



Transmittal Letter, December 11, 2019

To: Daryll Pope, Technical Officer, dpope@usgs.gov
Cc: Sherri Bredeesen, Contracting Officer, sbredeesen@usgs.gov

From: Anne Carroll, Director of Office of Water Resources, Department of
Conservation and Recreation, Commonwealth of Massachusetts

Subject: Final Report, Grant G16AC00362 titled Enhancing and
Modernizing the Massachusetts Department of Conservation and
Recreation/National Ground Water Network through Well Replacement

Mr. Pope:

Please find enclosed an electronic copy of the Final Report for Grant G16AC00362 titled
Enhancing and Modernizing the Massachusetts Department of Conservation and
Recreation/National Ground Water Network through Well Replacement.

Sincerely,

Anne Carroll
Director, DCR Office of Water Resources

COMMONWEALTH OF MASSACHUSETTS · EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS

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Final Report

Project Summary Information

- 1. Project Title:** Enhancing and Modernizing the Massachusetts Department of Conservation and Recreation/National Ground Water Network through Well Replacement.

Work included replacement of 34 existing monitoring wells in the network that have been compromised by age. Existing wells will be monitored simultaneously for one year to assure transferability of the historical data record.
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- 3. Authorized Institutional Representative** Norma Forgione, Federal Funds Officer
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- 4. Effective Grant Dates:** October 1, 2016 – September 30, 2019
- 5. Data Provider Status:** Existing Data Provider. The MA ground water observation program, with records back to 1936, pre-dates the NGWMN. As part of the state cooperative program the USGS has provided data to the NGWMN since it was formed in 2013. The NGWMN utilized most of the Massachusetts observation wells already being measured in 2013. Massachusetts has not previously submitted a proposal for NGWMN funding.

Completed Work

We completed the following tasks in Year 1 - October 1, 2016 to September 30, 2017:

- Release Request For Proposals for Well Drilling Services
- Selection of New England Boring (NEB) as the contractor for well drilling services, the only complete bid received
- Revised list of wells to include 34 instead of 39 wells because NEB's bid for 39 wells was greater than the grant award budget
- Initiated contracting with NEB for well drilling services
- Completed Interagency Agreement with University of Massachusetts Amherst for geologist oversight of NEB by the State Geologist
- Initiated logistics preparation such as permissions from property owners, Massachusetts Department of Transportation permits, police details, and others

We completed the following tasks in Year 2 - October 1, 2017 through September 30, 2018:

- Completed contracting with NEB for the replacement of 34 wells
- Conducted extensive work on securing property access permissions. The original wells were installed in the 1950s and 1960s. There is no documentation of property owners or permissions. In most cases property owners were not aware of the wells or the monthly monitoring by state or federal employees. In multiple cases permissions were difficult and time consuming to secure. In one case, permission was denied including continued access to the existing well. To ensure access and continuation of data, we relocated replacement wells to near-by public land or right-of-way areas whenever possible.
- Replaced 31 wells throughout the state (see table below)
- Encountered bedrock during the attempted replacement of a till well (MA-XGW 2, Weymouth). We are working with the property owners to identify another, closer site to original well (further detail under Deviations from Proposal)
- Initiated concurrent measurement of original and replacement wells
- Completion of over 100 percent of the matching costs (matching costs will be significantly over the estimate amount due to the described challenges with contracting the drillers during Year 1 and obtaining property permissions during Year 2 and 3)

Replacement wells completed during Year 2:

Region	Well	Completed
Southeast	Seekonk 275 (CELL)	10/31/2017
Southeast	Freetown 23	11/1/2017
Southeast	Attleboro 83	11/1/2017
Northeast	Wenham 76 (CELL)	11/2/2017
Northeast	Wakefield 38 (DCP)	11/2/2017
Northeast	Concord 167	11/3/2017
Northeast	Georgetown 168	11/6/2017
Southeast	Norfolk 27 (DCP)	11/7/2017
Northeast	Dover 10	11/8/2017

Central	Webster 1	12/6/2017
Central	Townsend 13	12/7/2017
Southeast	New Bedford 116	12/11/2017
Southeast	Hanson 76	12/12/2017
Northeast	Wayland 2 (CELL)	12/14/2017
Central	Templeton 3	12/15/2017
Central	West Brookfield 2	1/16/2018
Central	Hardwick 1	1/18/2018
Western	Otis 7	1/19/2018
Cape Cod	Wellfleet 17 (CELL)	4/4/2018
Cape Cod	Brewster 22 (DCP)	4/5/2018
Cape Cod	Brewster 21	4/6/2018
Cape Cod	Chatham 138 (CELL)	4/9/2018
Cape Cod	Sandwich 253 (CELL)	4/11/2018
Cape Cod	Barnstable 247	4/12/2018
Cape Cod	Sandwich 252	4/18/2018
Western	Sheffield 58	7/9/2018
Western	Great Barrington 2	7/10/2018
CT River	Deerfield 44	7/11/2018
Western	Granville 6 (CELL)	7/12/2018
Southeast	Duxbury 79 (DCP)	7/23/2018
Southeast	Lakeville 14 (DCP)	7/24/2018

We completed the following tasks in Year 3 - October 1, 2018 through September 30, 2019:

- Working with town officials, we identified an alternate location for Weymouth 2 and were able to complete the well replacement in similar aquifer material as the original well
- Continued to encounter property permission and town permitting challenges resulting in no replacement for two wells
- Completed replacement of three wells (see table below)
- Continued concurrent measurements of replacement wells
- Initiated discussion with USGS New England about methods for confirmation analyses to establish appropriateness of replacement well and for adjustment of historical record to provide a synthetic historical record for the replacement well
- Exceeded matching costs due to significantly greater state staff time spent on the project than estimated including contracting in Year 1, property permissions and permitting with local and state authorities in Year 2 and 3, and coordinating on well surveying work and replacement confirmation analyses in Year 3.

Replacement wells completed during Year 3.

Central	Chicopee 95	3/11/2019
Western	Heath 14	3/12/2019
Southeast	Weymouth 2	8/6/2019

Deviations from Proposal

We estimated replacing up to 39 wells in the proposal. In Year 1, based on NEB's bid, we revised the well list to 34 priority wells to remain within the grant award budget. These priority wells were selected based on multiple factors including the material, age and performance of the wells to estimate the severity of need for replacement, on the use of the data from the well monitoring and its location relative to other wells.

In addition to the need for a revised scope, State contracting staff encountered delays and challenges in engaging with this project in Year 1.

In Year 2, the contracting challenges were resolved and 31 of the 34 wells were replaced. The status of the three remaining wells is as follows:

1. MA-XGW 2, Weymouth: We have not been able to replace this well. The well was destroyed during redevelopment of the area in October of 2017. After a lengthy period of numerous contacts with various property owners in the area, we obtained permission for a new, nearby location. However, during drilling we continually encountered bedrock. The destroyed well with the long period of record was sand and gravel. In order to provide a proper replacement and not lose the data from previous well, we are working with the owners to identify a new location closer to the original well. The majority of the budget for this well was spent. Given that the old well was destroyed and that we wanted to save the data previously recorded, this is the highest priority well for which to complete replacement. Note: In Year 3 we successfully installed an appropriate replacement well in coordination with the town who had taken over the redevelopment project from the original real estate developers.
2. MA-ENW 52, Edgartown: This well measures to full depth and is the most expensive replacement well due to its location on the island of Martha's Vineyard. We have saved this well for last to ensure sufficient budget remained.
3. MA-NXW 54, Northbridge: The bent stickup of the well was fixed and the well was deemed undamaged below ground. Given that budget remains, it will be considered for replacement.

In Year 3, we made additional changes to well replacement targets as follows:

- Heath 14 was determined to need replacement. The original well installation was funded by MassDOT and installed in 2016 during a severe drought. Recharge of the well during integrity testing showed that it did not meet the criteria for climate response network wells. Since this well also has soil moisture sensors at multiple depths, we prioritized this location for replacement.
- Chicopee 95, which had difficulty recovering from the 2016 drought was brought back as a priority from our original list of target wells.
- Given the above, Edgartown 52 and Northbridge 54 were deemed lower priority targets and removed from the target list.

Finally, we note the following "lessons learned" which may help future grantees manage their efforts involved with well replacement projects:

- Property ownership: Depending on the owner of the property on which the well is located, consider that it may take significant time to secure permission to maintain access to the existing well and to install a replacement well. Most municipalities were amenable and some welcoming of “realizing” that they had a USGS groundwater monitoring well on their property. However, we encountered several private property owners that were not amenable to a replacement well and one that refused access even to the existing well.
- Roadway permitting and police detail: Due property permission issues, we relocated wells to right of ways on roads. Depending on the owner of the road, this required local or state permitting (e.g., grant of location, street opening permit, state highway access) and in some cases the hiring of police detail (state highways).
- Surveying: New well will require surveying of new elevations for measuring points. We secured state funding for this but could have been included in the budget estimate and done by a contractor.
- Confirmation analyses and adjustment of record: After 12 months of measurements, USGS New England is conducting analyses to confirm that the replacement wells are appropriate (e.g., same aquifer). From this analysis, USGS will also determine an elevation adjustment factor between the wells and apply it to the historical record to create a synthetic historical record for the new well based on the old well. This will allow the well to maintain its full period of record which is critical for the use of these wells for drought monitoring and other statistical analyses. This adjustment allows a seamless record to be queried for the new well for the full period of record. This will be noted on the replacement well’s webpage.