

To: Maurice Goulet, Director of Public Works

Cc: Medfield Board of Water and Sewerage

From: Environmental Partners Group, Inc.

Date: September 11, 2017

Subject: Preliminary Evaluation of Potential Public Water Supply Sites
Town of Medfield, MA

Environmental Partners Group, Inc. is working with the Town of Medfield (Town) to complete the preliminary planning and design of a new water treatment plant for Wells No. 3 and No. 4 at the Elm Street Wellfield site. As part of our preliminary design effort the Town requested that Environmental Partners perform a preliminary evaluation to identify other potential public water supply sources in Medfield specifically sources that would not require treatment aside from pH adjustment and disinfection. If such sources are identified, they could provide the Town with an alternate means of improving the Town's flexibility in managing their water supplies.

Environmental Partners completed the first phase of the alternative water supply source evaluation in April 2017. The desk-top study initially identified a total of sixteen (16) Town-owned parcels that had the potential to accommodate a wellhead protection area with a 400-foot Zone I radius. After taking into account available Town and State GIS data for land use, groundwater aquifers, surficial geology, and watershed groundwater withdrawal classification (Sustainable Water Management Initiative or SWMI), Environmental Partners recommended that four (4) of the potential water supply sites be evaluated further. These four sites are shown on the Town site locus map provided as Figure 1, and are summarized below.

1. ***Site #3 – 44 Hospital Road, McCarthy Park and Fields*** – The site was recommended for further evaluation due to its large available land area (Figure 1 of Appendix D), potentially favorable surficial geology, and coarse glacial stratified deposits (Figure 6 of Appendix D). Site #3 is located in the same moderately stressed watershed (SWMI category 4) as the Town's Well No. 6, located approximately one-half mile away. The site consists of two Town-owned parcels, portions of which are currently developed as the Town's

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McCarthy Park and Fields complex. The park facility is managed by the Medfield Park and Recreation Department. The site was formerly used as an agricultural farm supporting the Medfield State Hospital. A memorandum summarizing the data sets evaluated, the findings, and the supporting figures for Site #3 are provided as Appendix D.

2. ***Site #8 – Stop River Conservation Lands*** – The site was recommended for further evaluation due to its large available protected land area (Figure 1 of Appendix B), and potentially favorable surficial geology consisting of coarse glacial stratified deposits (Figure 6 of Appendix B). Site #8 is located in a moderately stressed watershed (SWMI category 4) of the Stop River, which is a tributary of the Charles River. The site consists of three Town-owned parcels located off of Noon Hill Road that are currently managed as part of the Noon Hill Reservation by the Trustees of the Reservation. The Town parcels are located along the banks of the Stop River and are generally woodlands and pastures. There is a gravel borrow pit located at the parking area off Noon Hill Road. A memorandum summarizing the data sets evaluated, the findings, and the supporting figures for Site #8 are provided as Appendix B.
3. ***Site #10 – Plain Street Conservation Land, Holmquist Farm*** – The site was recommended for further evaluation due to its large available protected land area (Figure 1 of Appendix C), potentially favorable surficial geology (coarse glacial stratified deposits, Figure 6 of Appendix C), and location in the Mine Brook watershed. Site #10 is located in the same SWMI basin (Category 5) as the Town wells No.3 and No.4 and the Walpole Mine Brook active public water supply wells. The site consists of seven Town-owned parcels located off of Plain Street that are part of the former Holmquist Farm. Site uses include a community garden, pastures, and woodlands. The eastern portion of the site is located along the Town's border with Walpole. A memorandum summarizing the data sets evaluated, the findings, and the supporting figures for Site #10 are provided as Appendix C.
4. ***Site #15 – Former Medfield State Hospital Wellfield off Colonial Road*** – The site was recommended for further evaluation due to its prior use as the public water supply for the Medfield State Hospital, the wellfield's historical registration for groundwater withdrawals of up to 0.5 million gallons per day, its location within a medium and high



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yield aquifer (Figure 5 of Appendix A), and its potentially favorable surficial geology (Figure 6 of Appendix A). The site consists of two Town-owned parcels, one of which is the former site of the Medfield State Hospital's public water supply tubular wellfield and pumping station. The second parcel is watershed protection lands managed by the Town's Board of Water and Sewerage. North Brook crosses through the site in a general north-south direction. The former pumping station and wellfield are accessed from Colonial Road and abut a former railroad line on the west side. The site consists primarily of undeveloped woodlands and significant wetlands. A memorandum summarizing the data sets evaluated, the findings, and the supporting figures for Site #15 is provided as Appendix A.

Methodology

This second phase of evaluation for these four sites included a walkover and focused on performing a more detailed evaluation of environmental data sets in order to evaluate their suitability as public water supply sites and develop recommendations for supplemental field investigations. The four sites were further evaluated as follows.

1. The property boundaries of the four potential sites (Sites #3, #8, #10, and #15) were identified and displayed over aerial photographs. Then a DEP required Zone I 400-foot buffer (large yield, single well sites) or 250-foot buffer (Site #15 wellfield configuration) was delineated for each site that complies with DEP requirements for ownership, control and protection, as shown on the Site Locus figures (Figure 1 of Appendices A through D).
2. Each Site was evaluated according to the following MassGIS data layers:
 - Areas of Critical Environmental Concern
 - Priority habitats for rare and endangered species
 - Lakes and ponds
 - Vernal pools
 - Public and private water supplies
 - Protected Open Space
 - NPDES permit sites
 - Automobile graveyards and junkyards
 - Petroleum and oil bulk stations and terminals
 - Agricultural uses
 - Industrial Parks
 - Combined Sewer Outfalls
 - Sanitary Sewer Overflows
 - Landfills



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- Hazardous waste sites
- Wastewater treatment facilities
- Stocked trout streams and cold water fisheries

The presence of any of the aforementioned data layers within a half mile radius of the potential well sites was mapped for further review (Figures 3 through 5 of Appendices A through D). The overall process is described in Figure 2 of this memorandum.

3. A MassDEP Priority Resource Map was prepared for each of the Sites (Figure 2 of Appendices A through D), which shows potential environmental receptors.
4. Each site was evaluated for proximity to the local water, sewer, and electrical distribution systems.
5. An Environmental Data Resources (EDR) Radius Map Report was reviewed for Site #3 to identify potential environmental concerns associated with nearby hazardous material release sites including the State Hospital Site, which is located immediately across Hospital Road from Site #3 (refer to Appendix E: Site #3 EDR Report).

It should be noted that this level of screening is based on readily available online databases as well as requested maps from EDR and MassDEP. The MassGIS assessors database is listed as last updated in 2015, the MassDEP Priority Resource Maps were updated in April of 2017 but rely on GIS data for much of the information shown (last updated in 2015). The Town of Medfield DPW Online Water Map was dated 2014.

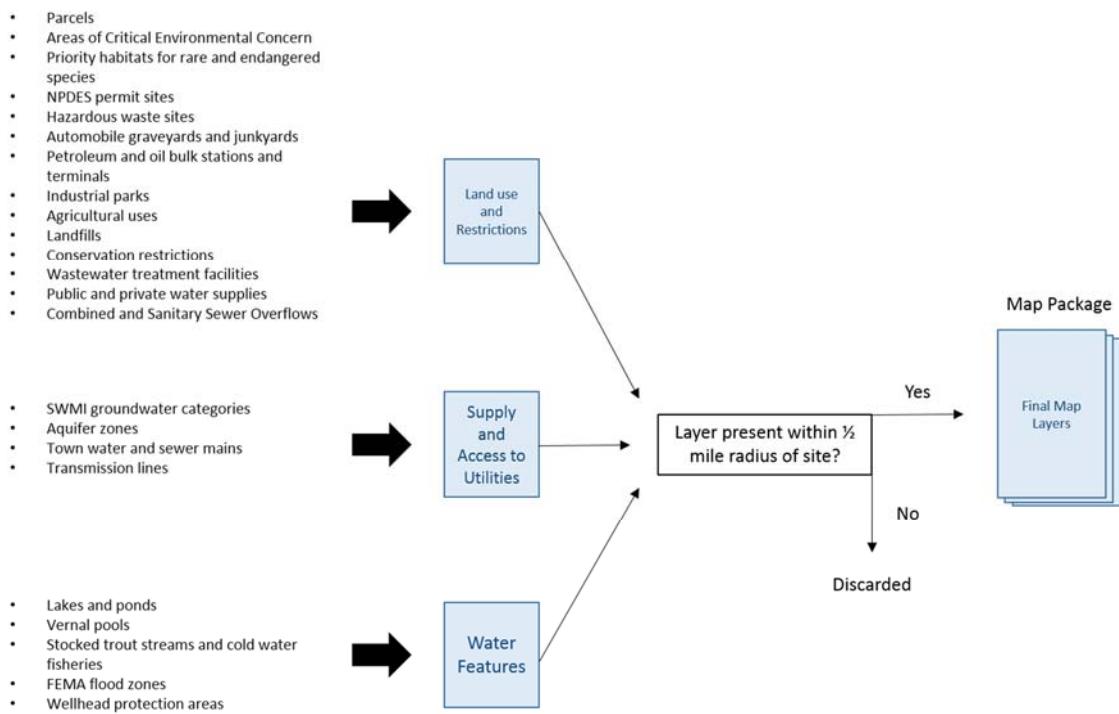


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Figure 2: Process of Mapping GIS Data Layers of Relevance



Preliminary Site Screening Results

The primary criteria used to evaluate each site's potential suitability as a water supply are related to water quantity, water quality, and general siting considerations (e.g. land use, proximity to sensitive environmental resources, utilities, etc.). The findings for the site screening process for each of the four sites is presented in the comparative table attached as Table 1. Based upon findings from the site-screening evaluation as well as site visits, the sites are ranked in terms of their favorability as a potential water supply site (most to least). The rankings, advantages, and challenges presented by each of these key criteria are summarized in Table 2 for each site.



Table 2: Summary of Primary Water Supply Evaluation Criteria and Recommendations

Rank	Site	Evaluation Criteria
1	Site #15 Former Hospital Wellfield	<p><i>Water Quantity</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none"> 1. Medium to High Yield Aquifer 2. Former 0.5 MGD registered withdrawal, transferred to Town 3. SWMI Groundwater Withdrawal Category 2, less stressed basin <p><u>Challenges:</u></p> <ol style="list-style-type: none"> 1. Shallow aquifer, limits well drawdown 2. Multiple wells vs. single well <p><i>Water Quality</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none"> 1. Historical use as public water supply <p><u>Challenges:</u></p> <ol style="list-style-type: none"> 1. Limited historical water quality data 2. Close proximity to North Brook; potentially groundwater under the influence of surface water 3. Close proximity to wetlands, secondary standards <p><i>Siting Considerations</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none"> 1. Land currently managed by Board of Water and Sewerage 2. Proximity to existing water, sewer, and electrical systems <p><u>Challenges:</u></p> <ol style="list-style-type: none"> 1. Limited available land area to accommodate water supply buffers, DEP Zone I 250-foot wellhead protection area for tubular wells and 150-foot buffer from surface water 2. Accurate delineation of wetland resource areas 3. Potential for land use protection on private property

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2	Site #8 Noon Hill / Stop River	<p><i>Water Quantity</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none">1. Proximity to Stop River2. Potentially suitable surficial geology, coarse glacial stratified deposits <p><u>Challenges:</u></p> <ol style="list-style-type: none">1. Undocumented aquifer yield2. Undocumented subsurface geology3. Located within existing Zone II Water Supply Protection Area for Public Water Source # 2175000 for the Town's Wells No. 1 and No. 2.4. SWMI Groundwater Withdrawal Category 4, moderately stressed basin <p><i>Water Quality</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none">1. Located within large protected open space, Noon Hill Reservation <p><u>Challenges:</u></p> <ol style="list-style-type: none">1. Close proximity to Stop River, potentially groundwater under the influence of surface water needs to be considered as portion of potential Zone I area is located within 150-feet of Stop River <p><i>Siting Considerations</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none">1. Protected Open Space2. Proximity to existing water and electrical systems, Noon Hill Rd.3. Existing field is open and accessible from public way <p><u>Challenges:</u></p> <ol style="list-style-type: none">1. Limited available area for 400-foot wellhead buffer, Zone 12. Location within Noon Hill Reservation3. Proximity to Stop River flood plain
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3	Site #10 Plain Street / Holmquist Farm	<p><i>Water Quantity</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none">1. Potentially suitable surficial geology, coarse glacial stratified deposits. <p><u>Challenges:</u></p> <ol style="list-style-type: none">1. Undocumented aquifer yield2. Undocumented subsurface geology, shallow bedrock3. SWMI Groundwater Withdrawal Category 5, Mine Brook classified as highest level of basin stress5. Located within existing Zone II Water Supply Protection Area Public Water Source # 430700 for the Town of Walpole's wells located approximately 0.6 miles away. <p><i>Water Quality</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none">1. Located within large protected open space <p><u>Challenges:</u></p> <ol style="list-style-type: none">1. Close proximity to wetlands, secondary standards2. Medfield and Walpole Mine Brook watershed wells require treatment <p><i>Siting Considerations</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none">1. Protected Open Space2. Proximity to existing water and electrical systems, Plain Street. <p><u>Challenges:</u></p> <ol style="list-style-type: none">1. Proximity to potential vernal pools2. Local delineation of wetland resource areas3. Land clearing required to access 400-foot wellhead buffer area4. Proximity to 100-year flood plain
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4	Site #3 McCarthy Park	<p><i>Water Quantity</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none">1. Potentially suitable surficial geology, coarse glacial stratified deposits.2. Located approximately 0.3 miles from Town's Well No. 6 <p><u>Challenges:</u></p> <ol style="list-style-type: none">1. Undocumented subsurface geology, shallow bedrock reported at State Hospital property2. Undocumented aquifer yield3. Portions of the site located within existing Zone II Water Supply Protection Area, Well No. 64. SWMI Groundwater Withdrawal Category 4, moderately stressed basin <p><i>Water Quality</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none">1. No data exists, water quality to be determined <p><u>Challenges:</u></p> <ol style="list-style-type: none">1. Proximity to hazardous material release sites at former State Hospital2. Proximity to wastewater disposal beds for former State Hospital3. Former State Hospital farm facility, potential use of oil and/or hazardous materials (pesticides, herbicides) <p><i>Siting Considerations</i></p> <p><u>Advantages:</u></p> <ol style="list-style-type: none">1. Located in large Protected Open Space2. Water, sewer, and electrical utilities located along Hospital Road3. Site generally accessible from on-site roads/paths <p><u>Challenges:</u></p> <ol style="list-style-type: none">1. Site previously developed by various farm facility buildings and out-buildings2. Potential use of parcels as disposal areas for State Hospital3. Portions of site currently used for stockpiling of reclaimed asphalt and aggregate materials4. Portions of site used for municipal playing fields, walking trails, and open space5. Proximity to wetland area and potential vernal pool
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Recommendations

Based upon the preliminary site screening of the four potential water supply sites, each of the sites has both favorable characteristics and challenges to be addressed. Based on the available site screening data, Environmental Partners developed a preliminary ranking of the sites in order of their favorability as a potential water supply site. None of the four sites were disqualified based on the site screening evaluation; therefore, Environmental Partners recommends that additional site subsurface investigations be performed at each of the four sites to evaluate potential well yield and water quality. The recommended site investigations would include the following:

1. Complete a site walk with Town representatives and a drilling sub-consultant to determine the preferred test boring/well locations at each of the four sites. Proposed test boring/well locations are shown on Figure 1 of Appendices A through D. Limited site clearing of trees/shrubs is likely required at Sites #10 and #15 in order to locate the drill site with ownership and control of a DEP Zone I buffer and outside wetland buffer areas.
2. Complete a limited subsurface investigation including drilling of up to two (2) soil borings at each of the four sites to observe the subsurface soil conditions in the overburden material to a depth of up to 60 feet below ground surface.
3. Installation of one 2-inch diameter test well and one 2-inch diameter observation well at each site.
4. Complete a two hour constant rate pump test at each site to evaluate aquifer capacity and water quality. Groundwater samples will be collected for field and/or laboratory analysis of common water quality indicators, including pH, specific conductivity, hardness, alkalinity, iron, manganese, volatile organic compounds, heavy metals, pesticides, herbicides, nitrate, nitrite, and color.

Upon completing the limited subsurface investigation and water quality analysis, the site screening evaluation will be updated to determine which of the four potential sites should be considered for public water supply development. The potential development of an alternative new water supply source at each of the four sites will be compared against the potential rehabilitation and treatment

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of Wells No. 3 and No. 4 in terms of design/construction cost, permitting requirements and schedule, and ability to address the Town's short and long-term water supply management goals.

Attachments:

Table 1 – Summary Table of Site Screening Data

Figure 1 – Locus Map of Potential Public Water Supply Sites

Appendix A: Site #15 Memorandum and Figures 1 through 6

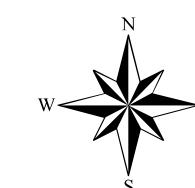
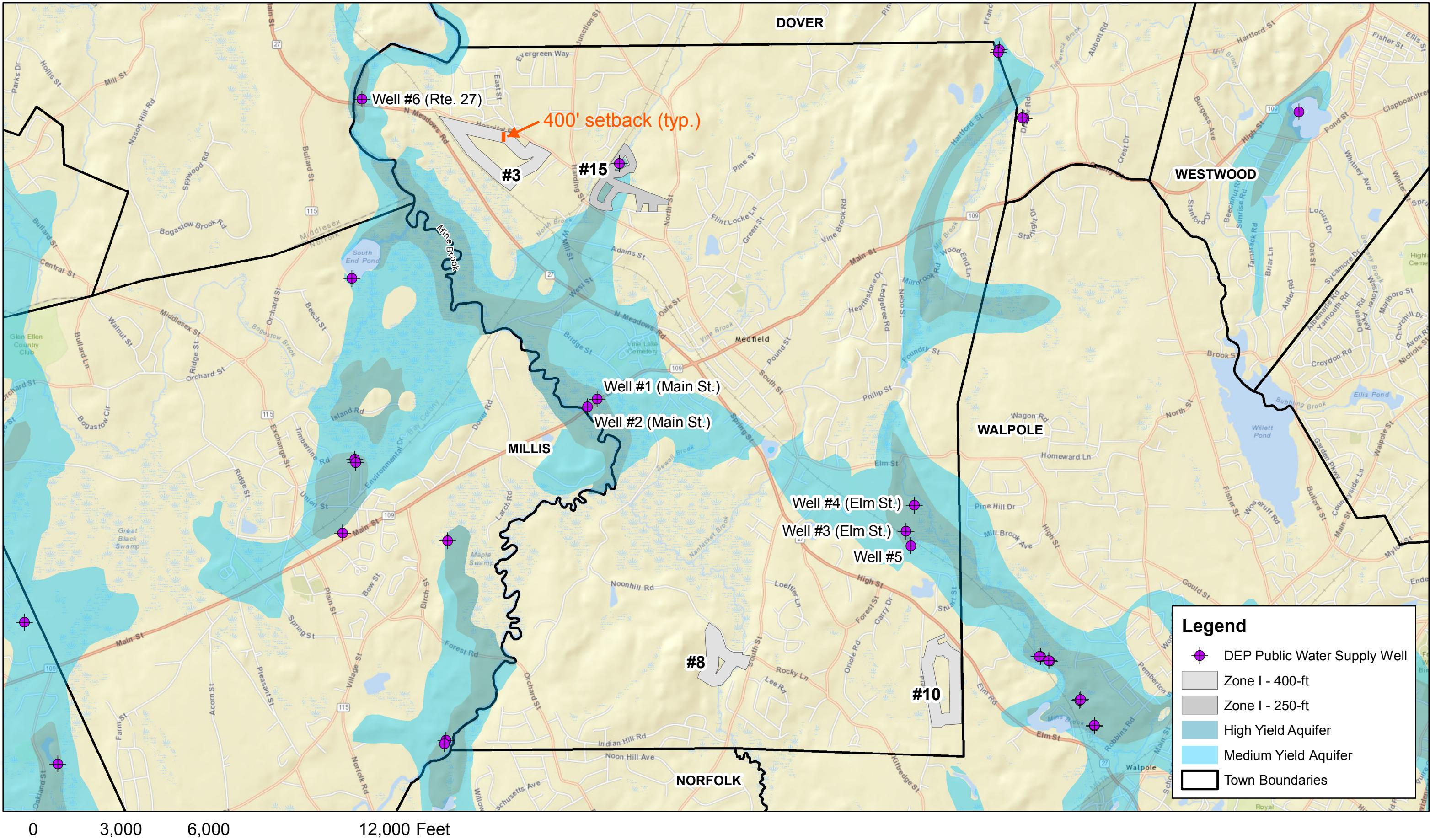
Appendix B: Site #8 Memorandum and Figures 1 through 6

Appendix C: Site #10 Memorandum and Figures 1 through 6

Appendix D: Site #3 Memorandum and Figures 1 through 6

Appendix E: Environmental Data Resources Report for Site #3 44 Hospital Road





Town of Medfield - Preliminary New Water Supply Source Evaluation

Table 1: Summary Table of Site Screening Data

		Parcels in Zone I		Relevant Nearby Parcels								21 E Release Sites		Wetlands			NHESP Priority Habitat and ACEC		
Site	Description	ID	Notes	ID	Owner	400 foot Zone I Buffer on Town Land	Area within 400 ft buffer (ft ² /acres)	Aquifer Zone ²	Surficial Geology	SWMI GWC Category ³	Vernal Pools	Present On-Site	Proximity of Nearest	Present in Zone I Area	Proximity of Nearest	Comments	Present On-Site	Proximity of Nearest	Comments
Site #3	Town Recreational Complex at 44 Hospital Road	63-009; 63-004	Athletic fields take up approx. half of 63-009	70-005; 63-007; 55-011	70-005 and 63-007 by dept of conservation and recreation; 55-011 by US Army Corps	Yes	26 acres	No data available	Coarse glacial stratified deposits and swamp deposits	4	There is one potential vernal pool on-site (within 500-feet of proposed test well), and one potential and two certified vernal pools within 0.5 mile of the Site	No	725 ft North; See EDR Report in Appendix E	Yes	On-Site	Source: Charles River. Shallow marsh meadow or fen takes up 5.44 acres of zone I parcel 63-009; possible to have 400 ft buffer from wetland	No	495 ft SW	Core Habitat present in zone 1 parcel 63-009 (423,726 ft ²)
Site #8	Stop River conservation lands off Noonhill Rd	09-005	Noon Hill lookout located in 09-005	None	N/A	Yes	1.82 acres	No data available	Coarse glacial stratified deposits, Swamp Deposits and Thin Till	4	Three certified vernal pools within 0.5 miles of the Site, and Four Potential Vernal Pools within 0.5 miles of the Site	No	1.13 miles SW	No	82 ft SE	Source: Stop River. Nearby shrub swamps and shallow marsh meadow or fen	No	1 mile SW	Two estimated rare wetland wildlife habitats within approximately one mile radius of the Site, to the southwest
Site #10	Plain Street Farm Lands	12-004; 12-005; 12-006	12-006 managed by the Town of Medfield Conservation Commission	None	N/A	Yes	22 acres	No data available	Coarse glacial stratified deposits, Thin Till and Swamp deposits	5	Five potential vernal pools within the 0.5 mile radius of the Site, to the north, east and south	No	1.14 miles SE	Yes	On-Site	Scattered. Wooded swamp mixed, wooded swamp deciduous, deep marsh, and shrub marsh take up 9.06 acres of zone 1; possible to have 400 ft buffer from wetlands	No	N/A	None
Site #15	Former Medfield State Hospital tubular wellfield	65-012; 57-021R	Granted by Commission of Mass., former tubular wellfield pump house on-site	64-067; 57-023; 65-001	Commonwealth of Mass.; Trustees; Norfolk Hunt Club	No	6.6 acres within 250 foot tubular wellfield buffer	Yes (Medium-High)	Coarse glacial stratified deposits, Thin Till, Bedrock outcrop, Floodplain alluvium, and swamp deposits.	2	None	No	0.88 miles NW	Yes	On-Site	Source: North Brook. Shrub swamp and shallow marsh meadow or fen take up majority of parcels; 150 ft buffer possible in small area	No	N/A	None

Notes:

1. Data layers not present in Medfield or within 1 mile of a bordering town were not included in this table
2. Aquifer Classification: High Yield (greater than 300 gpm), Medium Yield (100-300 gpm), Low Yield (less than 100 gpm)
3. SWMI: Sustainable Water Management Initiative
 - A. SWMI Groundwater Withdrawal Category (GWC) 1: Percent of Flow Alteration is less than 3%
 - B. SWMI GWC 2: Percent of Flow Alteration is greater than 3% and less than 10%
 - C. SWMI GWC 3: Percent of Flow Alteration is greater than 10% and less than 25%
 - D. SWMI GWC 4: Percent of Flow Alteration is greater than 25% and less than 55%
 - E. SWMI GWC 2: Percent of Flow Alteration is greater than 55%
4. Wellhead Protection:
 - A. Zone I: The protective radius required around a public water supply well or wellfield. For public water system wells with approved yields of 100,000 gpd or greater, the protective radius is 400 feet. Tubular wellfields require a 250-foot protective radius. Protective radii for all other public water system wells are determined by the following equation: Zone I radius in feet = (150 x log of pumping rate in gpd) - 350.
 - B. Zone II: "That area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone IIs shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock, or a recharge boundary)."

Town of Medfield - Preliminary New Water Supply Source Evaluation

Table 1: Summary Table of Site Screening Data

Automobile Graveyards and Bulk Oil Stations			Conservation Land			Other Possible Land Use Restrictions		Wellhead Protection Areas ³		Flood Plain Considerations		NPDES Surface/Groundwater Discharge Sites		Basins and Sub-basins					
Site	Present On-Site	Proximity of Nearest	Present in Zone I Area	Proximity of Nearest	Comments	Present in Zone 1 Area	Comments	Present On-Site	Comments	Present in Zone I Area	Comments	Proximity to nearest (miles)	Comments	Major basin/Sub-basin	Transmission Line Access	Water Distribution System Access	Sewer System Access	Special Considerations	
Site #3	No	Rick's Auto Body Shop - 1.6 miles	No	460 ft NE	Parcel 70-005 owned by the department of conservation and recreation	Yes	McCarthy Park (7.78 acres), State Hospital Property (8.38 acres)	Yes	6.17 acres of parcel 63-009 in Zone II of PWS 2175000 (Medfield)	Yes	0.33 acres of land in 500 year floodplain	2.43	Villages at River's Edge, Norfolk	Charles	No data available. Closest dwellings are 500 and 1500 feet NE of potential test well location	12" pipe 525 feet NW of potential test well location	525 feet NW of potential test well location	Reported as potential site of former hospital landfill, proximity to playing fields	
Site #8	No	Mobil - 3.1 miles	Yes	On-Site	Noon Hill Reservation (1.82 acres)	Yes	Noon Hill lookout located in 09-005, possible parking lot, walking trail considerations	Yes	All in Zone II of PWS 2175000 (Medfield)	No	None	4.20	Medfield Wastewater Treatment Facility	Charles	No data available. Closest dwellings are 656 and 984 feet East of potential test well location	8" pipe 700 feet East of potential test well location	700 feet East of potential test well location	Stream crossing may be required. Zone I well protection would be in private protected open space	
Site #10	No	S M Larusso & Sons Inc. - 1.9 miles	Yes	On-Site	12-006 managed by the Town of Medfield Conservation Commission (2.47 acres in Zone 1)	No	None	Yes	18.42 acres in Zone II PWS 4307000 (Walpole)	Yes	16.55 acres of land in 100 year floodplain	3.60	Villages at River's Edge, Norfolk	Boston Harbor	No data available. Closest road is 100 feet West, closest dwelling is 600 feet North of potential test well location	8" pipe 450 feet West of potential test well location	450 feet West of potential test well location	Community farm on West side of Plain Street	
Site #15	No	Randy's Automotive - 2 miles, Cumberland Farms - 2 miles	Yes	On-Site	Watershed protection land owned by Board of Water and Sewerage	Yes	North Brook bisecting the Zone I	Yes	Former tubular well had established Zone I and II	Yes	2.58 acres of land in 100 year floodplain	1.12	Dover-Sherborn High	Charles	No data available. Closest roads with dwellings are 475 and 950 feet from potential test well locations	10" pipe between 164 and 1500 feet from potential test well locations	Between 500 and 1000 ft from potential test well locations	Stream crossing may be required, potential rail trail access considerations	

Notes:

1. Data layers not present in Medfield or within 1 mile of a bordering town were not included in this table
2. Aquifer Classification: High Yield (greater than 300 gpm), Medium Yield (100-300 gpm), Low Yield (less than 100 gpm)
3. SWMI: Sustainable Water Management Initiative
 - A. SWMI Groundwater Withdrawal Category (GWC) 1: Percent of Flow Alteration is less than 3%
 - B. SWMI GWC 2: Percent of Flow Alteration is greater than 3% and less than 10%
 - C. SWMI GWC 3: Percent of Flow Alteration is greater than 10% and less than 25%
 - D. SWMI GWC 4: Percent of Flow Alteration is greater than 25% and less than 55%
 - E. SWMI GWC 5: Percent of Flow Alteration is greater than 55%
4. Wellhead Protection:
 - A. Zone I: The protective radius required around a public water supply well or wellfield. For public water system wells with approved yields of 100,000 gpd or greater, the protective radius is 400 feet. Tubular wellfields require a 250-foot protective radius. Protective radii for all other public water system wells are determined by the following equation: Zone I radius in feet = $(150 \times \log \text{ of pumping rate in gpd}) - 350$.
 - B. Zone II: "That area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone I shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock, or a recharge boundary)."