulics would be required to determine if one of the interconnection locations is better able to deliver water to Medway than the other and to determine what additional measures may be required (i.e. booster station, treatment systems, etc.). Along Main Street, the closest pipe to the Millis town-line is 6-inch, but there is a 12-inch line (approximately 50 feet from the Town-line) that seems to be a preferred interconnection point. Along Village Street, there is 6-inch and 8-inch line at the Town-line, with the 12-inch line being approximately 1000 feet away. Therefore, based on pipe capacity, the interconnection from Millis with the 12-inch main line on Main Street seems to be the preferred option. Without knowing more about the Millis system at both locations, including having modeled pressures and available flows at both interconnection locations, it is not possible to determine which interconnection would provide a better supply source, and as to whether a booster would be needed or not to get water into the system.

With regard to water quality and treatment, the raw water quality of Millis' sources is unknown at this time. Both systems disinfect with sodium hypochlorite and use hydroxides for corrosion control. Despite this, additional information would be required to verify that there is no significant

difference in pH between systems to identify an concerns relating to an interconnection. In-line monitoring at the interconnection to verify pH and chlorine residual meet DEP guidelines, with a sample port where a grab sample can be easily collected on a monthly basis should be implemented if a permanent connection is established. If Millis has any other treatment issues that Medway does not generally deal with further considerations may need to be given.

There is still much uncertainty in this scenario. Millis may not be willing to sell all of its remaining permitted capacity to Medway if there is potential growth in Millis that would increase demands. Further, Wells 1 and 4 are located fairly distant from Medway, limited information is known regarding the configuration of Millis' distribution system and any pressure zones, and the mechanism for Millis to sell water only from sub-basin 21123 is unclear. As with all the other interconnection options, the Town would need to negotiate an agreement with Millis, placing implementation outside Medway's direct control.

3.4.2 Interconnection with Franklin

Medway has two interconnecting points with the Town of Franklin water system. The interconnections are currently utilized as emergency interconnections only. In the past, Franklin has received water from Medway through this interconnection. Franklin's supply is drawn from wells located in the Charles River Basin.

The Franklin WMA Permit allows 3.64 MGD in average daily withdrawals. The WMA Permitting Tool indicates the baseline for Franklin is 3.05 MGD and recent ADD is 2.64 MGD. It is unclear why Franklin's baseline is lower than its permit limit. However, the 2011 town report notes the Franklin sources "can't meet demand during peak periods", so supply may not be available when most needed by Medway. The Franklin DPW Water Division has one well (Well 8) in the same SWMI sub-basin as the Populatic and Village Street wells. There are three Franklin DPW Water wells in another sub-basin (21157) adjacent to Medway. All of these wells, which could serve as potential water supply sources for Medway are located in sub-basins that are in alteration Category 5 for both groundwater withdrawal classification and biological category.

Withdrawal of the supply required by Medway from any of these well locations may trigger Franklin to be placed under SWMI Tier 3. For Tier 3 Water Management Act permit applicants, the 2014 Water Management Act Permit Guidance document requires that as part of the alternative source analysis, the permittee must demonstrate that "there is no feasible alternative source that is less environmentally harmful that the option they have proposed." Since the option exists for possible withdrawal from Millis' sources without negatively impacting the Bogastow Brook sub-basin, it may not be possible for Medway to justify withdrawal from Franklin. Also, Franklin is recognized as a fast-growing community, and may be unwilling to sell any of its limited remaining authorized supply to Medway.

3.4.3 Interconnection with Bellingham

Medway has a hydrant-to-hydrant interconnection capability with Bellingham. The interconnection is currently utilized as an emergency interconnection only. Bellingham has received water from Medway through this interconnection in the past. Bellingham withdraws from both the Charles River Basin and the Blackstone Basin. The below analysis considered only supply from the Charles Basin. If it is not possible to obtain supply only from the Charles, then the Interbasin Transfer Act may apply. If interbasin transfer applies, this solution is not recommended as the process is lengthy and likely to be viewed unfavorably by regulators and stakeholders with limited certainty of success. If seriously considered, it must be vetted early in the process with MassDEP and MassDCR.

According to the WMA Permitting Tool, Bellingham's Charles baseline is 0.91 MGD and annual use from 2008-2012 from the Charles basin wells (#5,6,7,8,12) averaged 0.75 MGD, indicating a potential unused permit capacity of up to 0.156 MGD. The Bellingham DPW Water and Sewer Division has three wells (Well #s 6, 7, 8) in the adjoining sub-basin that includes Exelon's facility. This sub-basin has only 0.02 MGD available before its GWC changes from Category 4 to 5. Withdrawal of the additional needed supply by Medway from any of these well locations may trigger Bellingham to be placed under Tier 3, with the obligation to mitigate the volume by offsetting. Another Charles subbasin (21165; Well 5) has only 0.097 MGD available and would cause the same situation for Bellingham. It appears that the Bellingham available permit capacity will be limiting, and the available subbasin supply is insufficient for Medway's needs. Therefore, it does not appear feasible for Medway to look to purchase water from Bellingham.

3.4.4 Interconnection with Milford Water Company

Medway's interconnection with Milford Water Company is utilized as an emergency interconnection only. Medway has received water from the Milford Water Company through this interconnection within the past 10 years. The Milford Water Company Water Management Act permit establishes a baseline of 3.43 MGD and a current permit limit of 3.14 MGD. Recent water use has been 2.58 MGD (2012). There are four Milford Water Company wells in the sub-basin adjacent to Medway. This sub-basin is Category 5 for both GWC and biological category. Additional withdrawal by Medway from this sub-basin from any of these well locations may trigger Medway to be placed under SWMI Tier 3. As described in Section 3.4.2, it will not be possible for Medway to justify withdrawing water from Milford as less environmentally harmful. Therefore, interconnection with Milford is not likely a feasible alternative source for Medway.

3.4.5 Summary of Interconnection Water Sources

Based on reviewing possible interconnections and availability of groundwater withdrawal from the surrounding towns, the Town of Millis seems to be the only feasible option. Medway can seek to withdraw from either one or a combination of three Millis wells in the Bogastow Brook sub-basin to meet Medway's present and future average day demand (including planned developments and the Exelon facility) and still be in compliance with the WMA permit. Medway should consult with MassDEP and Millis to determine the specific limitations and requirements that may be triggered under the new Water Management Act Regulations.

4. CONCLUSIONS AND RECOMMENDATIONS

As discussed in Section 2, there is a projected near term supply deficit of 0.06 MGD and a future supply deficit of 0.15 MGD to meet ADD. In addition, Medway is unable to meet MDD with its largest source offline (~0.46 MGD deficit).

Therefore, in order to safely and reliably meet projected future ADD, with adequate operational flexibility in meeting MDD, it is recommended that Medway:

1) Continue to implement demand management and water loss reduction measures.
2) Apply for a new WMA Permit to withdraw water above baseline of 0.99 MGD and meet future demands.
3) Supplement its supply for the near term through routine well cleaning and redevelopment and installation of a satellite well or wells in order to provide much needed operational flexibility in times of higher demand.
4) Construct treatment to remove iron and manganese for the Oakland Well and others to supply at least 1.14 MGD and allow the Town to meet MDD with largest source offline.

In Section 3, various options for meeting the current and projected supply deficit were presented in detail. These options are summarized in below.

A program of routine well cleaning / redevelopment is important to maintain existing pumping capacity from year to year. Nevertheless, the efficacy of well rehabilitation over time tends to decline as wells age. The installation of satellite well(s), particularly at the Populatic site, appears to be the greatest option to provide increased supply and operational flexibility for allowing to rest wells and take them out of service for cleaning. This would need to be further investigated with an exploratory drilling and pump testing effort.

Another way to supplement supply in the near term would be a purchase of water from Millis. The feasibility of this solution would need to be further explored in terms of hydraulics, water quality, and permit requirements.

The future goal should be to have a minimum treated (for iron and manganese removal) NDO of at least 1.14 and MDO of 1.79 MGD. In order to achieve this, the Oakland well will need treatment to remove iron and manganese. Since the other three wells already have elevated iron and manganese, it would not be cost effective or prudent to build a single treatment facility at the Oakland Well. A centralized facility with ability to treat 1.79 MGD would be the recommended long term solution. Because the planning, design and construction of a treatment facility could take several years, shorter term solutions as described above are needed.

In summary, the following steps are recommended for Medway:

Ongoing:

- Continue to implement existing actions to minimize withdrawal including:
    - UAW Compliance Plan measures including annual leak detection and repair, meter inspection/repair/replacement
    - Conservation outreach, water ban, fixture retrofits / rebates and other demand management actions
    - Distribution system improvements

Near Term:

- Consult with MassDEP on regulatory requirements for new WMA Permit application for withdrawal above baseline to identify specific minimization and mitigation credit options available.
- Fund and implement a comprehensive well rehabilitation program. Include well rehabilitation funding in annual Operations Budget to clean in order to rehab one well per year on an ongoing basis.
- Fund and implement a satellite well exploratory phase study.
- Initiate discussions with Millis about potential water purchase.
- Fund design of water treatment facility.
- Construct satellite well(s) as recommended by exploratory study.

Longer Term:

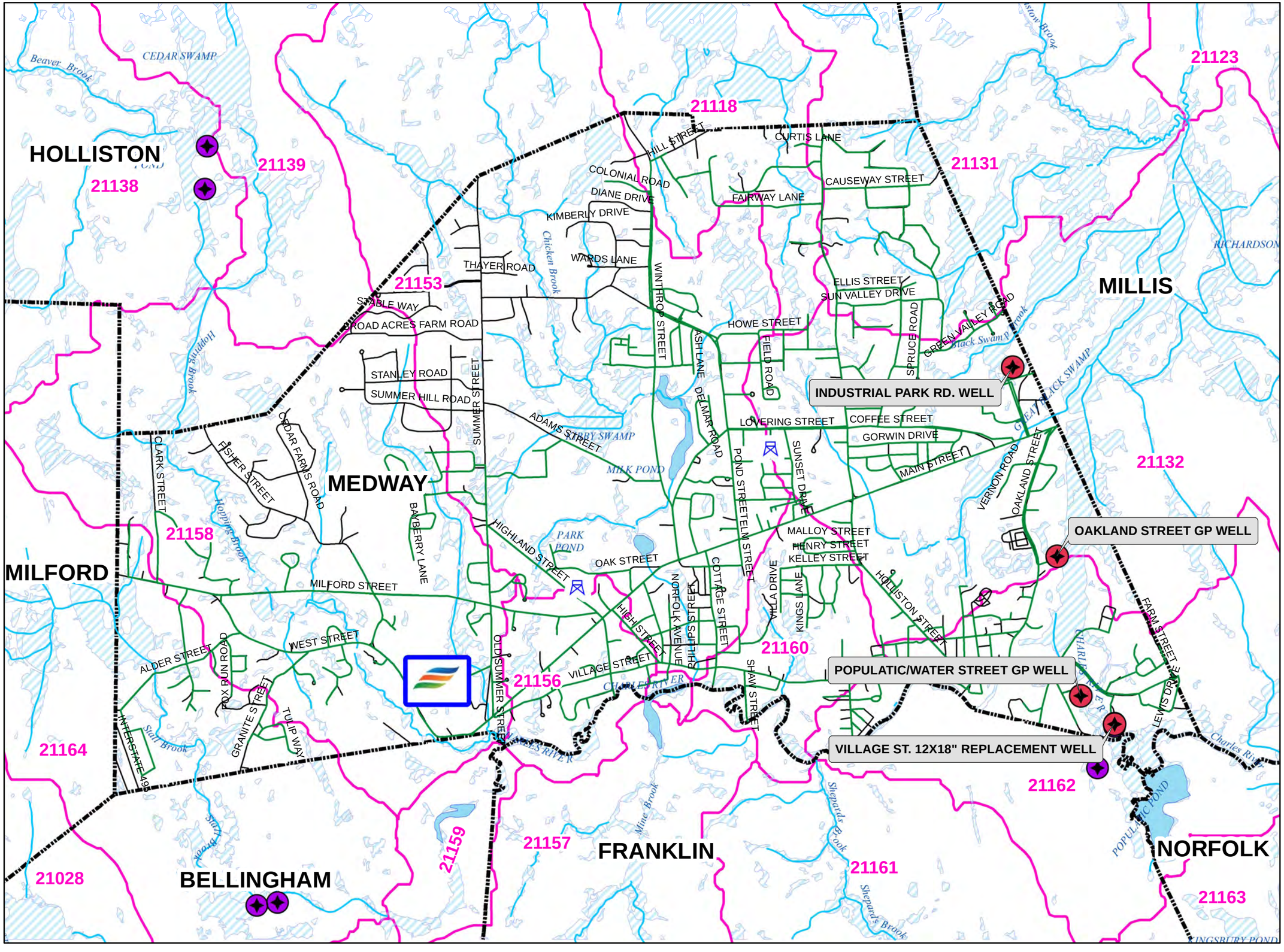
- Continue to construct water main replacement as recommended in 2010 Master Plan to eliminate pipe prone to leakage.
- Construct water treatment facility to remove iron and manganese.

There are a number of funding sources available to help offset costs including the following:

- Drinking Water SRF Grants and Loans (planning and construction)
- MassDEP Water Management Act Grant Program (planning, demand management, implementation projects that demonstrate environmental benefit)

APPENDIX A

FIGURE A-1: MEDWAY WATER SUPPLY SYSTEM



TOWN OF MEDWAY
EXISTING WATER SUPPLY SYSTEM
SEPT 2015

Legend

- **Exelon Power Site Location**
- Public Well - Medway
- Public Well - Other Towns
- Tank
- Water Mains
- Roads
- Major Streams
- DEP Wetlands
- Open Water
- SWMI Basins
- Town Boundary

N
W E
S

0 1,200 2,400 4,800 Feet

Rev Date: 07/30/2015

USERS OF THIS MAP SHOULD CONSULT PRIMARY SOURCES FOR VERIFICATION OF THE INFORMATION CONTAINED ON THIS MAP. THE TOWN OF MEDWAY AND ITS MAPPING CONTRACTORS ASSUME NO LIABILITY FOR THE INFORMATION CONTAINED HEREIN.

KLEINFELDER
Bright People. Right Solutions.

1. Medway's Water Management Act Permit - New Requirements

This Section discusses the Water Management Act (WMA) Regulations (310 CMR 36) and the new requirements that Medway will need to meet in order to obtain an increase in its Permit limit of ADD.

In fall 2014, MassDEP promulgated new Water Management Act regulations (310 CMR 36) based on the Sustainable Water Management Act Initiative (SWMI) Framework (see http://www.mass.gov/eea/waste-mgnt-recycling/water-resources/preserving-water-resources/sustainable-water-management/framework/sustainable-water-management-framework-summary.html). MassDEP will apply these new requirements when a water supplier's WMA permit is up for renewal, or when a water supplier requests an increase in withdrawal above a "baseline" withdrawal. Baseline has been defined by MassDEP as the larger of a water supplier's volume withdrawn during 2005, the average between 2003 and 2005, or the registered volume (whichever is highest).

1.1 Medway's Existing WMA Permit

Medway's existing June 2011 WMA Permit already includes the setting of a 'Baseline', as defined by the SWMI Framework. Medway's baseline is set at its reported 2005 withdrawal volume, or 0.99 MGD (361.35 MGY). Medway has pumped in exceedance of 0.99 MGD during 2013 and 2014, and based on projected demands in the attached report, may need to request to increase its withdrawal up to 1.14 MGD to meet future ADD. **This would represent an increase request of 0.15 MGD above baseline.**

As described in Medway's WMA Permit, Special Condition 9, the first time Medway's water withdrawals exceed baseline for a calendar year, Medway must perform an Offset Feasibility Study which includes a written analysis of the cost effectiveness of following various water management Best Management Practices (BMPs). Kleinfelder prepared an offset feasibility study for Medway in 2013 (Kleinfelder, 2013) with funding from the MassDEP SWMI Grant Program. It is expected that the 2013 Feasibility Study will meet most if not all of the requirements of the written analysis required under Special Condition 9.

The anticipated requirements of the new WMA Permit process are discussed below. Where they are expected to apply to Medway, this is indicated in each section. Kleinfelder has corresponded briefly with MassDEP regarding these requirements. It should be noted, however, that the details of specific requirements will need to be identified via more in depth consultation with MassDEP.

1.2 New WMA Permit Requirements for Public Water Suppliers

The following language was excerpted from the *Water Management Act Permit Guidance Document, (MassDEP, November 7, 2014*), which is available at http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/wmaguide14.doc .

1.2.1 Standard Permit Conditions Implementing Best Management Practices

Permittees must meet (or exceed) standard best management practices, including but not limited to:

- Water Conservation requirements including leak detection, metering and education

- Performance Standards of 65 residential gallons per capita per day (RGPCD) and 10% unaccounted for water (UAW), and
- Limits on non-essential outdoor water use

See WMA Guidance Document for full details of requirements.

- ***These requirements are incorporated into Medway's existing practices and 2014 UAW Compliance Plan***

1.2.2 Minimization

All groundwater permittees with withdrawals in subbasins with significant groundwater depletion must minimize the impacts of their withdrawals in those subbasins. These subbasins are defined as having August net groundwater depletion (August NGD) of 25% or greater. The equation and data used to calculate August NGD and the specific requirements to minimize the impacts of withdrawals for this group are outlined in Section 6 of the WMA Guidance Document. These include conducting a Desktop Minimization analysis, evaluating surface water releases/ returns and applying additional conservation measures beyond standard Permit requirements.

- ***APPLIES TO MEDWAY- A source optimization analysis and evaluation of additional minimization measures was presented in the 2013 grant-funded SWMI Feasibility Study (Kleinfelder 2013). That study ranked options for Medway to comply in relation to benefit, feasibility, and cost. However some of the specific requirements of the analysis have changed, and a Desktop Minimization will likely need to be updated to meet current Guidance.***

1.2.3 Rules for Permit Tier Determination

See discussion in 1.1 above for discussion of Medway's baseline (0.99 MGD).

Tier 1: The permittee's withdrawal request is not above baseline.

Tier 2: The permittee's withdrawal request is above baseline, and the

- Permittee only has surface water sources, or
- Permittee has sources only on Cape Cod, the Islands, or the Plymouth-Carver aquifer region, or
- Permittee has groundwater sources, and their groundwater withdrawals will not change the biological category (BC) or groundwater withdrawal category (GWC) in any of their subbasins. >> ***Will apply to Medway upon filing for new permit to increase WMA withdrawal limits to meet future ADD.***

Tier 3: The permittee's withdrawal request is above baseline, and the

- Permittee has groundwater sources, and withdrawals from these sources will change a BC or GWC in any of their subbasins.

* Note that volumes requested which are greater than those already allocated in an existing WMA permit will require the filing of a *new WMA permit* application. ***(Options exist to avoid this scenario for Medway)***

Table A-1: WMA Permit Tiers and Requirements		
Tier	Trigger	Requirements
Tier 1	No additional withdrawal request above Baseline- all GWLs	Comply with Water Management Act Permit Conditions 1-8, which apply to all Permits and minimize impacts by achieving the following demand management steps: • 65 rgpcd • 10% unaccounted for water • Institute seasonal nonessential outdoor water use restrictions • Use best management practices for leak detection, meter repair/replace, public education
	Additional requirements for GWL-4 & GWL-5	Evaluate the following minimization options and implement options that consider improvement, practicability, and cost: • Optimize existing sources • Use alternative sources • Seasonal Interconnections • Releases from surface impoundments • Other practicable measures
Tier 2*	Withdrawal request above baseline; which results in no change in subbasin seasonal groundwater withdrawal category, groundwater withdrawal category or BC	In addition to the Tier 1 requirements: Mitigate impacts commensurate with impact of withdrawal via Implementing a Mitigation / Offsets Plan.
Tier 3*	Withdrawal request above baseline that changes the subbasin seasonal groundwater withdrawal category, groundwater withdrawal category or BC	In addition to Tier 1 requirements: • Demonstrate no feasible alternative source that is less environmentally harmful • Develop and implement Mitigation/Offsets Plan

*Further additional requirements apply for sources in high quality resources (BC-1, 2, or 3; coldwater fishery).

1.2.4 Coldwater Fishery Resource (CFR) Protection

All permittees with withdrawals that impact streamflow at a CFR (identified on the interactive SWMI maps and in the permitting tool at http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html) must evaluate reducing impacts to CFRs through feasible optimization. Tier 2 and Tier 3 applicants whose withdrawals will increase above their baseline water use must evaluate further protection of their CFRs as part of their required mitigation planning, in consultation with the Department and DFG, Division of Fisheries and Wildlife (DFW).

- ***DOES NOT APPLY TO MEDWAY (no CFR in Medway subbasins)***

1.2.5 Alternative Sources

Tier 3 permittees, whose groundwater withdrawals will increase above their baseline water use and cause a change in the biological or groundwater withdrawal category of a subbasin, must show that they have no feasible alternative source that is less environmentally harmful. Section

6 of the WMA guidance document includes the methodology of evaluating optimization of available sources to reduce impact to streamflow and aquatic habitats. Without limitation, technical feasibility and cost should also be evaluated in determining whether a source is a feasible alternative.

- ***APPLICABILITY TO MEDWAY - TO BE DETERMINED: As described in Section 3 of the attached report, it appears that Medway has options that can avoid causing a change in groundwater withdrawal or biological category of a subbasin and avoid triggering Tier 3 requirements (see Table A-1). One of these options may be to increase withdrawals from subbasin 21132 (the subbasin in which Medway's Oakland and Industrial Wells are located) which has up to 0.132 MGD of capacity, according to the current version of MassDEP's Water Management Act Permitting Tool. Another option may be to obtain water from another supplier with capacity (e.g. Millis which has up to 0.202 MGD before exceeding its baseline and available subbasin capacity-).This question will need to be explored in detail in consultation with MassDEP.***

1.2.6 Mitigation

Tier 2 and Tier 3 permittees requesting an increase above their baseline withdrawal level must undertake mitigation commensurate with the impact of their increased withdrawals. Permit applicants that cannot avoid changing the biological or groundwater withdrawal category of a subbasin and having no feasible alternative sources that are less environmentally harmful) will be required to implement the highest level of mitigation.

Tier 2 and 3 permittees will need to develop a mitigation plan at the start of the 20-year WMA permit period. This plan should estimate the required volume of mitigation, identify feasible mitigation options, and include a timeline for the implementation of the mitigation options. The process and components of mitigation planning are outlined below followed by a description of each component.

a) Mitigation Hierarchy
b) Location Adjustment Factor
c) Wastewater Adjustments
    i. Groundwater Returns
    ii. Surcharged Reach
d) Calculation of Mitigation Volume
e) Direct Mitigation
f) Indirect Mitigation
g) Mitigation Plan Implementation Timeline
h) Mitigation and Cost Feasibility Guidance

- ***APPLIES TO MEDWAY – For a request in withdrawal above baseline Medway will be under Tier 2. All Tier 2 and 3 permittees must develop a Mitigation Plan. Mitigation options have been previously evaluated and ranked by the 2013 Medway SWMI Feasibility Study (Kleinfelder 2013). This evaluation will need to be updated, in consultation with MassDEP.***

Direct Mitigation: These options represent ways for a credibly estimated volumetric offset to be accounted for. Examples include septic systems or wastewater returns located within the basin, surface water releases, and stormwater recharge.

Indirect Mitigation: These options include actions to improve aquatic habitat through things like dam removal, stream channel restoration or promotion of improved capture, treatment, and infiltration of stormwater through regulatory/administrative controls such as bylaws.

Please refer to the WMA Guidance Document for detailed information on determining mitigation.

1.2.7 Impact Assessment for Individual Groundwater Withdrawal Points

The subbasins that supply Medway's wells are summarized below in relation to SWMI categories. The individual subbasin assessment allows MassDEP to evaluate whether an applicant's groundwater withdrawal above baseline will contribute to one or more subbasins changing BC or GWC categories.

Table A-2: SWMI Subbasin Characteristics, Medway

SWMI Charles Subbasin & Subbasin ID #	SWMI Subbasin Groundwater Withdrawal Category[1]	SWMI Subbasin Biological Category[1]	Sources	Net Groundwater Depletion	Available Withdrawal without changing BC (MGD)	Available Withdrawal without changing GWC (MGD)
Charles (Chicken Brook), #21162	5	5	Populatic Street Well Village Street Well	42.9%	0	0
Bogastow Brook, #21132	4	5	Oakland Street Well Industrial Road Well	19.1%	0	0.132

Notes:
1 SWMI Interactive Map and WMA Permitting Tool http://www.mass.gov/eea/agencies/massdep/water/watersheds/sustainable-water-management-initiative-swmi.html

For this assessment, MassDEP will assume that any withdrawal request above baseline could be withdrawn from any one subbasin in which the applicant has permitted groundwater sources, unless the applicant specifies otherwise. For each subbasin within which the applicant has a permitted groundwater source, the Department will evaluate whether the entire withdrawal above baseline will cause a change in BC or GWC in that subbasin. If the increased withdrawal would cause a change in BC or GWC in any subbasin within which the applicant has a permitted groundwater source, then the applicant will be subject to Tier 3 requirements. Data and assumptions used in the individual assessment may be refined by the applicant at the start of the permit process. Data refinement options are described in the WMA Guidance document.

- ***APPLICABILITY TO MEDWAY: Preliminary consultation with MassDEP has indicated that increased withdrawals may be considered less environmentally harmful if contributing watershed is larger and if the increase would result in a smaller percent change according to the WMA Permitting Tool. This seems to indicate that increased withdrawal from either the Populatic or Village Wells (Subbasin 21162) would be favored due to the subbasins much larger size. This analysis will require further consultation with MassDEP.***

1.2.8 Medway's Mitigation and Minimization Efforts Completed To Date

Kleinfelder prepared a grant-funded offset feasibility study in 2013 (Kleinfelder, 2013) for the Town of Medway. The feasibility study analyzed and ranked the SWMI Framework Options for minimization and mitigation. The feasibility study concluded that the Town of Medway had taken many actions to better manage water and to reduce demand, including meter replacement, outdoor watering restrictions, and promoting conservation. The feasibility study listed a number of recommendations for Medway to address.

The first priority was to address the requirements under existing regulatory programs:

- Conduct water audit to address persistently high unaccounted for water exceeding WMA Permit requirements.
- Initiate industrial / commercial /institutional demand management in accordance with WMA Permit requirements Done
- Initiate municipal building plumbing retrofits in accordance with WMA Permit requirements
- Continue implementation of NPDES MS4 existing and reasonably anticipated future stormwater program requirements.

The second priority, recommended that the Town pursue options that support proactive management of its water, stormwater, and wastewater programs.

The Town of Medway has implemented or is in the process of implementing many of the recommended minimization and mitigation measures over the past couple of years, including:

- The Town of Medway contracted Kleinfelder to conduct an audit of their water system in June 2014 to investigate sources of unaccounted for water (UAW).
- In June 2014, the Town of Medway contracted with Kleinfelder to implement an outreach program for the top industrial, commercial, and institutional water users.
- In November 2014, Kleinfelder prepared a revised UAW Compliance Plan for Medway. This included a *Summary of Completed UAW Compliance Actions*, which identified the efforts that the Town of Medway had taken to identify and reduce unaccounted for water.
- As discussed in Section 2 of the attached report, the Town of Medway increased leak detection survey frequency from biannually to annually in 2013 and contracted Liston Utility Services to perform a correlation leak detection survey of the Town's entire water distribution system in 2014. This survey found 350 gpm in leaks during November 2014, which were repaired in December 2014.
- Medway has continued to make progress to proactively address anticipated requirements

- ***Medway will need to consult with MassDEP to receive mitigation credits for efforts already completed or planned. The 2013 SWMI Feasibility Study provides a solid starting point for this discussion, because it already has evaluated and ranked various options for receiving credit.***