Municipality/Organization: Town of Lincoln

EPA NPDES Permit Number: MAR041043

MaDEP Transmittal Number: W-035460

Annual Report Number & Reporting Period: No. 13: May 2015 – May 2016

NPDES PII Small MS4 General Permit Annual Report

Part I. General Information

Contact Person: Timothy Higgins | Title: Town Administrator

Telephone #: 781-259-2600 | Email: higginst@lincolntown.org

Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: Timothy S. Higgins

Printed Name: Timothy S. Higgins

Title: Town Administrator

Date: April 29, 2016

Part II. Self-Assessment

The Town of Lincoln has completed the required self-assessment and offers the following feedback on the permit compliance of our municipality:

On April 4, 2016 the new MA MS4 General Permit was issued. This will go into effect on July 1, 2017. We realize that we need to make a strong attempt to establish bylaws and regulations for construction site stormwater management and for illicit discharge detection and elimination. The issuance of this new Permit will help facilitate this course of action. Our educational outreach program needs to be reinvigorated and again this will be encouraged with the issuance of the new Permit. Clearly, as with all Towns and Cities, the cost of implementation is a real concern. We appreciate the extended timeline for providing the new Notice of Intent.

Much of Lincoln is located outside the MS4 regulated area, and the northern area of our MS4 is part of Hanscom Air Force Base which is governed by their own NPDES Permitting. However, we do our best to have clean stormwater discharges to the receiving waters throughout our community. Lincoln is unique in that our land area includes three separate watersheds; the Charles River, the Shawsheen River, and the Sudbury, Concord, Assabet (SuAsCo) Rivers. Two of these have Total Maximum Daily Load (TMDL) requirements. The Charles watershed has a TMDL requiring a reduction in phosphorus, and the Shawsheen watershed has a TMDL requiring a reduction of bacteria/pathogens (fecal coliform).

On April 5, 2016 Lincoln's Town Planner and Conservation Director attended the Stormwater Workshop sponsored by the Charles River Watershed Association held at MA Audubon's Broadmoor Sanctuary. This was valuable in learning more about the requirements for phosphorus reduction in the Charles Watershed (which is the largest one in Town) and the success of various municipal initiatives for stormwater best management practices (BMPs). The Charles River Watershed is of special local significance because these surface waters provide drinking water for Lincoln and Cambridge. In addition, the Tower Road Well in Lincoln is also located within this watershed.

There are a few significant take-home messages from all the stormwater guidance we have received over recent years. One is that natural landscapes are infinitely better for accepting and infiltrating stormwater than developed landscapes. In this area Lincoln has done an excellent job and nearly half of our community is permanently preserved open space (please see the attached summary of open space). In fact, since 2008 we have protected an additional 560 acres of land. Currently the average impervious cover in seven of our abutting towns is 16.67% while Lincoln has the lowest at 9.09%.

Another take-home message is that "country drainage" is preferable to a piped system with concentrated outflows. Most of our roadways are already narrow and the bulk of the runoff is directly to the side of the roads into vegetated buffer strips. Our Department of Public Works (DPW) is implementing a program of eliminating sand accumulation along our roads to ensure this type of drainage continues to function properly (see attached specification sheets).

Being a small community we have limited staff. In order to comply with the new NPDES MS4 Permit we will likely retain the professional services of a consulting firm with local stormwater management expertise to help us develop our Notice of Intent and associated plan for achieving compliance.

Several major multi-year projects that include significant improvements to stormwater management are nearing completion. These include the Hanscom Air Force Base Middle School and the Crosby's Corner-Route 2 roadway improvement project. This year's local roadway projects incorporated three new leaching catchbasins and the planting of new trees (see attached photos). The DPW uses its relatively new leaf vacuum to carry out an active fall leaf cleanup along our roadways. These leaves are then composted and used as fertilizer by our local farms. This past winter the DPW pre-treated our roads with a brine solution to prepare for winter storm events. Implementation of this BMP allows the Town to minimize overall use of salt and sand on our roads during the winter season.

A major educational outreach publication that was produced by our Conservation Planner continues to be distributed and used. It is titled "Ecological Design, Construction and Maintenance Handbook – best practices for balancing site construction & land protection". A link to this electronic magazine is on the Town's website – www.lincolntown.org and hardcopies are available at the Conservation Office. In addition we have a new wetlands filing checklist to accompany Notices of Intent and Requests for Determination of Applicability. The focus of this is summarizing total impervious area and stormwater management. We also have a one page "Ecological Design, Construction and Maintenance" guide focusing on plants. Both are included at the end of this report.

Part III. Summary of Minimum Control Measures

1. Public Education and Outreach

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 13 (Reliance on non-municipal partners indicated, if any)
1-A	Lincoln Specific Stormwater Flyers	ConCom	Distribute at Town Hall and public events.	Lincoln has several brochures relating to stormwater awareness and healthy lawns and landscapes available at the Town Offices. These are also made available at the annual Town Meeting
1-B	Education via Newspaper Articles	ConCom	Write at least one article per year	Article on stormwater in Lincoln Journal published from CRWA.
1-C	Education via the Internet	ConCom	Provide stormwater information and links on Town website	Stormwater information is posted on Town Website. Links to other websites including EPA's site also posted. The Town has a brand new website within the past year with extensive new content. It is much more user-friendly and has lots of "green" information.
1-D	Homeowner and Contractor BMP Manual	ConCom	Provide manual with best current methods.	This manual is completed and available as an electronic magazine with live links to many stormwater web resources. Hardcopies are available at the Conservation Office.

1-E	Invasives Plant Guide	ConCom	Color guidebook is available. Published in 2015.	This guide is focused directly on Lincoln although it is pertinent for any community in the Commonwealth. It will help protect ecological integrity throughout our watersheds.
1-F	Open Space and Recreation Plan	Open Space Committee	State approved Open Space and Recreation Plan	This year we started the process for updating our Open Space and Recreation Plan.
1-G	New Homeowner Information Packet	ConCom	Provide property information to new homeowners.	Distributed packets including Lincoln specific fliers and return postcard to new homeowners. Work is ongoing and effective
1-H	Municipal GIS Website	ConCom	Offer public free GIS website with datalayers for Town.	The revised GIS system is functioning effectively. Layers include wetlands, buffer zone,& floodplain. Completely updated in 2014 with very accurate parcel boundaries. This is used extensively by residents and others.
1-I	Conservation Walk Series	ConCom	Provide educational outings for the public.	Spring and fall series of walks to get people on land and educated about conservation issues with a concentration on watershed activities. This is an annual series that is well attended and connects residents to the Town's natural resources.
1-J	Healthy Lawn and Landscape Brochures	ConCom Garden Club	Distribute to residents.	This brochure was fully revised and updated in 2011 and is distributed at Town Hall and at municipal events. Minimizing or eliminating fertilizer and pesticides are the key components discussed.

2. Public Involvement and Participation

BMP ID #	**BMP Description**	**Responsible Dept./Person Name**	**Measurable Goal(s)**	**Progress on Goal(s) – Permit Year 13** (Reliance on non-municipal partners indicated, if any)
2-A	Annual Meeting on NPDES Plan and Report	Town Administrator	Hold Committee meeting each year	NPDES meeting Including Town Planner, Conservation Director, and Public Works Director was held.
2-B	Watershed Group Involvement	ConCom Local Groups	Continue ongoing activities to protect the health of our wetlands & watersheds.	We work closely with the City of Cambridge's Water Department on stormwater issues. ConCom partnered with Concord for 16th consecutive year of water chestnut removal. ConCom representatives are active with the SuAsCo River Stewardship Council. We also continue to participate with the SuAsCo CISMA.

2-C	Involve Lincoln Children's Groups	ConCom	Involve Lincoln Children's Groups in watershed clean-up and other activities.	Worked with various classes and groups on local ecological issues, including teaching importance of stormwater management for drinking water quality.
2-D	Wetland buffer restoration through invasive species removal	ConCom	Work at least once per year with community and/or school group to restore wetland habitat.	Sixth annual Garlic Mustard pull day held with excellent community participation. This is critical work for maintaining the health of native plant ecosystems. .
2-E	Open Space and Recreation Plan	ConCom Open Space Committee	State Approved Plan with 5-year Action Plan	This year we started the process for updating our Open Space and Recreation Plan.
2-F	Elm Brook Stream Restoration	ConCom Minute Man National Historical Park	Stream daylighting with natural stream-bed construction and native plantings	This is a Shawsheen River watershed project. Stream is healthy with native plants and abundant macro-invertebrate and amphibian life.
2-G	Habitat inventory and monitoring	ConCom	Conduct habitat inventories	Baseline monitoring of all conservation lands and holdings is completed. We are partnering with Brandeis University and the Harvard Forest on establishing long-term ecosystem monitoring.
2-H	Comprehensive Plan (Town's Master Plan)	Planning Board	Work to achieve goals outlined in plan, which include open space preservation and ecological protection.	Work on implementing plan is ongoing. Open space goals mirror what is in the Open Space Plan. A new Town Planner has been hired who is actively working on the various issues and goals that are described in the Master Plan.

3. Illicit Discharge Detection and Elimination

BMP ID #	**BMP Description**	**Responsible Dept./Person Name**	**Measurable Goal(s)**	**Progress on Goal(s) – Permit Year 13** (Reliance on non-municipal partners indicated, if any)
3-A	Illicit Discharge Bylaw	DPW Board of Health	Discussions and review of regulations	Board of Health continues to review and permit all septic system maintenance and construction. Conservation permitting is done for all systems within 100 feet of wetlands or 200 feet of perennial streams.
3-B	Storm Drain Map	DPW Town Administrator	Field-verify and map storm drains and outfalls	Used GPS to collect accurate field data for all stormwater, culvert, and Water Department infrastructure. This work continues and is not yet completed. We have encountered problems with both the hardware and software used for the GPS/GIS program. We hope to resolve this soon.

3-C	Illicit Discharge Detection and Elimination Plan	DPW	Visually screen outfalls during dry weather.	Priority areas are the Tower Road wellhead protection zones A and B and Flint's Pond and Cambridge Reservoir surface water protection Zones 1 and 2. This aspect of the MS4 program needs to become more active. Household hazardous waste coordinated with the Town of Lexington.
3-D	Illicit Discharge Education for General Public and Businesses	ConCom Planning	Include illicit discharge education information in fliers.	ConCom brochures distributed on how to reduce lawn and yard pesticide and chemical fertilizer use. DPW maintains metal "No Dumping – Drains to River" catchbasin markers.
3-E	Illicit Discharge Education for Municipal Employees	DPW Fire Department	Municipal training for Town.	Fire Department continues their training in spill prevention and containment. DPW employees trained on spill prevention and containment.
3-F	Annual Monitoring of all public and private Conservation Land.	ConCom Lincoln Land Conservation Trust	Inspect boundaries and interiors of all permanently protected open space	Work completed by LLCT and ConCom staff. Any violations, including illicit discharges, are searched for.

4. Construction Site Stormwater Runoff Control

BMP ID #	**BMP Description**	**Responsible Dept./Person Name**	**Measurable Goal(s)**	**Progress on Goal(s) – Permit Year 13** (Reliance on non-municipal partners indicated, if any)
4-A	Construction Site Runoff Bylaw	Planning ConCom	Initial Discussions and review of existing and model bylaws	Construction site runoff is now managed through wetlands permitting and site-plan review. Under the new MS4 we will be revisiting this issue.
4-B	BMPs for Construction Site Erosion, Sediment, and Waste Controls	Planning ConCom	Stay current with construction-site BMP's	DEP Stormwater Regulations are administered by the Conservation Commission. BMP's required through wetland and site-plan permitting.
4-C	Construction Site Plan Review Procedures	Planning ConCom	Maintain review and communication between land-use boards	Planning Board and ConCom both currently review construction site plans.
4-D	Construction Site Inspection and Enforcement Procedures	Planning ConCom	Inspect and Enforce Construction Site through local boards	Planning and Conservation staff monitor construction sites as does the Building Inspector.
4-E	Response to Public Stormwater Hotline	DPW ConCom	Maintain Stormwater Hotline	Conservation Department phone is the Hotline during working hours and Public Safety Dispatcher during other hours.

4-F	Zoning Bylaw Revisions for FEMA Floodplain Requirements	Planning Board ConCom	Revise floodplain regulations and get approved by Town Meeting.	In 2014 Town Meeting approved the changes that strengthen regulatory authority to limit floodplain alteration, thus protecting this resource area that is critical to stormwater management.

5. Post-Construction Stormwater Management in New Development and Redevelopment

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 13 (Reliance on non-municipal partners indicated, if any)
5-A	Post-Construction Site Runoff Bylaw	Planning ConCom	Initial discussions; review current local/state regulations; review proposed samples	Post-Construction site runoff is managed through wetlands permitting and site-plan review. Under the new MS4 permit we will explore the establishment of a new bylaw to meet this requirement.
5-B	Choose Structural and Non-structural BMPs	Planning ConCom	Stay current with construction-site BMP's	Continued enforcing current BMPs as shown on 5-year NPDES Stormwater Phase II Compliance Plan. Planning Board is taking on a more active role with BMP consideration during site plan review.
5-C	Long-Term BMP Operation and Maintenance Procedures	Planning ConCom	Require Operation and Maintenance Plan Procedures for single-family through Bylaw.	OMPs are required under DEP Stormwater Management Regulations for projects requiring a Stormwater Management Plan. General review provided through existing permitting.
5-D	Structural BMP Implementation Procedures	Planning ConCom	Outline structural BMP requirements in Bylaw	Review structural stormwater management controls through existing permitting process. Where possible require low-impact development strategies and non-structural components.
5-E	Permits Issued for Major Projects with Drainage Improvements	ConCom	Work with applicants to ensure proper stormwater BMPs are used during and after construction.	Major projects that are still ongoing include: Crosby's Corner/Route 2 Project with extensive stormwater management BMPs and wetlands habitat restoration. This work is nearly complete and the stormwater management system is largely functional. Hanscom Air Force Base Middle School reconstruction is near completion.

6. Pollution Prevention and Good Housekeeping in Municipal Operations

BMP ID #	BMP Description	Responsible Dept./Person Name	Measurable Goal(s)	Progress on Goal(s) – Permit Year 13 (Reliance on non-municipal partners indicated, if any)
6-A	Employee Training to Prevent/Reduce Stormwater Pollution	DPW Fire Department	Municipal training for DPW and Fire Department employees.	Fire Department and DPW continue ongoing spill prevention and cleanup training. Containment booms have been placed in the DPW garage. These booms will be available to be placed around catch basins in the event of a fluid spill.
6-B	Maintenance/Inspection of Storm Sewers and Structural/Non-Structural Controls	DPW	Assess existing controls, maintenance activities, schedules, and long-term inspection procedures	Annual cleaning of approximately 510 catchbasins. Continued maintenance and inspection of existing stormwater drainage system. New leaching catchbasins continue to be installed where feasible and during roadway reconstruction. A new initiative to fully remove accumulated material from roadway shoulders to improve natural drainage is currently being implemented. Cleaning of newly constructed sedimentation basins is ongoing. These newly constructed sediment basins work extremely well in reducing sediment flow into wetland areas. Several drainage lines have been replaced or cleaned-out.
6-C	Pollutant Source Reduction/Elimination from Municipal Facilities and Activities	DPW	Assess existing facilities, activities, and BMPs and continue additional or improved BMPs	DPW continues to refine its snow and ice management technique with a focus on brine pre-treatments to minimize overall use of salt and sand. Roadside Maintenance Program with continued roadside sweeping activities Continue sweeping and maintenance of DPW Barn
6-D	Waste Disposal Procedures from Storm Sewers and Municipal Facilities/Activities	DPW	Assess existing waste disposal procedures, review MA guidelines, brainstorm improved and new procedures	Proper disposal methods as approved by DEP on the material are undertaken each year.

6-E	Hazard Mitigation Plan	Fire Department	Update Plan to current requirements	FEMA requires the Town to have a current approved Hazard Mitigation Plan. This has been in the draft stage and needs to be carried through to completion. MAPC has assisted with this project and is willing to continue in that role.

Part IV. Summary of Information Collected and Analyzed

Incorporation of watershed, stream, wetland and other water related layers in GIS database	yes	Now accessible to public via web-based GIS viewer
GPS identification of storm drains, outfalls and other water-related information	(90%)	Ongoing
Water quality data – please see the attached 2015 Annual Water Quality Report from the Lincoln Water Department	yes	Lincoln & Cambridge Water Dept.s

Attached are:

- *Lincoln Open Space Summary (1 page)*
- *DPW Specifications for Sand Removal to Restore Country Drainage (2 pages)*
- *Wetlands Permit Application – Stormwater Management Tables (2 pages)*
- *Ecological Design, Construction and Maintenance handout (1 page)*
- *Annual Water Quality Report 2015(4 pages)*
- *DPW Photos of Catch Basins & Tree Plantings (5 pages)*

Town of Lincoln Open Space: Cumulative Totals

	Parcels	Acres	Percent of Total Acres
TOWN OF LINCOLN LAND TOTALS	**2284**	**9282**	100%
Conservation Deeds	183	2389	26%
Conservation Restrictions on non-Deeded Conservation Land	151	700	8%
Conservation Land Totals	**334**	**3089**	**34%**
Minute Man National Historical Park	122	330	4%
Great Meadows National Wildlife Refuge	4	10	0.1%
Walden Pond State Reservation	12	73	1%
National and State Park Totals	**138**	**413**	**5%**
PROTECTED LAND GRAND TOTALS	**472**	**3502**	**38%**
City of Cambridge non-Conservation Land	10	308	3%
Mass Audubon non-Conservation-Restricted Land	7	167	2%
Walden Woods Project non-Conservation-Restricted Land	0	12	0.1%
Historic New England	3	21	0.2%
Other Open Space Totals	**20**	**508**	**5%**
Chapter 61A non-Conservation-Restricted Land	17	93	1%
Chapter 61B non-Conservation-Restricted Land	1	6	0.1%
Chapter 61 Totals	**18**	**99**	**1%**
PROTECTED LAND PLUS OTHER OPEN SPACE AND CHAPTER 61 GRAND TOTALS	**510**	**4109**	**44%**

Notes:

The acres given under Town of Lincoln Land Totals does not include streets. It is the sum of acres for all parcels in the Assessors database.

Individual parcels may be protected in more than one way. They are counted in the category with the highest level of protection.

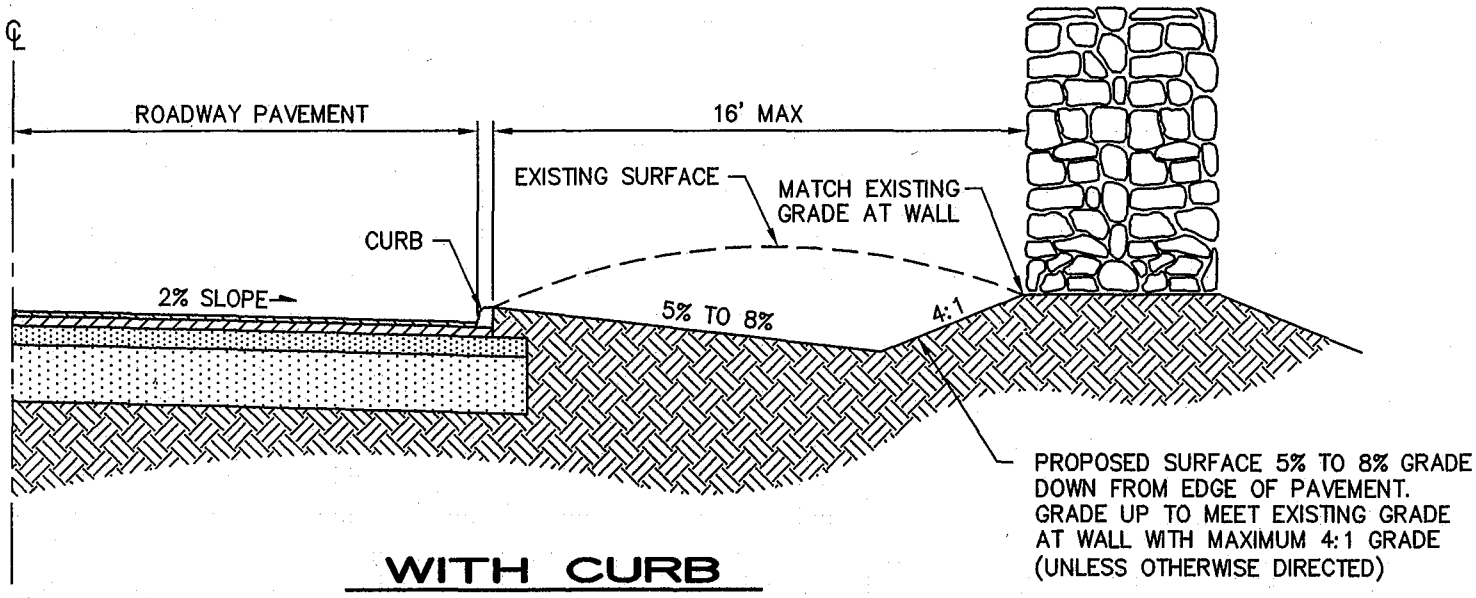
Some of the deeded conservation land parcels have Conservation Restrictions on them.

The Conservation Restrictions category includes Agricultural Preservation Restrictions.

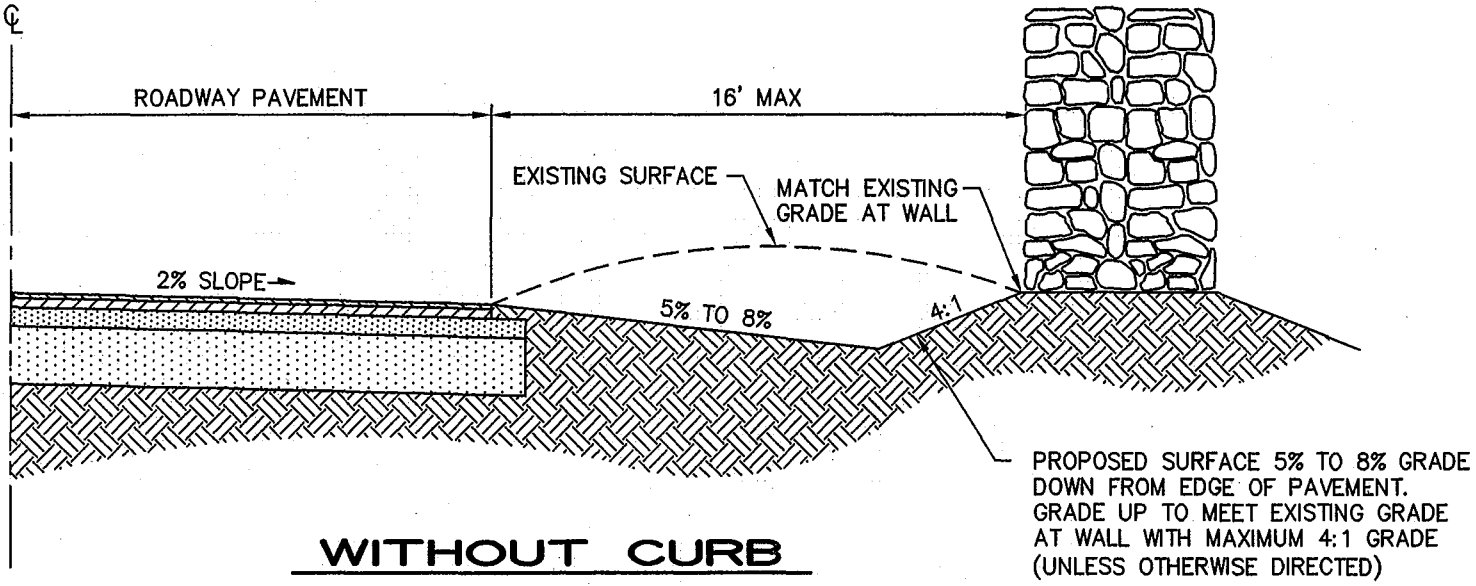
Some of the City of Cambridge parcels in Lincoln are City of Cambridge conservation land.

Some of the City of Cambridge and Massachusetts Audubon Society parcels also have Conservation Restrictions on them.

Some of the Chapter 61 parcels have Conservation Restrictions on part or all of the parcel.



WITH CURB



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THE LINCOLN DPW WILL WORK TO CONTINUE TO REMOVE BUILT-UP SAND FROM THE ROADSIDES TO PROMOTE BETTER & ENVIRON. FRIENDLY DRAINAGE

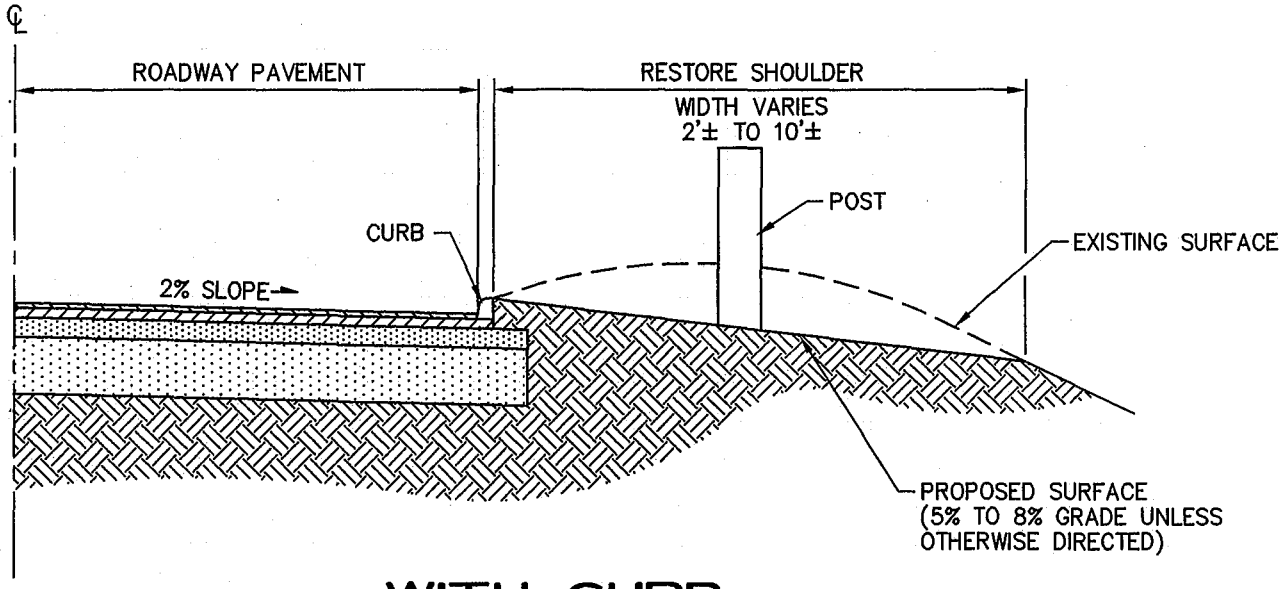
NOTES

1. RESTORE SHOULDER BY REMOVING DEPOSIT OF SANDY MATERIAL TO ALLOW ROADSIDE STORMWATER RUNOFF AS DETAILED ABOVE.
2. LOOSEN EXPOSED SOIL, APPLY FERTILIZER AND NO-MOW SEED MIX.

DETAIL - RESTORE SHOULDER IN FRONT OF STONE WALL

NOT TO SCALE

– SEE PLAN FOR LOCATION



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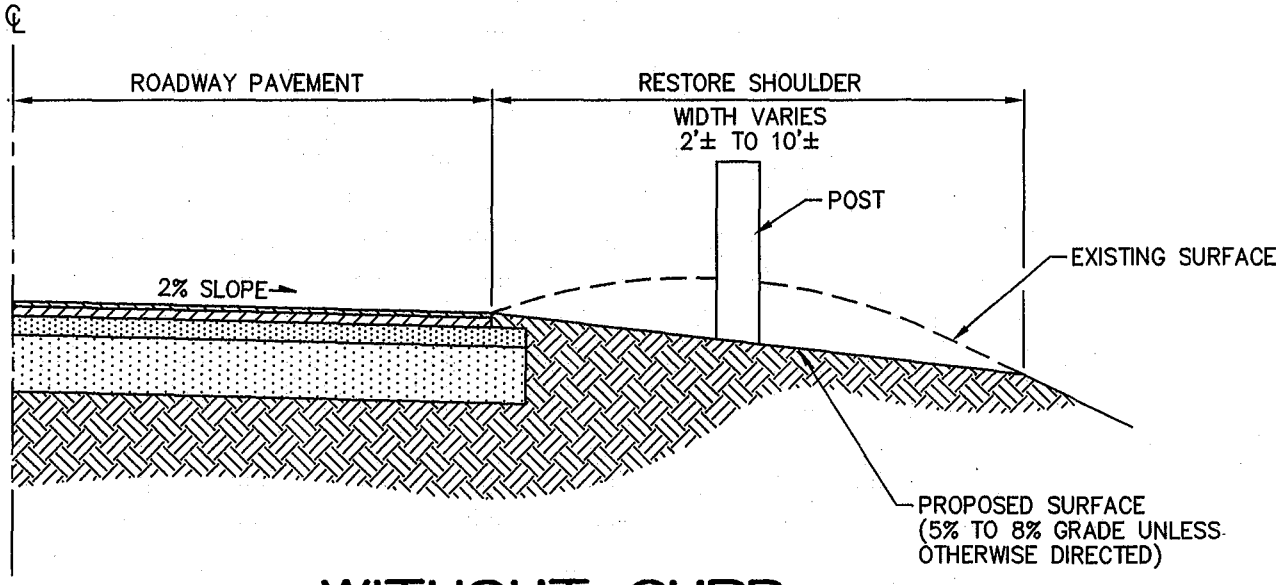

WITHOUT CURB

NOTES

1. RESTORE SHOULDER BY REMOVING DEPOSIT OF SANDY MATERIAL FROM ROADSIDE AND BETWEEN POSTS (GUARDRAIL POSTS) TO ALLOW ROADSIDE STORMWATER RUNOFF.
2. LOOSEN EXPOSED SOIL, APPLY FERTILIZER AND NO-MOW SEED MIX.
3. FOR SHOULDERS IN FRONT OF STONE WALLS SEE DETAIL THIS SHEET.

DETAIL - RESTORE SHOULDER BETWEEN POSTS

NOT TO SCALE

– SEE PLAN FOR LOCATION

LINCOLN CONSERVATION COMMISSION

16 LINCOLN ROAD : LINCOLN, MA 01773
KEARNEYA@LINCOLNTOWN.ORG : 781-259-2612

Required Tables & Checklist for RDA and NOI Filings

Buffer Zone Resource Area Disturbance Table (Square Feet)

	0 to 50 FOOT BUFFER ZONE			50 to 100 FOOT BUFFER ZONE		
	Existing	Proposed	Difference	Existing	Proposed	Difference
Work access & graded area	N/A		----	N/A		----
Semi-pervious *						
Impervious **						
Total Disturbance	----	----		----	----	

* Semi-pervious includes: pervious asphalt or paver driveway, decks, dry-laid walkways and patios
** Impervious includes: house, septic tanks, paved or gravel driveways, wet-set walkways and patios, pool

Shade the plan (in grey) all new areas of impervious area within the 100' Buffer Zone
Crosshatch (in black) all removed areas of impervious area within the 100' Buffer Zone

Riverfront Resource Area Disturbance Table - if applicable (Square Feet)

	0 to 100 FOOT RIVERFRONT			100 to 200 FOOT RIVERFRONT		
	Existing	Proposed	Difference	Existing	Proposed	Difference
Work access & graded area	N/A		----	N/A		----
Semi-pervious *						
Impervious **						
Total Disturbance	----	----		----	----	

Stormwater Discharge Rates for Drainage Area (cfs) (incl. area outside 100' BZ if applicable)

Storm Event	Pre-Condition	Post-Condition	Difference (cfs)	Difference (%)
2 Year				
10 Year				
100 Year				

Checklist for Best Stormwater, Construction Site & Landscape Maintenance Practices

☐ This project will not result in any new stormwater conveyances that will discharge untreated stormwater directly to or cause erosion in the wetland, buffer zone or riverfront resource areas.
Proposed *Green Infrastructure* – (circle) sheet flow, swale, rain garden, other _____
Proposed *Hard Infrastructure* – (circle) stone drip edge, drywell, chambers, other _____

☐ As indicated above, post-dev. discharge rates will not exceed pre-dev. discharge rates

☐ This project will not result in the loss of annual recharge to groundwater

☐ This project employs the following best construction practices in order to prevent pollutants and suspended solids from entering the wetland, buffer zone and riverfront resource areas.
- Erosion controls and construction fencing will be installed and maintained
- Stone aprons and construction staging areas will be used and maintained
- Topsoil stockpile areas and waste & recycling dumpsters will be used and maintained
- Import and export of natural materials will be minimized

☐ This project employs the following best landscape practices in order to prevent pollutants and suspended solids from entering the wetland, buffer zone and riverfront resource areas.
- Salt, sand and deicing chemicals will be minimized and only used as needed
- Fertilizers, herbicides and pesticides will be minimized and only used as needed
- All disturbed soils will be stabilized and planted with regionally native vegetation
- New infestations of invasive species will be properly managed

Applicant's Signature Date Representative's Signature Date

Information for Calculating Stormwater Discharge Rates on Small Projects

Q=CiA

Where,
Q=peak discharge, cfs
C=Runoff Coefficient
i=Rainfall Intensity, in/hr
A=Area, acres

Below are the suggested i values for small watersheds.
(Taken from Boston Intensity-Duration-Frequency Curve; assuming 5 minute time of concentration)

Storm Event	Rainfall Intensity, i (in/hr)
2 Year	4.1
10 Year	5.4
100 Year	7.4

Suggested C factors (conservative, but commonly used values).

Surface	Runoff Coefficient, C
Impervious (e.g. roof, pavement)	0.9
Semi-pervious	0.4
Pervious (e.g. grass)	0.3

Example:

Given:
Total Area = 1.0 acre (43,560 sf)
Area Impervious = 0.25 acres (10,890 sf)
Area Pervious = 0.75 (32,670 sf)

Solve for Peak Discharge for 10 Year Storm Event:
Step 1: Determine weighted runoff coefficient, Cw

$Cw=[(A_{impervioius} \times 0.9)+ (A_{pervious} \times 0.3)] / A_{Total}$

$Cw=[(0.25 \times 0.9)+(0.75 \times 0.3)] / 1.0$

$Cw=0.45$

Step 2: Determine Peak Discharge

$Q_{10\text{-}year} = (Cw)(i_{10\text{-}year})(A_{Total})$ [Please note: Area should be in acres. A unit conversion factor is already built into the equation.]

$Q_{10\text{-}year} = (0.45)(5.4)(1.0)$

$Q_{10\text{-}year} = 2.43$ cfs

Ecological Design, Construction and Maintenance
Angela Kearney : February 10, 2016

Ecological design is the symbiotic relationship between organisms and their physical surrounding. The easiest way to build ecology is to add native plants to your yard.

ENSURE THE PLANTS YOU ADD TO YOUR GARDEN ARE:

- **Free of neonicotinoids & chemical pesticides (seeds, plugs and plants)**
- **As regionally native as possible**
- **Harvested or collected legally, sparingly and with permission from the land owner**

PLANT NATIVES THAT:

- **Fix nitrogen:** alder, birch, bayberry, baptisia, alfalfa, clover, lupine, oat & field pea, raddish
- **Bioaccumulate minerals:** switchgrass, indian grass, chicory, comfrey, yarrow, lemon balm
- **Provide structure & shelter:** ilex opaca & verticillata, concolor fir, white spruce, little bluestem
- **Are edible to people & wildlife:** amalanchier, aronia, highbush blueberry, elderberry, rubus, strawberry, allium, ostrich & cinnamon fern, grape, beach plum, fruit trees, helianthus
- **Provide nectar for pollinators:** New England aster, crocus, agastache, penstemmon, monarda, asclepias incarnata, echinacea purpurea, eupatorium purpureum, rudbeckia, phlox, grasses

PLANT NATIVES IN THE RIGHT CONDITIONS:

- **Woodland & woodland edge:** Remove invasive species. Layer up with Atlantic white cedar, black birch, amalanchier, pagoda dogwood, witch hazel, rhododendron maximum, mountain laurel, bottlebrush buckeye, oak-leaf & annabelle hydrangea, redtwig dogwood, lecothue, black cohosh, barren strawberry, ferns, white & blue wood aster, chrysogonum, heuchera and iris cristata.
- **Around the house:** Remove lawn & overgrown foundation plants. Replace with hinoki cyprus, ilex glabra & verticillata, aronia melanocarpa, common ninebark, grape vine on an arbor, rhus aromatica, clethra alnifolia, itea, annabelle hydrangea, creeping juniper, strawberry, creeping phlox, switchgrass, salvia, yarrow, allium, chamomile, rosemary and pollinator perennials.
- **Open lawn & slopes:** Establish 'no-mow' or 'stepable' paths and meadow borders to define open play & destination lawn areas. Create a clean edge and remove all grass from the beds. Use native grasses including big & little bluestem, indian grass and panicum as the backbone. Add nitrogen fixers and mineral accumulators listed above as well as large groupings of pollinator perennials. In large spaces & steep slopes add birch, rhus copallina & lacinata, red buckeye, beach plum, fruit trees, rattlesnake muster, mountain mint, goldenrod and liatris.
- **Wet areas:** Direct downspouts to a rain barrel or naturally low area. Create a rain garden with plants that can sustain periodic inundation including fothergilla gardenii, redtwig dogwood, swamp milkweed, monarda, chelone glabra, Pennsylvania sedge and royal fern.

LOCAL PLANT SOURCES & RESOURCES:

- **Plants & Plugs:** Bigelow Nursery, Garden in the Woods, Tripple Brook Farm, North Creek Nursery
- **Organic Fertilizer & Seed:** fertrell.com, highmowingseeds.com, turtletreeseed.org
- **Plant Databases:** northcreeknurseries.com, stepables.com, pfaf.org, foodforestfarm.com
- **Books:** Bringing Nature Home, Edible Forest Gardens, Restoration Agriculture, Gaia's Garden

Annual Water Quality Report 2015
TOWN OF LINCOLN, MASSACHUSETTS

Introduction

This report describes Lincoln's drinking water sources, treated water quality, and how we maintain the high quality of your water. This report is issued annually to you, the consumer, to keep you updated on your drinking water quality. The report also provides information on where your water comes from, how we treat it, and answers to questions you may have about Lincoln's water system. We are proud to report that the water provided by the Lincoln Water Department (LWD) meets or exceeds established water-quality standards set forth by the U.S. Environmental Protection Agency (USEPA) and the Massachusetts Department of Environmental Protection (MaDEP).

Lincoln's Drinking Water – A Well-Protected Source

The Town of Lincoln is supplied by both surface water and groundwater well. Flint's Pond, also known as Sandy Pond, is the primary year-round supply. Tower Road Well is a supplemental source used during peak periods and when Flint's pond is off-line for servicing.

Since 1874, when the system was known as the Lincoln Water Works, the Town has recognized the need to protect its watershed. The watershed consists of 465 acres of land surrounding Flint's Pond, which is approximately 92 percent owned and/or controlled by the Town. The Town has in place a Watershed Protection Plan designed to limit access to the water and protect the land from any development that would endanger the water supply. One of the biggest threats to the Town's water supply is improperly maintained septic systems. You can help protect your drinking water quality by pumping out your septic system every two years. Never dump hazardous substances down septic or storm drains. Do not use septic system cleaners.

For Your Health

In order to ensure that tap water is safe to drink, MaDEP and USEPA prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. The Food and Drug Administration and the Massachusetts Department of Public Health regulations establish limits for contaminants in bottled water that must provide the same protection for public health.

Regulated contaminants are those substances for which the USEPA has established drinking water standards to protect human health. Unregulated contaminants are those for which USEPA has not established drinking water standards. The purpose of unregulated contaminant monitoring is to assist USEPA in determining their occurrence in drinking water and whether future regulation is warranted.

Source Water Assessment Program

The Source Water Assessment & Protection (SWAP) Program, established under the federal Safe Drinking Water Act, requires every state to: inventory land uses within the recharge areas of all public water supply sources; assess the susceptibility of drinking water sources to contamination from these land uses; and publicize the results to provide support for improved protection. A susceptibility ranking of moderate for Flint's Pond and ranking of high for Tower Road well were assigned using the information collected during the assessment by MaDEP. You can download a copy of the SWAP Report from **www.mass.gov/eea/docs/dep/water/drinking/swap/nero/3157000.pdf** or call LWD at (781) 259-1329.

Information About Drinking Water

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. However, some people may be more vulnerable to contaminants than the general population. Immuno-compromised persons, such as persons with cancer undergoing chemotherapy, persons who have undergone organ

transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care provider. More information about contaminants and potential health effects, including EPA/CDC guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants, can be obtained by calling the USEPA's Safe Drinking Water Hotline (1-800-426-4791).

The sources of drinking water generally include rivers, lakes, streams, ponds, reservoirs, springs and wells. Because water is the universal solvent, it dissolves naturally-occurring minerals, and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity as it travels over the surface of the land or through the ground. Contaminants that can be present include:

- *Microbial contaminants,* such as viruses and bacteria, which may come from septic systems and wildlife.
- *Inorganic contaminants,* such as salts and metals, which can be naturally occurring or result from urban storm water runoff, industrial or domestic wastewater discharges.
- *Pesticides and herbicides,* which may come from a variety of sources such as agriculture, urban storm water runoff and residential uses.
- *Radioactive contaminants*, may be naturally occurring or be the result of oil and gas production and mining activities.
- *Organic chemical contaminants,* including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff, and septic systems.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. LWD is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may want to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at **http://www.epa.gov/safewater/lead.**

Turbidity has no health effects. However, turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease-causing organisms. These organisms include bacteria, viruses and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches. **Sodium** sensitive individuals, such as those experiencing hypertension, kidney failure, or congestive heart failure, should be aware of the sodium levels where exposures are being carefully controlled.

How Can I Learn More?

LWD's Superintendent, Gregory Woods, and staff are available **Monday - Friday**, from **7:00 A.M. - 3:30 P.M.**, and at **(781) 259-1329.** Water Commission meetings are held on the 2nd Wednesday of each month at 4:30 P.M. at 77 Sandy Pond Road. You can also check the Town's website at **http://www.lincolntown.org**. Lincoln's Public Water System I.D. # is: **3157000.**

Water Rates

$4.06 per 1,000 gal. for usage **under 20,000** gal.
$8.57 per 1,000 gal. for usage **over 20,000** gal.
$20.02 per 1,000 gal. for usage **over 40,000** gal.
$20.02 per 1,000 gal. for **all irrigation only** meters.
Rates based on a quarterly billing period.
Base Charge + Usage = Total Amount Due
Base charge = $30 for water meter

Mandatory Water Use Restriction

The MaDEP, through its Water Management Act permitting process, has drastically reduced Lincoln's water allocation starting in 2014. Lincoln missed the December 31, 2011, mandate to reduce individual water consumption to the 65 gallons per person per day performance standard. Due to last year's exceedingly dry summer, Lincoln's average usage was 78 gallons per person per day. To meet the permit requirements, the Town must continue its mandatory outdoor use restriction program from May 1st through September 30th.

The mandatory water conservation program restricts all nonessential outdoor watering: House addresses that end with an even number may water on Tuesday and/or Thursday; House addresses that end with an odd number may water on Wednesday and/or Friday. Nonessential outdoor watering is prohibited Saturday, Sunday and Monday. Watering is allowed only between 7 P.M. and 7 A.M.; drip irrigation, while restricted to the odd/even schedule, is allowed at any time during the day.

Restricted activities include irrigation of lawns via sprinklers or automatic irrigation systems, washing of vehicles, and washing of exterior building surfaces, parking lots, driveways or sidewalks. Sprinkle irrigation of lawns, gardens, flowers or ornamental plants by means of a hand held hose or bucket is not subject to the restriction.

LWD staff will be monitoring sprinkler use in Town and will stop to remind residents of the policy. A second notice will result in a $50 fine, and subsequent violations will warrant a $100 fine.

New Water Protection Zoning

Lincoln passed overlay water protection by-laws in 2012 and 2013 to protect the well and pond from contamination. If you have property in the protected areas, please minimize use of fertilizers, pesticides and other chemicals that can impact the drinking water. A map of the protected areas is available on the Department's website at **www.lincolntown.org/index.aspx?NID=224.**

Meter Modernization Program

The Department has almost completed upgrading its metering system with digital display, radio-frequency water meters. If a new digital meter detects a leak, it will display a dripping faucet icon in the top left side of the display. If you request, the Department can download 96 days of daily use records to help you identify the frequency and magnitude of the leak. Instructions on how to read the meter, as well as examples of daily and hourly data graphs from water meters can be found at **www.lincolntown.org/index.aspx?NID=398**.

You should record your meter reading at regular intervals (weekly or monthly). Subtract the new meter reading from the previous reading to calculate your water consumption for that period. Watch for leaks and monitor your progress toward the MaDEP goal of no more than 65 gallons per person per day, averaged over a one year period.

Quarterly Water Bills

The Department changed from semi-annual to quarterly billing in 2014 to allow earlier discovery of leak conditions. Early leak detection reduces both lost water and the resultant high customer charges that leaks can cause. Rates were also reduced for lower tier users and raised for higher tier users. Finally, the fixed fee component was increased to reflect that most of the Department's operating budget is fixed. The rate structure is available on the Department web site at **www.lincolntown.org/index.aspx?NID=222.**

Water Treatment

Depending on the source location, LWD adds a very low concentration of either potassium hydroxide or sodium hydroxide to the drinking water in order to increase the pH (reduce the acidity) of the water to reduce its natural corrosiveness. Chlorine is added as a disinfectant at the Flint's Pond facility and fluoride is added at both the treatment plant and the Tower Road well to aid in dental health and hygiene. Zinc orthophosphate is also added at both sites for corrosion control and to reduce levels of iron and manganese.

Water Quality Data

Data presented in this table is for testing completed during the 2015 calendar year. We monitor for some contaminants less than once per year, because the concentrations for those contaminants are not expected to vary significantly from year to year. In these cases, the most recent sample information and the year the sample was collected, are included in the table.

Regulated Contaminants

Substance	Sample Date	MCLG/ MRDLG	MCL/ MRDL	Highest Detected or Running Average	Range Detected	Violation	Possible Source(s) of Contamination
Nitrate (ppm)	2015	10	10	0.87	ND – 0.87	No	Runoff from fertilizer use; septic systems.
Turbidity (NTU)	2015	--	TT	0.12	0.01 – 0.12	No	Natural sediment; soil runoff.
TTHMs (ppb)	2015	--	80	73.7	55.9 – 92.2	No	By-product of drinking water chlorination.
HAA5s (ppb)	2015	--	60	27.9	4.99 – 45.0	No	By-product of drinking water chlorination.
Fluoride (ppm)	2015	4	4	1.2	0.6 – 1.2	No	Erosion of natural deposits; water additive that promotes strong teeth.
Chlorine - Total (ppm)	Monthly	4	4	0.82	0.00 – 0.82	No	Water additive used to control microbes.

Unregulated Contaminants

Substance	Sample Date	SMCL	ORSG	Highest Detected	Range Detected	Violation	Possible Source(s) of Contamination
Sodium (ppm)	2015	--	20	24.3	9.5 - 24.3	No	Widely present in natural waters.

Lead & Copper (Tap water was collected from homes in service area)

Substance	Sample Date	MCLG	MCL/ AL	No. of Sites Sampled	90th Percentile	Sites above AL	Possible Source(s) of Contamination
Lead (ppb)	2014	0	15	20	5	0	Corrosion of household plumbing systems.
Copper (ppm)	2014	1.3	1.3	20	0.31	0	Corrosion of household plumbing.

Bacteria Sampling

Substance	Sample Date	MCLG	MCL/ AL	Highest Number Positive in Routine Monthly Samples	Violation	Possible Source(s) of Contamination
Total Coliform	2015	0	>1/mon.	0	No	Naturally present in the environment.
Fecal Coliform or E.Coli	2015	0	**	0	No	Human or animal fecal waste.

Definitions

ppm = *Parts per million, or milligrams per liter (mg/l)*

ppb = *Parts per billion, or micrograms per liter (ug/l)*

ND = *Not detected above laboratory method detection limits*

TTHM = *Total Trihalomethanes*

** = *Compliance with fecal coliform/E.coli MCL is determined upon additional repeat testing*

MCL = *Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology.*

MCLG = *Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.*

AL = *Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements, which a system must follow.*

MRDL = *Maximum Residual Disinfectant Level: The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.*

MRDLG = *Maximum Residual Disinfectant Level Goal: The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.*

TT = *Treatment Technique: A required process intended to reduce the level of a contaminant in drinking water.*

ORSG = *MA Office of Research and Standards Guideline: This is the concentration of a chemical in drinking water, at or below which, adverse health effects are unlikely to occur after chronic (lifetime) exposure. If exceeded, it serves as an indicator of the potential need for further action.*

90th Percentile = *Out of every 10 homes, 9 were at or below this level.*

NTU = *Nephlometric Turbidity Units*

MFL = *Million of Fibers per Liter*

-- = *No applicable standard*

HAA5 = *Haloacetic acids*